Frontiers in Optics + Laser Science 2025
Session Guide

Disclaimer: this guide is limited to technical program with abstracts and author blocks as of 22 October. For updated and complete information with special events, reference the online schedule or mobile app.

Wednesday, 22 October – Virtual Day

07:30 -- 09:15
FV2A • Quantum Electronics and Integrated Devices for Computing, Sensing and Other Applications
Presider: Bienvenu Ndagano; INRS-Energie Mat & Tele Site Varennes, Canada

FV2A.1 • 07:30
Composite Photonic Crystal Symmetric Cavity on a Nanocapillary Fiber for Cavity QED, Srinu Gadde[1], Jelba John[1], Ramachandrarao Yalla[1]; [1]*School of Physics, Univ. of Hyderabad, India.* We report a composite photonic crystal symmetric cavity on a nanocapillary fiber (NCF). The cavity is formed by combining a nano grating-coupler with the waist region of an NCF, and the maximum coupling efficiency of 87% is obtained through NCFguided modes

FV2A.2 • 07:45
Beam Propagation in an Unstable Laser Cavity using Bandlimited Angular Spectrum method, vikas mishra[1], Ajay Kumar[1]; [1]*IIT Delhi, India.* An unstable laser cavity has advantages over a stable cavity, such as high-power discrimination in transverse modes. We calculated the beam profile and quality factor by applying the band-limited angular spectrum method.

FV2A.3 • 08:00
A Continuous Quantum Random Walk Model with Self-Entangled, State-Driven Hamiltonian Dynamics, Rohan R. Rao[1], NagaPhani Rahul S[1], Rohan K[1], ramaseshan raghavan[1], kaustav bhowmick[1]; [1]*PES Univ., India.* This paper deals with the simulation of a single qubit evolving in the Bloch sphere under state-dependent Hamiltonians, which carve out rich nonlinear trajectories and spontaneous quantum behavior caused by feedback, randomness, and entanglement.

FV2A.4 • 08:15
Silicon Photonic Lidar Using Subwavelength Grating with Short T-shaped Auxiliary Block Structure, Yuxuan He[1], Wenpu Geng[1], Qiang Wang[2], Zhongqi Pan[3], Yang Yue[4]; [1]*Nankai Univ., China;* [2]*Angle AI (Tianjin) Technology, China;* [3]*Univ. of Louisiana at Lafayette, USA;* [4]*Xi'an Jiaotong Univ., China.* A silicon waveguide grating antenna with short T-shaped auxiliary blocks has been designed to exhibit low wavelength dependence, achieving a viewing angle approximately 2.25 times and radiation efficiency with a variation range less than 14%.

FV2A.5 • 08:30
Analysis of 3D Taper Profiles for Efficient and Tolerant Edge Coupling in Polymer Photonics, Ritvik Raina[1], Aravindkumar Yelashetty[1], Tapajyoti D. Gupta[1]; [1]*Indian Inst. of Science, India.* This study explores a range of three-dimensional taper geometries with varying profiles to optimize edge coupling efficiency at 1400-1600 nm. Using FDTD simulations, we achieve up to -0.9 dB coupling within 100 µm taper length.

FV2A.6 • 08:45
Minimizing Leakage and Bending Loss in Silicon Integrated MMRRs through Geometric Optimization of Polygonal Cut-outs, pranav bharadwaj[1], prajwal koushik[1], ramaseshan raghavan[1], kaustav bhowmick[1]; [1]*PES Univ., India.* Polygonal ring resonators perform better

mode confinement through reduced scattering and bending loss, aided by careful geometric optimization. By relating the number of inner cut-out sides and confinement, we identify optimal geometries, with confinement improving as the shapes approach circularity.

FV2A.7 • 09:00
High-Efficiency Silicon Photonic Lidar Using Shallow Etching-Assisted Block Structures, Yuxuan He[1], Wenpu Geng[1], Qiang Wang[2], Zhongqi Pan[3], Yang Yue[4]; *[1]Nankai Univ., China; [2]Angle AI (Tianjin) Technology, China; [3]Univ. of Louisiana at Lafayette, USA; [4]Xi'an Jiaotong Univ., China.* To enhance the radiation efficiency, a subwavelength grating antenna with a shallow-etched auxiliary block is designed, achieving radiation efficiency above 60% with a total variation of less than 14% across the operating wavelength range.

07:30 -- 09:15
FV2B • Fabrication, Design and Instrumentation
Presider: Shuhe Zhang; Tsinghua Univ.

FV2B.1 • 07:30
Designing a Half-wave plate using a single mode fibre optic cable., Erick N. Maronga[1]; *[1]Multimedia Univ. of Kenya, Kenya.* A fiber optic fabrication method is used for making the passive fiber optic polarization control element capable of transforming an arbitrary oriented linear polarization of light to a desired specific orientation.

FV2B.2 • 07:45
Method for Prescribing Target Angles in Camera Testing, Kevin Sweeney[1]; *[1]Optikos Corporation, USA.* A geometrical analysis describes the orientation of target features in the image plane of a rotationally symmetric lens given only its radial distortion function. Simulations illustrate application to a wide-angle camera resolution test.

FV2B.3 • 08:00
Displacement Measurement through Speckle Pattern Imaging Technique, Vikas Vikas[1], Surya K. Gautam[1], Kuldeep Kumar[1]; *[1]National Physical Laboratory, India.* A non-contact displacement measurement technique using speckle pattern imaging is presented. The method offers high sensitivity, accuracy, and robustness, making it suitable for precise deformation analysis in engineering and scientific applications.

FV2B.4 • 08:15
TiO_2 Nanostructure Enhanced Interdigitated Cu Electrodes for Pb ion Detection in Aqueous Media, Prakash Nandi[1], Rajib Biswas[1]; *[1]Tezpur Univ., India.* In this work, Interdigitated electrodes (IDE) were designed in a Cu clad. The prepared electrodes were functionalized with green synthesized TiO_2 nanoparticles (TiO_2 NPs) to study the electrical response (V-I characteristics) of Pb metal.

FV2B.5 • 08:30
Amplitude Shifting Holography using E-Paper Display, Surya K. Gautam[1], Kuldeep Kumar[1], Vikas Vikas[1]; *[1]National Physical Laboratory, India.* Reconstructing the complex object wavefront is crucial in many applications. We propose using an electronic paper (E-paper) display to modulate the reference beam amplitude, enabling multiple holograms and reducing unwanted

terms in wavefront reconstruction.

FV2B.6 • 08:45
Saliency-guided Progressive Hologram Generation, Shima Rafiei[1], Shahram Shirani[1]; *[1]McMaster Univ., Canada.* We decompose 2D objects using Haar wavelet to generate multilevel hologram quality. Our method uniquely incorporates object saliency, enabling focused quality on visually important regions and improving time efficiency for offline dataset generation.

FV2B.7 • 09:00
Small Force Measurement by Photoelastic Low-Force Sensor, Vikas Vikas[1], Surya K. Gautam[1]; *[1]National Physical Laboratory, India.* This work presents a compact, cost-effective photoelastic birefringent transducer developed for small-force measurement applications utilising the speckle cross-correlation technique. The sensor detects stress-induced optical changes, offering high sensitivity and non-contact measurement in the millinewton to newton range.

09:30 -- 11:15
FV3A • Fiber Optics and Optical Communications
Presider: Stanley Cheung; Hewlett Packard Labs, USA

FV3A.1 • 09:30
Enhanced FSO-Fiber 5G Fronthaul Architecture Design and Scalability Analysis in the Face of Turbulence and Polarization Diversity, Gargi Singh[1], Yugnanda Malhotra[1], Jolly Parikh[1], Jyoteesh Malhotra[2]; *[1]Bharati Vidyapeeth's College of Engineering, India; [2]National Inst. of Technology, India.* A scalable 5G fronthaul using hybrid Fiber-FSO with OFDMA-WDM and polarization diversity is implemented for BBU pool in C-RAN architecture. It demonstrates robust and resilience under various turbulence, offering energy-efficient architecture for ultra-dense urban deployments.

FV3A.2 • 09:45
Influence of Fourth-Order Diffraction in Shaping Equilibrium States of Nonlocal Solitons, Manoj Mishra[1]; *[1]SciSER, FOS, Somaiya Vidyavihar Univ., India.* This article investigates the impact of fourth-order diffraction on equilibrium points of nonlocal solitons via linear stability analysis of evolution equations derived from the NNLSE across varying nonlocality levels.

FV3A.3 • 10:00
Suppression of MI by Third-Order Diffraction\\ in Nonlocal Nonlinear Optical Media, Manoj Mishra[1]; *[1]SciSER, Somaiya Vidyavihar Univ., India.* This article investigates the influence of third-order diffraction (TD) on modulation instability (MI) in nonlocal nonlinear optical media, emphasizing its effect on the gain spectrum and the area under the gain curve across various degrees of nonlocality.

FV3A.4 • 10:15
ZBLAN Photonic Crystal Fiber for OAM Supercontinuum Generation with Extended Bandwidth, Haoyang Ren[1], Wenpu Geng[2], Zhongqi Pan[3], Yang Yue[1]; *[1]Xi'an Jiaotong Univ., China; [2]Inst. of Modern Optics, Nankai Univ., China; [3]Department of Electrical & Computer Engineering, Univ. of Louisiana at Lafayette, USA.* A ZBLAN photonic crystal fiber is proposed

for broadband orbital angular momentum supercontinuum generation. The designed fiber enables the generation of supercontinuum spanning near 2 octaves, from 1750 to 6640 nm, within a 1.5-cm fiber.

FV3A.5 • 10:30
Random Noise Enhances Learning-Based Multimode Fiber Imaging Robustness over Fiber Bending, Yunong Li[1], Yangyang Xiang[1], Junhui li[1], Mingying Lan[1], Li Gao[1], Jianxin Ma[1], Zhanyu Yang[1]; *[1]Beijing Univ. of Posts and Telecomm, China.* This work boosts the robustness of machine-learning based multimode fiber single-pixel imaging against fiber bending by adding Gaussian noise in training data. Training on single-configuration data improves cross-configuration generalization, reducing data complexity versus multi-configuration methods.

FV3A.6 • 10:45
Broadband Flattened Dispersion for High-Order OAM Modes in Tapered Fibers with Dual Coupled Ring-Cores, Wenpu Geng[1], Zhi Zeng[2], Zhongqi Pan[3], Yang Yue[2]; *[1]Nankai Univ., China; [2]Xi'an Jiaotong Univ., China; [3]Univ. of Louisiana at Lafayette, USA.* A tapered fiber with broadband and flat negative dispersion for OAM modes is proposed. The dispersion of the $OAM_{15,1}$ mode maintains approximately -127.4 ps/(nm●km) with 0.2 ps/(nm●km) variation across a broad bandwidth of 86 nm.

FV3A.7 • 11:00
Scalable Millimeter-Wave Frequency Multiplication Based on Thin-Film Lithium Niobate Photonics, Jingxian Deng[1], Jiayao Li[2], Zhiyong Wu[1], Xiaoyu Zhou[1], Shaolin Liao[2], Zhengji Xu[1]; *[1]School of Microelectronics Science and Technology, Sun Yat-Sen Univ., China; [2]School of Electronics and Information Technology, Sun Yat-Sen Univ., China.* This work reports millimeter-wave frequency quadrupling using a thin-film lithium niobate IQ modulator, demonstrating 4 GHz output and simulating eighth-order harmonic generation under enhanced RF drive.

11:00 -- 12:30
JV4A • Joint FiO + LS Laser Science
Presider: Kin On Ho; Univ. of Texas at Austin, USA

JV4A.1 • 11:00
Photocurrent Injection in Graphene via Quantum Interference between Stimulated Electronic Raman Scattering and Single-Photon Absorption, Xiangyu La[1], Yuhang He[1], Yuxuan Chen[1], Chenyin Dai[1], Zhen Tian[1], Jianming Dai[1]; *[1]Center for Terahertz waves and School of Precision Instrument & Opto-electronics Engineering, Tianjin Univ., China.* We demonstrate that in intrinsic graphene, quantum interference between stimulated electronic Raman scattering and single-photon absorption critically contributes to the total photocurrent, whereas interlayer coupling has a negligible impact on photocurrent injection.

JV4A.2 • 11:15
Enhancement of Lateral Terahertz Emission Based on Reshaped Plasma Induced by Colliding Laser Pulses, Chenyin Dai[1], Yuxuan Chen[1], Xiangyu La[1], Zhen Tian[1], Jianming Dai[1]; *[1]Center for Terahertz waves and School of Precision Instrument & Opto-electronics Engineering, Tianjin Univ., China.* We demonstrated that reshaping the gas plasma generated by colliding ultrafast laser pulses can effectively enhance the terahertz emission in the lateral

direction relative to the laser axis.

JV4A.3 • 11:30
Functional form of matrix multiplication in Hermite Gaussian basis, Asif Habib[1], Vijay Kumar[1]; [1]*NIT Warangal, India.* Matrix multiplication, a fundamental yet complex computational task, poses challenges for optics due to its algorithmic nature. Here, we present a functional realization in the Hermite-Gaussian basis, promising for future optical computing

JV4A.4 • 11:45
Polyvinyl Alcohol/Ag-Fe_3O_4 Based Nanofiber: Preparation and Characterization, Kaushik K. Nath[1], Nikhil K. Daimari[1], Rajib Biswas[1]; [1]*Tezpur Univ., India.* The primary aim of this research is to develop PVA/Ag-Fe_3O_4 nanofiber mats via electrospinning and examine the modification in their physical properties.

JV4A.5 • 12:00
Plasmonically Enhanced Band Gap of 2D MoS_2 Nanosheets via Ag Nanoparticle Decoration: Optical Properties, Shahnaz Shabnam[1], Shimanchal Borah[1], Gazi A. Ahmed[1]; [1]*Tezpur Univ., India.* In this study we decorated exfoliated MoS_2 nanosheets with silver nanoparticle showed an increase band gap(~2.46eV) and improved optical dispersion indicating enhanced quantum confinement and interfacial interactions, making the composite suitable for optoelectronic applications.

JV4A.6 • 12:15
Broadband Achromatic Reflective Metalens via Group-Delay Engineered α-Si/GaN DBR meta-atoms, Sani Mukhtar[1], Jaime Viegas[1]; [1]*Khalifa Univ. of Science and Techno, United Arab Emirates.* We demonstrate a broadband, polarization-independent reflective metalens based on group-delay-engineered α-Si/GaN DBR meta-atoms, achieving achromatic focusing from 650 - 900 nm with focal length variation <14%, near-diffraction-limited spots, and peak efficiency exceeding 45%

13:00 -- 15:00
JV5A • Frontiers in Optics: Laser Science, Quantum Electronics, Fiber Optics and Integrated Devices
Presider: Mengjie Yu; Univ. of Southern California, USA

JV5A.1 • 13:00
Study of Multi-Walled Carbon Nanotubes using Drude and Drude-Lorentz Models for Efficient THz Detectors, Naga Vamsi Krishna Reddy[1], Abhijit Sethi[1], Shyamal Mondal[1]; [1]*Defence Inst. of Advanced Technology, India.* The paper reports the complex-conductivity of MWCNT by Drude and Drude-Lorentz models. The change in complex-conductivity and larger imaginary part in the perpendicular polarization indicates higher absorption-rate, making it suitable candidate for THz detector.

JV5A.2 • 13:15
Broadband Supercontinuum Generation using a High-power femtosecond source, Masood Kadiri[1], Akshay Raj R[1], Sri Sai Satish M[1], Shyamal Mondal[1]; [1]*Defence Inst. of Advanced Technology, India.* We demonstrate supercontinuum generation in Single Mode Fiber and Highly Nonlinear Fiber using a high-power femtosecond source at 1560 nm. A comparative

study highlights the spectral broadening achieved in each fiber.

JV5A.3 • 13:30
On Quantifying the Degree of Coherence in Qubits, Debabrata Goswami[1]; *[1]Indian Inst. of Technology Kanpur, India.* We specifically define the amount of coherence that a specific state holds. We quantify the "quantum character" of qubits by considering their temporal evolution of the coherent character through off-diagonal density matrix elements.

JV5A.4 • 13:45
Enhanced Emission and Polarization of a Single Quantum Emitter for Quantum Technologies, Jelba John[2], Resmi M[1,3], SRINU GADDE[1], Ramachandrarao Yalla[1]; *[1]Univ. of Hyderabad, India; [2]Physics, Univ. of Hyderabad, India; [3]Quantum Machines Unit, Okinawa Inst. of Science and Technology, Japan.* A nano photonic-plasmonic interface is designed and demonstrated for collecting the enhanced and polarized emission from a quantum emitter coupled to an optical nanofiber tip. The designed system's properties are analyzed numerically as well experimental demonstration is achieved.

JV5A.5 • 14:00
Creation of higher order quantum NOON states using superradiant emitters in the cavity, Roman Shugayev[1], Brandon Munguia Torres[1]; *[1]Univ. of Nevada, Las Vegas, USA.* Sensing using higher order NOON states offers a path to scalable improvement of signal to noise ratio beyond classical limit. In this work we propose a novel scheme for on-chip generation of superradiant NOON states

JV5A.6 • 14:15
Gaussian Mixture Models and Deep Learning for Spectral Spacing Estimation in Gridless Nyquist-WDM Systems, Cesar A. Montoya Ocampo[1], Santiago J. Vargas Higuera[1], Jhon J. Granada Torres[1]; *[1]Universidad de Antioquia, Colombia.* We propose a method using Gaussian Mixture Models and Deep Learning to estimate spectral spacing in gridless optical networks, achieving 86.7% accuracy and 0.277 GHz MAE in an experimental 3×16-Gbd Nyquist-WDM system.

JV5A.7 • 14:30
ZBLAN Dual-Ring Fiber for Near 3-Octave OAM Supercontinuum Generation, Haoyang Ren[1], Wenpu Geng[2], Zhongqi Pan[3], Yang Yue[1]; *[1]Xi'an Jiaotong Univ., China; [2]Inst. of Modern Optics, Nankai Univ., China; [3]Department of Electrical & Computer Engineering, Univ. of Louisiana at Lafayette, USA.* A ZBLAN dual ring-core fiber is proposed for vortex beam supercontinuum generation. When an ultra-short pulse is launched into the 7.5-mm-long proposed fiber, the generated $OAM_{4,1}$ mode supercontinuum spans from 950 nm to 6880 nm.

JV5A.8 • 14:45
Design and Fabrication of Point-of-Care Microfluidic Immunoassay Device for the Detection of Oral Cancer Biomarker, Prachi Sinha[1], Oindrila Banik[1], Prasoon Kumar[1], Earu Banoth[1]; *[1]National Inst of Technology Rourkela, India.* This paper reports the designing of a low-cost paper-based lateral flow immunoassay kit for rapid, non-invasive salivary Oral Squamous Cell Carcinoma biomarker detection. The shows promising initial results for early detection of same in low-resource settings

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15:00 -- 15:45
FV6A • Integrated Devices for Computing Sensing and Other Applications
Presider: Tzu-Yung Huang; Nokia Bell Labs, USA

FV6A.1 • 15:00
Deep Learning-Based 3D Event Reconstruction in CdZnTe Radiation Detectors, Manuel Ballester[1], Jaromir Kaspar[2], Francesc Massanes[2], Alexander Hans Vija[2], Aggelos Katsaggelos[1]; [1]*Northwestern Univ., USA;* [2]*Siemens Healthineers, USA.* We present a deep learning framework for 3D event reconstruction in CdZnTe detectors, incorporating 3D charge cloud transport and expansion, frequency-domain analysis, and a hybrid CNN-RNN architecture. We achieve sub-mm spatial resolution and accurate energy estimation.

FV6A.2 • 15:15
Bragg Grating Terminated Angled MMI Refractive Index Sensor, Merna Khafagy[1], Hamdy Elshehaby[1], Karim El-seherawy[1], Abdelrahman Nasser[1], Mohamed A. Swillam[1]; [1]*Department of Physics, School of Science and Engineering, The American Univ. in Cairo, Egypt.* A Bragg grating terminated angled MMI device is proposed for NIR gas sensing. Optimized via FDTD, it offers low insertion loss and enables multiple gas detection through multi-band sensing.

FV6A.3 • 15:30
Development of Screen-Printed Graphene-Based Ink Electrodes for flexible electronics, Jiyanshu Singh[1], Pragyan Ray[1], Prasoon Kumar[1]; [1]*National Inst of Technology Rourkela, India.* This study presents cost-effective graphene nail polish ink for lateral flow assay device. Optimizing layer thickness yields high conductivity on different surfaces. This mechanically robust film can be potentially be used for making flexible electronic devices and integrating electrochemical systems in disposable LFA devices.

16:30 -- 17:15
FV7A • Fiber Optics and Optical Communications
Presider: Rachel Sampson; MIT Lincoln Laboratory, USA

FV7A.1 • 16:30
Analog Photonic and Digital Electronic Mixed-Signal Processor with Two-Stage Interference Separation, zhenghao yang[1], Taichu Shi[1], huaxia wang[1], Ben Wu[1]; [1]*Rowan Univ., USA.* We propose and demonstrate a hybrid blind source separation system that integrates analog photonics and digital electronics to recover signals from strong interference. The interference is separated in two stages for high interference suppression ratio.

FV7A.2 • 16:45
Interference Source Tracking with Photonic Time Difference of Arrival Measurement for Radio Telescope Arrays, zhenghao yang[1], Alexander Goldbacher[1], Kevin Gifford[2], Qianqian Zhang[1], Ben Wu[1]; [1]*Rowan Univ., USA;* [2]*Univ. of Colorado Boulder, USA.* We propose and demonstrate a wireless interference source tracking system synchronized with photonic links. The system locates interference source for radio telescope arrays and is optimized with sensor data from Hat Creek Radio Observatory.

FV7A.3 • 17:00

Enhanced Vibration Recognition via Multi-Domain Fusion and Attention-Based FCN in Φ-OTDR Systems, Bang Yang[1], Shangyi Wang[1], Pengxi Yang[1], Jianwei Tang[1,2], Shuang Gao[1], Yong Yao[1], Yanfu Yang[1,2]; *[1]Harbin Inst. of Technology, Shenzhen, China; [2]Pengcheng Laboratory, China.* Based on the fusion of multi-domain information, a fully-convolutional neural network with channel attention and spatial attention effectively enhances vibration recognition accuracy in Φ-OTDR systems, achieving a vibration event recognition accuracy of 96.8% within the network inference latency of 1 ms.

17:30 -- 19:00
JV8A • Joint FiO LS: Laser Science and Quantum Electronics
Presider: Kin On Ho; Univ. of Texas at Austin, USA

JV8A.1 • 17:30
Characterizing Semiconductor Gamma-Ray Sensors using a Biologically-Inspired Optimizer, Manuel Ballester[1], Jaromir Kaspar[2], Francesc Massanes[2], Alexander Hans Vija[2], Aggelos Katsaggelos[1]; *[1]Northwestern Univ., USA; [2]Siemens Healthineers, USA.* We present a novel approach for characterizing CdZnTe detectors using the Slime Mold Algorithm, enabling efficient identification of crystal defects that affect carrier transport in high-energy Gamma-ray detection applications.

JV8A.2 • 17:45
Recursive Light Encoding of Mass and Space-Time in Quantum Optics, Matt Leibel[1]; *[1]Douglas College, Canada.* This paper presents the Grand Computational System, a unified model where mass, spacetime, and observation emerge from recursive light. Through quantum optical formulas, it predicts and validates energy behaviors across atomic and macroscopic systems.

JV8A.3 • 18:00
Interaction Dynamics of Solitons in Semilinear Coupled Bragg Gratings with Cubic-Quintic Nonlinearity and Phase Mismatch, Etu Podder[1], Javid Atai[1]; *[1]School of Electrical and Computer Engineering, The Univ. of Sydney, Australia.* We investigate the interaction dynamics of quiescent solitons in a semilinear grating-assisted coupler with cubic-quintic nonlinearity and phase mismatch. The interplay of phase mismatch with other system parameters in shaping interaction outcomes is also studied.

JV8A.4 • 18:15
Photothermal Transport Perturbation in Methanol-Water Binary System Using Non-Absorbing Fluorescein Dye, SUMIT KOTWAL[1], Aman Sharma[1], Debabrata Goswami[1]; *[1]Indian Inst. of Technology Kanpur, India.* We show that adding non-absorbing fluorescein to a methanol-water system modifies the thermal lens signal. Fluorescein disrupts the solvent's hydrogen bonds, lowering thermal conductivity, trapping heat, and amplifying the photothermal effect.

JV8A.5 • 18:30
Super Cell Symmetric Bound States in the Continuum on Graphene-based Metasurface, Shuvajit Roy[1], Sweta Rani[1]; *[1]School of Engineering, Sister Nivedita Univ., India.* A symmetric super unit cell bound state in the continuum (BIC) is proposed on a

graphene metasurface. Quasi-BIC transmission radiation channels are accessed by altering the radius of the etched circles on graphene.

JV8A.6 • 18:45
Multi-Layer Polaronic Multi-Electron Nondispersing Trojan-Like Wavepackets on Multiple Click-Clack Balls Trajectories in Atoms and Quantum Dots, Matt Kalinski[1]; [1]*Utah State Univ., USA.* Multi-electron extension of the Trojan-like wave packets on the Langmuir oscillating He model trajectories is found with the electrons fractionally-orbitting the nucleus and bouncing collectively from each other in analogy to few groups of multiple Click-Clack Balls.

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Monday, 27 October

08:00 -- 09:00
Room 2A
FM1A • Virtual Reality and Augmented Reality Theme: VR and Augmented Vision I
Presider: Groot Gregory; Synopsys, Inc, USA

FM1A.1 • 08:00 (Invited)
Portable and Wearable Visual Simulators of Eye Optical Corrections, Susana Marcos[1]; [1]*Univ. of Rochester, USA.* Myopia and presbyopia are highly prevalent. With increasingly sophisticated optical solutions, see-through binocular visual simulators let patients experience real-world vision through simulated lenses—via spatial or temporal multiplexing—prior to contact lenses prescription or surgery.

FM1A.2 • 08:30 (Invited)
Extreme Etendue Astronomical Cameras: Enabling the Big Data AI/ML Era, Daewook Kim[1]; [1]*Wyant Coll of Opt Sciences, UArizona, USA.* The Vera Rubin Observatory, with its 8.4m diameter mirror and 49-moon field-of-view, generates unprecedented astronomical data. Next-generation extreme etendue camera systems are crucial for maximizing information throughput, driving the big data AI/ML era.

08:00 -- 09:00
Room 1A
FM1B • Computational Methods in Imaging and Sensing
Presider: Rongguang Liang; Univ of Arizona, Coll of Opt Sciences, USA

FM1B.1 • 08:00
See-through binocular visual simulator with automatic convergence control, Renuka Manjula Narayanan[1,2], Davd Fernandez[2], Tianlun Zou[1,2], Keith Parkins[2], James Germann[2], Jannick P. Rolland[1,2], Susana Marcos[2,1]; [1]*U of Rochester, The Inst. of Optics, USA;* [2]*Center for Visual Science, Univ. of Rochester, USA.* Visual simulators allow the preview of vision through prospective optical corrections. Here, we present a 20-degree field-of-view, see-through binocular visual simulator-aberrometer with automatic convergence control to simulate and assess corrections while preserving natural accommodation cues.

FM1B.2 • 08:15
Label-Free Sensing and Real-Time Holographic Optogenetic Control of Cardiac Excitation Wavefronts, Lars Buettner[1], Robert Wendland[1], Felix Schmieder[1], Muhammad A. Sikandar[2], Wolfram-Hubertus Zimmermann[2], Olaf Bergmann[2], Juergen W. Czarske[1]; [1]*Technische Universität Dresden, Germany;* [2]*Department of Pharmacology and Toxicology, Univ. Medical Center Goettingen, Germany.* We present label-free real-time cardiac excitation wavefront characterization to identify pathologic contraction states. Sparsely sampled optical signals are used for optogenetic closed-loop wavefront control of *in vitro* human cardiomyocyte networks expressing Chrimson.

FM1B.3 • 08:30

Exploring Spatiotemporal Wave Packets for Extended Depth of Field Biomedical Imaging, Kefu Mu[1], Hsiao-Chih Huang[1], Chen-Ting Liao[1], Hui M. Leung[1]; *[1]Indiana Univ. Bloomington, USA.* Spatiotemporal wave packets designed to achieve propagation invariance through enforcing correlation between the optical beam's wave vector and frequencies are explored to enhance biomedical imaging. We present experimental results comparing such spatiotemporal structured free-space and in-medium beam propagation against Gaussian beams.

FM1B.4 • 08:45
Underwater Computational Ghost Imaging Based on Advanced Anti-Degradation Model, Annan Xia[1], Zhiyan Chen[1], Qingyang Zhu[1], Yi Hao[1], Qian Li[2], H. Y. Fu[1]; *[1]Tsinghua Univ., China; [2]School of Electronic and Computer Engineering, Peking Univ., China.* An advanced anti-degradation model for underwater computational ghost imaging is proposed. It predicts degraded patterns by considering the attenuation coefficient, achieving a 99.96% MSE reduction, a 296.46% PSNR boost, and a 90.38% SSIM improvement.

08:00 -- 09:00
Room 1B
FM1C • Space-Based Imaging and Optical Processing
Presider: Partha Banerjee; Univ. of Dayton, USA

FM1C.1 • 08:00 (Invited)
Blurring the Line Between Ground and Space: Adaptive Optics for Sharper Astronomy, Suresh Sivanandam[1], Jacob Taylor[3], Robin Swanson[1], Ross Cheriton[2], Uriel Conod[4], Scott Chapman[5]; *[1]Univ. of Toronto, Canada; [2]National Research Council of Canada, Canada; [3]Keck Observatory, USA; [4]Univ. of British Columbia, Canada; [5]Dalhousie Univ., Canada.* We demonstrate innovations in adaptive optics and astrophotonics that advance astronomical instrumentation, including wide-field turbulence correction and photonic phase correctors, enabling diffraction-limited infrared imaging and spectroscopy from the ground and bridging ground–space observational capabilities.

FM1C.2 • 08:30 (Invited)
Surface Profiling by Digital Holography, Myung K. Kim[1]; *[1]Univ. of South Florida, USA.* An overview is given of the development of digital holographic technieques in metrology, including surface profilometry. Quantitative phase microscopy is extended to multi-wavelength methods that extend height measurements to macroscopic ranges while maintaining micrometer resolution.

08:00 -- 09:00
Room 1C
FM1D • Integrated Photonic Devices and Subsystems I
Presider: Wesley Sacher; Max-Planck-Inst fur Mikrostrukturphysik, Germany

FM1D.1 • 08:00
Low-Loss Coupler to Vertical Plasmonic Waveguides, Aditi Chaluvadi[1], Boris Vukovic[1], Dominik Bisang[1], David Moor[1], Manuel Kohli[1], Andreas Messner[1], Yuriy Fedoryshyn[1], Daniel

Chelladurai[1], Juerg Leuthold[1]; *[1]ETH Zurich, Switzerland.* We present a coupler from silicon photonic to vertical plasmonic metal-insulator-metal waveguides with a measured efficiency of -1.4 dB at 1550 nm, and an optical bandwidth of more than 100 nm.

FM1D.2 • 08:15
Shortest Adiabatic Optical Coupler (~14um) with Broadest Bandwidth (~310nm @ 1.55um) for Si Photonics, Tianyao Huang[1], Xiaofeng Yu[1], Xi Cheng[1], Ziyu Lin[1], Jiachen Sun[1], Dingwen Hu[1], Yingyan Huang[2], Seng-Tiong Ho[1]; *[1]Department of Electrical and Computer Engineering, Northwestern Univ., USA; [2]Optonet, USA.* Ultra-short (2x shorter than literature) ultra-broadband (2x broader) optical adiabatic couplers for Silicon-Photonics are designed, using a new approach: ~310nm bandwidth at 1.55um is achieved with 2x2 coupler's length of 7um (~14um with input/output).

FM1D.3 • 08:30
Core and Cladding Contributions to Fluorescence and Raman Emission in Integrated Photonic Waveguides, Andres Garcia Coleto[1], Henry Crawford-Eng[1], Nathan Tyndall[3], Alin Antohe[2], Soumen Kar[2], Lewis Carpenter[2], Todd Stievater[3], Jelena Notaros[1]; *[1]Massachusetts Inst. of Technology, USA; [2]American Inst. for Manufacturing Integrated Photonics, USA; [3]Naval Research Laboratory, USA.* We introduce a novel method to identify the core and cladding contributions to background emission in integrated photonic waveguides, enabling more effective development and material optimization for low-noise and low-loss integrated photonics platforms. We validate the method by characterizing nine wafers fabricated in the AIM Photonics platform.

FM1D.4 • 08:45
Lasing from Ultracompact InP Nanowire PCSELs, Navoda Jayawardana[1], Samia Alyami[1], Matthew T. Larson[1], Chia-Wei Tu[1], Wei Wen Wong[2], Hark Hoe Tan[2], Chennupati Jagadish[2], Heidrun Schmitzer[3], Hans-Peter Wagner[1]; *[1]Univ. of Cincinnati, USA; [2]Australian National Univ., Australia; [3]Xavier Univ., USA.* The lasing characteristics of InP nanowire PCSELs with hexagonally shaped photonic crystal arrays of different sizes, have been examined, and moderately small arrays results in a lower threshold compared to large area PCSELs.

08:00 -- 09:00
Room 1D
FM1E • Light-Matter Interactions
Presider: Peter Dombi; Wigner Research Centre for Physics, Hungary

FM1E.1 • 08:00
Using Nonlinear Thomson Scattering to Probe Electron Dynamics in a High-Intensity Laser Focus, Michael Ware[1], Yance Sun[1], Kimberly Barr[1], Jacob Fuller[1], Andrew Jones[1], Nuno Sá[1], Justin Peatross[1]; *[1]Brigham Young Univ., USA.* Nonlinear Thomson scattering emission patterns give insights into electron dynamics in a high-intensity focus. We discuss recent measurements that demonstrate velocity asymmetry in the figure-8 motion, ponderomotive effects, and dwell time for electrons in the focus.

FM1E.2 • 08:15

Faraday Effect with Polarization Entangled Photons, Hernando Garcia[1], Sudhir Trivedi[2], Abdulatif Y. Hamad[1]; *[1]Southern Illinois Univ Edwardsville, USA; [2]Brimrose Technology Corporation, USA.* We report on the polarization-rotation as function of magnetic field for entangled photons in $Cd_{0.85}Mn_{0.15}Te$:Fe. A Verdet constant of 1128.94 Rad/m-T was measured, which is 20% higher than previously reported when 10^{16} photons/s were used.

FM1E.3 • 08:30
Probing Spin-Dependent Dispersion Effects in Plasmonic Metasurfaces, Nishkarsh Kumar[1], Sujit Rajak[2], Suman Mandal[2], Jeeban K. Nayak[3], Olivier J. Martin[3], Nirmalya Ghosh[2]; *[1]Indian Inst. of Technology Kanpur, India; [2]Physics, Indian Instititute of Science Education and Research, Kolkata, India; [3]Electrical and Microengineering, Ecole Polytechnique Federale de Lausanne, Switzerland.* We investigated spin-dependent dispersion in symmetric plasmonic metasurfaces (1D grating) using Fourier-domain Mueller matrix polarimetry, enabled by tight focusing and wavevector transformation under high-NA conditions in the far field.

FM1E.4 • 08:45
Trapping Efficiency Optimization in Plasmonic Optical Nanotweezers for Translatable Applications, Nasrin Abdollahi Borazjan[1], Abraham Vazquez-Guardado[1,2]; *[1]North Carolina State Univ., USA; [2]Center for Advanced Self-Powered Systems of Integrated Sensors and Technologies (ASSIST), USA.* This manuscript presents a study of optical nano-trapping produced by a plasmonic array on gold and dielectric nanoparticles. The system supports directional force and potential profiles to achieve stable trapping in an aqueous environment.

08:00 -- 10:00
Room 1E
LM1F • Anderson Dissertation Award Presentations
Presider: Brian Washburn; NIST, USA

LM1F.1 • 08:00 (Invited)
Free-space Optical Time Transfer for Future Femtosecond Ground-to-satellite Clock Networks, Emily Caldwell[1], Jean-Daniel Deschenes[2], William Swann[1], Hugo Bergeron[2], Benjamin Stuhl[3], Jennifer Ellis[1], Ian Coddington[1], Laura C. Sinclair[1], Nathan R. Newbury[1]; *[1]National Inst. of Standards and Technology, USA; [2]Waxwing Instruments, Canada; [3]Space Dynamics Laboratory, USA.* Leveraging the time programmable frequency comb, recent demonstrations of free-space optical time transfer show femtosecond time transfer and sub 10-18-level frequency transfer across 300 km of air at losses expected for ground-to-space optical links.

LM1F.2 • 08:30 (Invited)
Expanding the Reach of Quantum Enhanced Gravitational-wave Detectors, Dhruva Ganapathy[1]; *[1]Massachusetts Inst of Technology, USA.* We present the first realization of frequency dependent squeezing in a gravitational wave interferometer.Non-classical states of light are injected to reduce quantum noise, resulting in significant enhancement of the detectors' astrophysical reach.

LM1F.3 • 09:00 (Invited)

Terahertz-Driven Metastable Magnetism and Its Coherent Control in FePS3, Batyr Ilyas[1], Tianchuang Luo[1], Alexander von Hoegen[1], Emil Vinas Bostrom[2], Zhuquan Zhang[3], Jaena Park[4], Junghyun Kim[4], Je-Geun Park[4], Keith A. Nelson[3], Angel Rubio[2], Nuh Gedik[1]; *[1]Department of Physics, Massachusetts Inst. of Technology, USA; [2]Max Planck Inst. for the Structure and Dynamics of Matter, Germany; [3]Department of Chemistry, Massachusetts Inst. of Technology, USA; [4]Department of Physics and Astronomy and Inst. of Applied Physics, Seoul National Univ., Korea (the Republic of).* We demonstrate ultrafast terahertz control of magnetism in a van der Waals antiferromagnet, inducing a metastable magnetic state and coherently manipulating it via resonantly driven phonons, stabilized through a new mechanism involving critical spin fluctuations.

LM1F.4 • 09:30 (Invited)
Sculpturing Light with Metamaterials and the Topologies of Light in Free Space, Haiwen Wang[1], Shanhui Fan[2]; *[1]Department of Applied Physics, Stanford Univ., USA; [2]Department of Electrical Engineering, Stanford Univ., USA.* Shaping and controlling electromagnetic waves have wide-ranging scientific and practical implications. In this work, we investigate two themes in photonics: the design and functionality of non-local metasurfaces and the topological structures in electromagnetic waves.

09:15 -- 10:00
Room 2A
FM2A • FiO Visionary Session I: Machine Learning
Presider: Tom Hausken; Optica, USA

FM2A.1 • 09:15 (Visionary)
Building the Future of Photonic Design and Simulation with Machine Learning, Tyler W. Hughes[1], Yannick Augenstein[1], Gregory Roberts[1], Bohan Zhang[1], Momchil Minkov[1]; *[1]Flexcompute Inc, USA.* Machine learning and electromagnetics share deep mathematical foundations. I'll overview fundamental ML concepts and show how they map naturally onto photonic device design—from inverse design, to surrogate modeling and GPU-accelerated simulation. We'll explore how the application of these ideas unlocks a new paradigm for photonic design and simulation.

10:30 -- 12:30
Room 2A
FM3A • Quantum Technologies Theme: From Quantum Computing Hardware to Quantum Error Mitigation
Presider: Christopher Myatt; QPIC, Inc, USA

FM3A.1 • 10:30 (Invited)
Photonic Quantum Systems: From Interference to Integration, Stefanie Barz[1]; *[1]Univ. of Stuttgart, Germany.* Photonic quantum systems are central to quantum technologies. This talk covers quantum interference and entanglement, both at the heart of photonic quantum technologies. I will then discuss recent advances in the building blocks of photonic quantum computing and outline how photonic integration is key to developing large-scale systems.

FM3A.2 • 11:00 (Invited)

Visible Photonics for Trapped-Ion Quantum Computing, Molly R. Krogstad[1]; [1]*Quantinuum, USA.* Quantinuum has built world-class trapped-ion quantum computers and is advancing technology to support further scaling. I will discuss our latest results and progress developing visible photonics for scalable light delivery for trapped-ion quantum computing systems.

FM3A.3 • 11:30 (Invited)
Transforming the Path to Quantum Advantage with Quantum Software, Yuval Baum[1]; [1]*Q-Ctrl, USA.* Quantum computers have the potential to solve problems that are beyond the reach of today's supercomputers. Before this cutting-edge technology can achieve the first commercial demonstration of quantum advantage, quantum computers will need to become much more capable. In this talk, I will survey several promising applications in quantum chemistry and optimization where commercial quantum utility may appear in the near future, well before fault tolerant quantum computing will be available, and demonstrate how Q-CTRL software tools enable these applications and bring the utility era closer.

FM3A.4 • 12:00 (Invited)
Mid–Circuit Measurement and Ancilla Reuse on a Zone-Based Neutral Atom Quantum Processor, Mickey M. McDonald[1]; [1]*Atom Computing, Inc., USA.* We describe a zone-based architecture for performing quantum computation using optically-trapped neutral atoms, describe recent experiments demonstrating reuse of ancillas and coherence across multiple reloadings, and discuss the path toward scaling to ever larger systems.

10:30 -- 12:00
Room 1A
FM3B • Machine Learning Theme: Machine Learning I
Presider: Chenkai Mao; Stanford Univ., USA

FM3B.1 • 10:30 (Invited)
End-to-End Inverse Design for Repeatable, High-Performance Silicon Photonics, Alfred Cheung[1], Kieran Culligan[1], Krishna Gadepalli[1], Lucas Grosjean[1], Jian Guan[1], Yang Meng[1], Xavier Serey[1], Rhett Stucki[1], Jiahui Wang[1], Ian Williamson[1], Yi-Kuei Wu[1]; [1]*Google X, USA.* We introduce a foundry-validated, end-to-end inverse design pipeline for repeatable, high-performance silicon photonics. It overcomes fabrication/simulation gaps, demonstrating CWDM design for manufacturability and low variability across dies and wafers.

FM3B.2 • 11:00 (Invited)
Machine Learning–Enhanced Optimization for Metamaterial Design, Raphael Pestourie[1]; [1]*Georgia Inst. of Technology, USA.* We present machine learning methods that accelerate and generalize optimization of metamaterials. By learning reusable geometric representations, rather than surrogates, we enable efficient design while leaving the task of solving Maxwell's equations to a physics-based PDE solver.

FM3B.3 • 11:30 (Invited)
Automatic Differentiation and Reinforcement Learning for Inverse Design in Nanophotonics, Yannik Mahlau[1]; [1]*Leibniz Univ. Hannover, Germany.* Most previous work on inverse design uses gradient information through the adjoint method. We show recent advancements in GPU-accelerated inverse design through time reversed automatic

differentiation as well as gradient-free optimization through reinforcement learning.

FM3B.4 • 12:00 (Invited)
Tools for inverse design algorithm research, Martin F. Schubert[1]; [1]*invrs-io, USA.* Photonic inverse design has seen development of many innovative algorithms. This talk discusses software tools for developers and users of these algorithms, which support experimentation and benchmarking and fill a gap in inverse design research.

10:30 -- 12:30
Room 1B
FM3C • Novel Displays and Diffractive Optics
Presider: Juergen Czarske; Technische Universität Dresden, Germany

FM3C.1 • 10:30 (Invited)
Vision with a two-photon infrared RGB display, Pablo Artal[1]; [1]*Universidad de Murcia, Spain.* I will present the first functional two-photon infrared RGB display enabling color perception using near-infrared light. Additive color mixing allows full-spectrum hue rendering, demonstrating the feasibility of polychromatic vision beyond the visible range.

FM3C.2 • 11:00
Tuning the Exploration–Exploitation Tradeoff in Bayesian Optimization of Diffractive Waveguide AR Displays, Nick M. Anthony[1], Joseph S. Smalley[1], Alastair Grant[1]; [1]*DigiLens Inc., USA.* We apply Bayesian optimization to a diffractive waveguide AR display aiming to tune the acquisition function hyperparameter affecting the exploration-exploitation tradeoff. We find an ideal hyperparameter value that suggests exploitation is favorable over exploration.

FM3C.3 • 11:15
Diffractive Optical Waveguides, Yuntian Wang[1], Yuhang Li[1], Tianyi Gan[1], Kun Liao[1], Mona Jarrahi[1], Aydogan Ozcan[1]; [1]*Univ. of California Los Angeles, USA.* We introduce cascadable diffractive waveguides capable of selectively transmitting/blocking any desired set of spectral, spatial and polarization modes, providing a streamlined approach for functional waveguide design. An experimental demonstration was conducted at the terahertz spectrum.

FM3C.4 • 11:30
Broadband Unidirectional Visible Imagers, Che-Yung Shen[1], Paolo Batoni[2], Jingxi Li[1], Xilin Yang[1], Kun Liao[1], Jared Stack[2], Jeff Gardner[2], Aydogan Ozcan[1]; [1]*Univ. of California Los Angeles, USA;* [2]*Broadcom Inc., USA.* We introduce broadband and polarization-insensitive unidirectional imagers in the visible spectrum, which create images in the forward direction while blocking the image formation in the reverse direction.

FM3C.5 • 11:45
Snapshot Multispectral Imaging via Defocus Encoding and a Fourier Imager Network, Xilin Yang[1], Michael J. Fanous[1], Hanlong Chen[1], Ryan Lee[1], Paloma C. Costa[1], Yuhang Li[1], Luzhe Huang[1], Yijie Zhang[1], Aydogan Ozcan[1]; [1]*Univ. of California Los Angeles, USA.* Using wavelength-dependent defocus as a spectral encoding mechanism, we capture a single monochrome snapshot image and reconstruct multispectral images with a deep multispectral Fourier Imager Network, achieving 98.25% channel accuracy.

FM3C.6 • 12:00
Ultra-High-Resolution Micro-LED Displays Enabled by Transparent Negative Photoresist-Based Color Conversion, Ching-Fuh Lin[1], Yu-Han Kung[1], Ting-Chun Lee[1], Chih-Yuan Tsai[1], Hao-Sung Chiu[1], Tzu-Yi Yang[1]; *[1]National Taiwan Univ., Taiwan.* We developed a photolithography process that reduces fabrication time by over threefold, enabling 1 × 1 μm color-conversion pixel arrays (14,115 PPI monochrome; 7,058 PPI panchromatic) with high conversion efficiency—ideal for AR/VR microdisplays.

FM3C.7 • 12:15
Inverse Design of Photonic Metasurfaces Through Physics-Informed Deep Learning Using a Rigorous Point-Dipole Scattering Model, Timo Gahlmann[1], Femius Koenderink[1], Ewold Verhagen[1]; *[1]Amolf, Netherlands.* We present a physics-informed deep-learning approach for inverse design of photonic metasurfaces with a multiple-scattering model employing Ewald summation of dipolar lattices. This inherently ensures physical consistency, leads to better resonance prediction, and enables rapid design generation once trained.

10:30 -- 12:30
Room 1C
FM3D • Integrated Photonic Devices and Subsystems II
Presider: Amirhassan Shams-Ansari; DRS Daylight Solutions, USA

FM3D.1 • 10:30 (Invited)
Chip-scale Low Noise Oscillators Based on Integrated Optical Frequency Division, Jiang Li[1]; *[1]HQPhotonics, USA.* In this talk, I will review our recent progress on chip-based low phase noise photonic microwave oscillators based on integrated electro-optic frequency comb. The measured phase noise achieves record low phase noise for chip-based oscillators.

FM3D.2 • 11:00
Photonic Crystal Microring Resonator (PhCR)-based Tunable Optical Frequency Converter on a Hybrid silicon nitride-on-lithium niobate Platform, Zhongdi Peng[1], Rakesh Krishna[1], Xi Wu[1], Tianren Fan[1], Amir Hosseinnia[1], Ali Adibi[1]; *[1]Georgia Inst. of Technology, USA.* We demonstrate a photonic crystal resonator on a hybrid silicon nitride-on-lithium niobate platform for a tunable optical frequency converter. We precisely control the splitting bandwidth (93.4 MHz/nm) and measure the frequency tuning rate (0.85 pm/V).

FM3D.3 • 11:15
Fabrication-Tolerant Polarization Splitter-Rotator Using Adiabatic Design in Silicon Nitride, Ramesh Kudalippalliyalil[1,2], Thomas E. Murphy[1], Karen E. Grutter[2]; *[1]Univ. of Maryland at College Park, USA; [2]Laboratory for Physical Sciences, USA.* We demonstrate an adiabatic polarization splitter-rotator on a 500 nm Si3N4-on-SiO2 platform, with < 1 dB insertion loss, < −12 dB crosstalk, and > 50 nm bandwidth near 1550 nm, tolerant to ±50 nm width variations.

FM3D.4 • 11:30
Heterogeneously integrated broadband optical isolator, Kyunghun Han[1,2], Yiliang Bao[1], Junyeob Song[1,2], Vladimir Aksyuk[1]; *[1]National Inst. of Standards and Tech, USA; [2]Theiss Research, USA.* We demonstrate a traveling-wave optical isolator integrated on thin-film lithium

niobate and silicon nitride waveguides. A four-channel Mach–Zehnder interferometer with two push–pull modulators achieves efficient broadband backward isolation without spurious harmonics while preserving the forward transmission.

FM3D.5 • 11:45
An Integrated Ytterbium-Doped Amplifier, Danxian Liu[1], Tianyi Zeng[1], Erik W. Masselink[1,2], Kiyoul Yang[1]; *[1]School of Engineering and Applied Sciences, Harvard Univ., USA; [2]Massachusetts Inst. of Technology, USA.* We demonstrate an integrated Ytterbium-doped amplifier achieving over 17 dB of small-signal off-chip net gain and 16 dB of large-signal off-chip net gain at 1020 nm.

FM3D.6 • 12:00
Hybrid Integration of a Semiconductor Saturable Absorber and Solid-State Gain, Erik W. Masselink[2,1], Tianyi Zeng[2], Danxian Liu[2], Kiyoul Yang[2]; *[1]MIT, USA; [2]School of Engineering and Applied Sciences, Harvard Univ., USA.* We demonstrate hybrid integration of a semiconductor saturable absorber and an Ytterbium-doped $\mathrm{Al_2O_3}$ cavity to produce a Q-switched laser with 120 ns pulse width and 170 pJ pulse energy at 1 \textmu m.

FM3D.7 • 12:15
Reduced-Crosstalk Grating-Based Antennas for Wide-Field-of-View Integrated Optical Phased Arrays, Henry Crawford-Eng[1], Benjamin M. Mazur[1], Andres Garcia Coleto[1], Daniel M. DeSantis[1], Jelena Notaros[1]; *[1]Massachusetts Inst. of Technology, USA.* We develop and experimentally demonstrate the first reduced-crosstalk integrated grating-based optical antennas, and utilize them to enable a half-wavelength-pitch grating-lobe-free integrated optical phased array with a wide 180-degree field of view.

10:30 -- 12:30
Room 1D
FM3E • Computational and Transformation Optics
Presider: Myung Kim; Univ. of South Florida, USA

FM3E.1 • 10:30
Optical ReLUs for Holographic Convolutional Neural Nets, Kelvin H. Wagner[1], Sean McComb[1], Diego Olaya[1], Doug McKnight[2], Tim Slagle[3]; *[1]Univ. of Colorado Boulder, USA; [2]Meadowlark Optics, USA; [3]Knob Electronics, USA.* The array of adaptive interconnections needed for multilayer convolutional neural networks can be implemented and learned with all-optical back-propagation using thick Fourier-plane dynamic holographic photorefractive crystals and a phase sensitive bidirectional optical binary ReLU switch.

FM3E.2 • 10:45
Ultrafast Pulse Retrieval from Partial FROG Traces Using Implicit Diffusion Models, Abhimanyu Borthakur[4], Jack Hirschman[1,2], Sergio Carbajo[5,3]; *[1]Applied Physics, Stanford Univ., USA; [2]SLAC National Accelerator Laboratory, USA; [3]California NanoSystems Inst., USA; [4]ECE, UCLA, USA; [5]Physics and Astronomy, UCLA, USA.* We present a novel generative diffusion model to automate the recovery of ultrafast pulses from highly incomplete Frequency Resolved Optical Gating traces resulting in a precise, fast and advanced deep learning algorithm.

FM3E.3 • 11:00 (Invited)
Mitigating Vergence-Accommodation Conflict in Near-Eye Displays, Atanas Gotchev[1]; [1]*Tampereen Yliopisto, Finland.* The vergence-accommodation conflict hinders the adoption of immersive near-eye displays. The talk discusses three conflict-mitigation approaches: light field displays and accommodation-invariant systems, operating in either non-coherent or coherent-lingt regimes.

FM3E.4 • 11:30
Enhancing Multiphoton Microscopy through Photon Number Resolution, Daniel W. Scarbrough[2], Matteo Moioli[1], Edoardo Mornacchi[1], Mireia Perera-González[1]; [1]*Swabian Instruments, Germany;* [2]*Physics, Colorado School of Mines, USA.* We demonstrate enhancement of multiphoton microscopy by integrating photon number resolution with Swabian Instruments' Time Tagger X, improving contrast and signal-to-noise in low light, enabling high-fidelity imaging using room-temperature detectors.

FM3E.5 • 11:45
Convolutional Neural Networks for Predicting Nonlinear Pulse Propagation in Multimode Fibers, Bora Carpinlioglu[1], Bahadir U. Kesgin[1], Ugur Tegin[1]; [1]*Koç Universitesi, Turkey.* We evaluate convolutional neural networks for predicting nonlinear pulse propagation in multimode fibers by constructing a dataset and training U-Net models for different tasks. Our results indicate a future strategy for applications requiring real-time control.

FM3E.6 • 12:00 (Invited)
Simulation and Optimization of EPE Lightguides with VHOEs, Yeh-Wei Yu[1], Chung-Wei Lin[1], Tsung-Hsun Yang[1], Ching-Cherng Sun[1]; [1]*National Central Univ., Taiwan.* Exit pupil expansion (EPE) lightguides are crucial for AR/MR glasses, enabling seamless virtual-real integration. This paper highlights advancements in VHOE-based EPE lightguides, focusing on VOHIL models, ASP methods, and optimized spectrum distribution for improved efficiency.

10:30 -- 12:30
Room 1E
LM3F • Nanophotonics and Unconventional Photonics
Presider: Markus Raschke; Univ. of Colorado Boulder, USA

LM3F.1 • 10:30 (Invited)
Title to be Announced, Jim Schuck[1]; [1]*Columbia Univ., USA.* Abstract not available.

LM3F.2 • 11:00 (Invited)
Unconventional Photonics, Hui Deng[1]; [1]*Univ. of Michigan, USA.* Modern photonics provide a versatile platform for exploring novel phenomena. We will discuss examples such skin effect by dissipation engineering, driven topological Chern insulators, and ultrafast, low power chirality switch and non-reciprocal optical rotator and isolators.

LM3F.3 • 11:30 (Invited)
The Physics of Sub-wavelength Liquid-crystal Metasurfaces and applications, Patrice Genevet[1]; [1]*Colorado School of Mines, USA.* Subwavelength confinement of liquid crystal can

achieve active metasurfaces with strong light confinement and tunable anisotropy. The hybrid platform presented during the talk is composed of non resonant GaN and sub-wavelength LC to enhance electro-optic modulation speed, leveraging GaN's wide bandgap and liquid crystal reconfigurability for ultrafast, broadband, compact, and efficient nanophotonic devices.

LM3F.4 • 12:00
Resonant and Non-Resonant Phenomena in Hybrid Nanodiamond-Microbottle Resonator, Debojyoti Ray Chawdhury[1], Tulika Agrawal[1], Aneesh Vincent Veluthandath[2], Senthil Murugan Ganapathy[2], Prem Ballabh Bisht[1,3]; *[1]Department of Physics, Indian Inst. of Technology Madras, India; [2]Optoelectronics Research Centre, Univ. of Southampton, UK; [3]Centre of Excellence in Biochemical Sensing and Imaging Technologies, Indian Inst. of Technology Madras, India.* Photoluminescence of nitrogen vacancy centres coupled with microbottle resonators (MBRs) exhibits whispering gallery modes. In addition, the non-resonant phenomenon of photonic nanojets through these MBRs have been numerically investigated.

LM3F.5 • 12:15
Symmetry-protected line of bound states in the continuum for surface-emitting lasers, Ki Young Lee[1], Weng W. Chow[1], Alexander Cerjan[1]; *[1]Sandia National Laboratories Albuquerque, USA.* We propose a surface-emission cavity incorporating a monolithic 3D photoniccrystal superstrate atop the cavity, supporting symmetry-protected lines of bound states in the continuum for large-area beam steering.

LM3F.6 • 12:30
Photoluminescence from metals – theory and experiments, Yonatan Sivan[1], Ieng Wai Un[2], Imon Kalyan[1]; *[1]Ben-Gurion Univ., Israel; [2]South China Normal Univ., China.* We provide a simple quantitative analytical expression describing photoluminescence from metals, show that it yields essentially the same predictions as a full scale discrete quantum mechanical calculation, and use it to explain seemingly contradicting experimental measurements

14:00 -- 15:30
Room 2A
FM4A • Quantum Technologies Theme: Applications of Quantum Sensors: From Neuroscience to Gravitational Waves
Presider: Christopher Myatt; QPIC, Inc, USA

FM4A.1 • 14:00 (Invited)
Title to be Announced, Ryan Hill[1]; *[1]Cerca Magnetics, UK.* Abstract not available.

FM4A.2 • 14:30 (Invited)
Withdrawn

FM4A.3 • 15:00 (Invited)
Shaping Quantum Noise in LIGO with Frequency-Dependent Squeezing: O4 Performance and Future Outlook, Begum Kabagoz[1]; *[1]MIT Kavli Inst., USA.* We present frequency-dependent squeezing (FDS) performance in LIGO during the O4 run and discuss strategies toward future -10 dB goals. We demonstrate how FDS shapes quantum noise in both radiation-pressure- and shot-noise-limited regions.

Frontiers in Optics + Laser Science 2025
Session Guide

Disclaimer: this guide is limited to technical program with abstracts and author blocks as of 22 October. For updated and complete information with special events, reference the online schedule or mobile app.

13:30 -- 15:30
Room 1A
FM4B • Virtual Reality and Augmented Vision Theme: New Technologies I
Presider: Barry Silverstein

FM4B.1 • 13:30 (Invited)
Power Consumption of Light Engines for AR Glasses, Shinston Wu[1]; [1]*Univ. of Central Florida, CREOL, USA.* The power consumption of five commonly employed microdisplay light engines for AR glasses, including micro-LEDs, OLEDs, liquid-crystal-on-silicon, laser beam scanning, and digital light processing are analyzed. Several methods for reducing power consumption will be discussed.

FM4B.2 • 13:50 (Invited)
Laser Light Source for AR LCoS Light Engines, Ronny Timmreck[1], Jonas Zeuner[1]; [1]*vitrealab GmbH, Austria.* Vitrealab's Quantum Light Chip technology enables ultra small, efficient and bright LCoS light engines for AR. Laser light is routed within a 3D waveguide architecture and emitted as an array of single mode laser beams.

FM4B.3 • 14:10 (Invited)
Designing Diffractive Waveguides for Laser Projectors, Juuso Olkkonen[1]; [1]*Dispelix, Finland.* Characteristics of laser light, such as well-defined polarization state and narrow spectral bandwidth, can be utilized in diffractive waveguide designs. This talk introduces challenges and opportunities of diffractive waveguides when designed for laser projectors.

FM4B.4 • 14:30 (Invited)
Peripheral Light Field Display for Wide FOV, Xuan Wang[1], Melissa Geng[1], Brian Wheelwright[1], Colby Vavolotis[1], Wataru Nishizawa[1], kevin Dao[1]; [1]*Meta Platforms Inc, USA.* We present a compact peripheral light field optical architecture to expand the field of view (FOV) of mixed reality system. Tilted to a pancake based center optics, the proposed system can provide FOV beyond human vision with a decent resolution.

FM4B.5 • 14:50 (Invited)
High efficiency LCOS laser projector with Holographic beam expander, Julian Ni[1], Wai Sze Tiffany Lam[1], Wanli Chi[1]; [1]*Meta Platforms Inc., USA.* We describe a compact laser LCoS projector using volume Bragg gratings for beam expansion and temporal-to-spatial coherence conversion. When combined with display waveguide, we achieved good image quality with speckle contrast below eye detection threshold.

Room 1B
14:00 -- 15:30
FM4C • Advanced Microscopy
Presider: Ruikang Wang; Univ. of Washington, USA

FM4C.1 • 14:00 (Invited)
Breaking the Speed Barrier: High-Speed Light-Field Microscopy for Kilohertz 3D Imaging and beyond, Liang Gao[1]; [1]*Univ. of California Los Angeles, USA.* Light-field microscopy offers

unprecedented capabilities for 3D visualization of biological samples down to the sub-cellular level. Despite its strengths, the technique has historically faced limitations in imaging speed due to the acquisition of large-format light field data. This bottleneck has restricted its use in high-speed bioimaging applications like voltage imaging or fluorescence lifetime imaging microscopy (FLIM). In this presentation, I will discuss our innovative approaches [1, 2] to overcoming this challenge by leveraging advancements in computational optics and detector technology, enabling a volumetric frame rate from kilohertz to terahertz.

FM4C.2 • 14:30 (Invited)
Phase Retrieval and Inverse Scattering with On-Chip Microscopy, Shwetadwip Chowdhury[1]; [1]*Univ. of Texas at Austin, USA.* Abstract not available.

FM4C.3 • 15:00 (Invited)
Optical Coherence Tomography Angiography and its Biomedical Applications, Ruikang K. Wang[1]; [1]*Univ. of Washington, USA.* This talk highlights OCT angiography fundamentals, enabling technologies, and key biomedical applications that benefit from visualizing microcirculatory blood flow.

14:00 -- 15:30
Room 1C
FM4D • Highly Integrated Photonic Platforms
Presider: Jiang Li; hQphotonics Inc., USA

FM4D.1 • 14:00 (Invited)
Heterogeneous Photonic-Electronic Platform with Slow-Wave Mach-Zehnder Modulator for High Bandwidth-Density Co-Packaged Optics, Nathan Lin[1], Colin McDonough[1], Robert Carroll[1], Amir Begović[1], Seth Kruger[1], Sarah Baranowski[1], Tat Ngai[1], Chris Striemer[1], Amit Dikshit[1], Chris Baiocco[1], David Harame[1]; [1]*AIM Photonics, USA.* By embedding the silicon photonics wafer with TSVs and RDLs, we demonstrate a 300 mm photonic-electronic interposer platform for heterogeneous integration of PICs, EICs, with slow-wave modulators and photodetectors for high-density, scalable co-packaged optics systems.

FM4D.2 • 14:30 (Invited)
Active Submicrometer-Wavelength Silicon Photonics, Wesley D. Sacher[1]; [1]*Max-Planck-Inst fur Mikrostrukturphysik, Germany.* This talk presents my group's work on foundry-fabricated silicon photonics spanning 445–980 nm, integrating three silicon nitride waveguide layers, photodetectors, thermo-optic devices, MEMS, and hybrid lasers into a versatile platform for active photonic circuits.

FM4D.3 • 15:00 (Invited)
PHz Current Control in Metals and Dielectric Media, Jeffrey B. Driscoll[1]; [1]*Rockley Photonics, USA.* Abstract not available.

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14:00 -- 15:15
Room 1D
FM4E • Nanophotonics
Presider: Lyuba Kuznetsova; San Diego State Univ., USA

FM4E.1 • 14:00 (Invited)
Miniaturized Reconfigurable Nanophotonic Devices enabled by Phase-change Materials, Hamed Abiti[1], Reza Marzban[1], Ashkan Zandi[1], Ali Adibi[1]; [1]*Georgia Inst. of Technology, USA.* This talk is focused on reconfigurable nanophotonic devices enabled by using volatile and nonvolatile phase-change materials, mode engineering, and novel inverse-design techniques. In addition to material and device aspects, state-of-the-art applications will be covered.

FM4E.2 • 14:30 (Invited)
Nanophotonics for Single-photon Nonlinear Optics and Coherent Control of Topological Electron States, Alexey Belyanin[1]; [1]*Texas A&M Univ., USA.* Nanophotonics offers extreme field localization and nonperturbative nonlinear optical interactions at the single photon level. I describe several examples including single-photon nonlinear parametric processes, quantum gates, and optical control of topological chiral edge states.

FM4E.3 • 15:00
On the Nonlinear Optical Response of ITO Nanocrystals-Embedded Glass Ceramics, Amir Ashjari[1], Brian Topper[2], Doris Möncke[1]; [1]*Alfred Univ., USA;* [2]*Clemson Univ., USA.* This study discusses significant and inconsistent nonlinearities in ITO nanocrystal-embedded glass-ceramics at 532 nm using a picosecond laser and explores their potential large nonlinear behavior near the epsilon-near-zero (ENZ) region at near-infrared wavelengths.

FM4E.4 • 15:15
Space-Time Optical Diffraction from Synthetic Motion, Anthony C. Harwood[1], stefano Vezzoli[1], Raziman T V[1], Calvin Hooper[2], Romain Tirole[1], Fanyi Wu[1], John B Pendry[1], Simon Horsley[2], Riccardo Sapienza[1], Stefan A Maier[3,1]; [1]*Imperial College London, UK;* [2]*Exeter Univ., UK;* [3]*Monash Univ., Australia.* Ultrafast photoexcitation of a 40 nm Indium Tin Oxide film are used to create superluminal, space-time modulations, enabling complex, non-separable control of diffraction patterns in momentum-frequency space [Harwood *et al.*, *Nat. Commun.* 16, 5147 (2025)].

14:00 -- 15:30
Room 1E
LM4F • Excitons and Ultrafast Dynamics in 2D Materials
Presider: Matthew Graham; Oregon State Univ., USA

LM4F.1 • 14:00 (Invited)
Many-body effects on Excited-State Dynamics and Nonlinear Optics in 2D Materials, Diana Y. Qiu[1]; [1]*Yale Univ., USA.* In this talk, I will present new theoretical and computational developments to understand many-body effects on high harmonic generation and exciton scattering processes.

LM4F.2 • 14:30
Ultrafast Transient Absorption Spectroscopy in Few-layered MnTe, Prasanta K. Datta[1], Sayan Prodhan[1], Ayon J. Karmakar[1], Debkanta Ghosh[1], Chinmayee C. Gowda[1], Chandra S. Tiwary[1]; [1]*Indian Inst. of Technology Kharagpur, India.* Ultrafast carrier dynamics in 2D MnTe is studied using femtosecond transient absorption spectroscopy, revealing excited-state absorption primarily due to free carrier absorption and trap-assisted recombination (60 ps) as the dominant decay mechanism.

LM4F.3 • 14:45 (Invited)
Mapping Ultrafast Photocarrier Transport in van der Waals Materials via Transient Absorption Microscopy, Hui Zhao[1]; [1]*Department of Physics and Astronomy, The Univ. of Kansas, USA.* We use a spatially resolved transient absorption technique to investigate in-plane photocarrier transport in van der Waals materials, including layered crystals and heterostructures where band alignment engineering enables precise control of layer-specific carrier distribution.

LM4F.4 • 15:15
Ultrafast Photocarrier Dynamics in 2D SnS_2, Ayon J. Karmakar[1], Debkanta Ghosh[1], Sayan Prodhan[1], Subhamay Pramanik[1], Dipak K. Goswami[1], Prasanta Kumar Datta[1]; [1]*Indian Inst. of Technology Kharagpur, India.* We perform ultrafast carrier dynamics of few-layered 2H-SnS_2 using pump-probe spectroscopy and it's band calculation is done. It's trap-state dominated free carrier recombination dynamics has been identified in band model.

16:00 -- 17:00
Room 2A
FM5A • Quantum Technologies Theme: From Quantum Networks to Exploiting Quantum Light
Presider: Anindya Banerji; Centre for Quantum Technologies, Singapore

FM5A.1 • 16:00 (Invited)
Title to be Announced, Mehdi Namazi[1]; [1]*Qunnect Inc., USA.* Abstract not available.

FM5A.2 • 16:30 (Invited)
Two-photon induced coherence without induced emission, Dong-Gil Im[1], Seung-Yeun Yoo[1], Chung-Hyun Lee[1], Jongheon Suh[1], Yoon-Ho Kim[1]; [1]*Pohang Univ of Science & Technology, Korea (the Republic of).* We demonstrate two-photon induced coherence without induced emission, showing 2φ phase modulation from undetected photons. This advances quantum imaging and metrology by extending induced coherence effects beyond single photons using two-photon Fock states.

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16:00 -- 18:00
Room 1A
FM5B • Virtual Reality and Augmented Vision Theme: New Technologies II
Presider: Barry Silverstein

FM5B.1 • 16:00 (Invited)
Power Efficiency of progressive Lissajous Laser Scanning Displays for AR, Ulrich Hofmann[1], Thomas von Wantoch[1], Marcel Metschulat[1], Fabian Schwarz[1], Leon Pohl[1], Lars Bole[1], Frank Senger[1], Jakob Studer[1], Michael Birlo[1], David Zopf[1], Stefan Franz[1], Matthias Powelleit[1], Matthieu Gaudet[1], Wjatscheslaw Galjan[1]; *[1]OQmented, Germany.* This talk will focus on how power consumption of a progressively scanning Lissajous laser display can be minimized while also addressing image quality, brightness and size requirements.

FM5B.2 • 16:20 (Invited)
Innovative 24-Channel RGB Illuminator Engine with compact Multi-Ridge Lasers and cutting-edge Driver IC providing 4.8Gpulses/s for Laser Beam Scanning Displays, Karolina Traczyk[1], Radoslaw Gancarz[2], Michael Boehm[2], Stefan Weiglhofer[2], Stefan Bernhard[2], Joerg Erich Sorg[2], Nicole Berner[2], Daniel Greif[3], Jacques Gollier[3], Greg Daly[3], Chloe Fabien[3], Brian Wheelwright[3], Emanuel Ehnes[2], Pouyan Eslami[2], Christian Filipic[2], Dalibor Kolar[2], Andreas Krebl[2], Dominik Maier[2], Michael Meitz[2], Franz Meitz[2], Duy-Dong Pham[2], Dusan Prelog[2], Emir Serdarevic[2], Jeff Smith[2], Igor Stanke[2], Jim Laudolff[3], Ken Diest[3], Lindsey Gilman[3], Ezz Hamed[3], Ziv Magoz[3], Amiel Quadri[3], Ray Smith[3], Varun Srivastava[3], Cedric Wu[3], Chunxin Yang[3], Vedad Mekic[2], Tobias Haupeltshofer[2], Sergey Lamansky[3], Azad Khizri[2], Stephan Haneder[2], Markus Rossi[1], Doug Carmean[3], Barry Silverstein[3]; *[1]AlphaLum SA, Switzerland; [2]ams-OSRAM, Austria; [3]Meta Reality Labs Research, USA.* A 24-channel illuminator engine for next gen LBS displays featuring a novel ams-OSRAM laser driver IC and a miniaturized multi-ridge RGB lasers. The system deployed at Meta generates few-nanosecond optical pulses with extensive programmability.

FM5B.3 • 16:40 (Invited)
Advanced InGaN Laser Manufacturing and Applications in Display, Phillip Skahan[1], Greg Niven[1], Terry Towe[1]; *[1]Kyocera, USA.* Laser displays are of growing interest for AR/VR applications and require InGaN laser diodes to provide visible light. In this talk, we will report on our epitaxial transfer manufacturing process and how it enables unique laser architectures applicable to display. We will also present updates on lasers tailored for efficient low-power operation and symmetrical beam output spanning the violet to green wavelength range

FM5B.4 • 17:00 (Invited)
Nonlinear Wave-mixing of Infra-red Lasers as a Route to Transparent Near-to-eye Displays, Peter Smith[1], Goronwy Tawy[1], Rex H. Bannerman[1], Corin Gawith[1]; *[1]Univ. of Southampton, UK.* Nonlinear wave-mixing offers next-gen 100% transparent AR displays. Harnessing short-pulse infrared lasers, it enables spectacle lenses that are absolutely clear, daylight-bright, and ultra-efficient—unlocking vivid, all-day wearable AR without sacrificing form, comfort, or battery life.

FM5B.5 • 17:20 (Invited)
Diode-pumped Solid-state Surface-emitting Lasers, Masanao Kamata[1]; *[1]Sony Semiconductor Solutions, Japan.* We report diode-pumped solid-state surface-emitting lasers at

wavelengths of 946 nm, 1030 nm and 1.3 μm, respectively. These devices represent the smallest lasers capable of delivering pulse peak powers exceeding one kilowatt allowing for example the IR up-conversion into the visible spectrum for specific applications.

16:00 -- 18:00
Room 1B
FM5C • Ultrafast Optical Interactions
Presider: Lyuba Kuznetsova; San Diego State Univ., USA

FM5C.1 • 16:00 (Invited)
Terahertz Nonlinear and Parametric Dynamics in Quantum Materials, Richard D. Averitt[1]; [1]*Univ. of California San Diego, USA.* This presentation will provide an overview of dynamics in quantum materials that are encoded in the parametric response at terahertz frequencies which provides insights beyond experiments that probe the linear time-invariant response.

FM5C.2 • 16:30 (Invited)
PHz Current Control in Metals and Dielectric Media, Peter Dombi[1,2]; [1]*HUN-REN Wigner Research Centre for Physics, Hungary;* [2]*ELI ALPS Research Inst., Hungary.* A fundamental challenge in PHz electronics is controlling electric currents on sub-femtosecond timescales. We realized current control with pJ-level pulses using the carrier-envelope phase. Metal-dielectric heterostructures result in 40-times signal increase with on-chip optoelectronic circuitry.

FM5C.3 • 17:00
Determining Gain Parameters of Bulk Solution-Processible Nanocrystals with Ultrafast Pump-Probe Spectroscopy, Ivo Tanghe[1,2], Zeger Hens[1], Dries Van Thourhout[1,2], Pieter Geiregat[1]; [1]*Universiteit Gent, Belgium;* [2]*imec, Belgium.* We investigate optical gain in bulk solution-processed semiconductors using transient absorption spectroscopy, highlighting these materials as high-performance candidates for lasing, offering long lifetimes, high gain coefficients, and compatibility with integrated photonics platforms.

FM5C.4 • 17:15 (Invited)
Towards ultrafast quantum imaging, Bienvenu Ndagano[1]; [1]*INRS-Energie Mat & Tele Site Varennes, Canada.* We report an ultrafast quantum imaging scheme that maps biphoton time bins onto spatial correlations. Through post-selection on specific correlation structures, we recover the time evolution of an ultrafast dynamic process, using slow imaging devices.

FM5C.5 • 17:45
Enhancing nonlinear optics in the mesoscopic regime with ultra-thin crystalline silver films, Philipp K. Jenke[1,2], Saad Abdullad[3], Andrew Weber[3], Álvaro Rodríguez Echarri[4,5], Fadıl Iyikanat[3], Vahagn Mkhitaryan[3], Frederik Schiller[6,7], J. Enrique Ortega[6,7], Philip Walther[1,8], F. Javier García de Abajo[3,9], Lee Arthur[1]; [1]*Faculty of Physics, Vienna Center for Quantum Science and Technology (VCQ), Univ. of Vienna, Austria;* [2]*Vienna Doctoral School in Physics, Univ. of Vienna, Austria;* [3]*The Barcelona Inst. of Science and Technology, ICFO-Institut de Ciencies Fotoniques, Spain;* [4]*Max-Born-Institut im Forschungsverbund Berlin e.V., Germany;* [5]*Center for Nanophotonics, NWO Inst. AMOLF, Netherlands;* [6]*Centro de Fisica de Materials CSIC/UPV-EHU-Materials Physics Center, Spain;* [7]*Donostia International Physics Center (DIPC),*

Spain; [8]Faculty of Physics, Christian Doppler Laboratory for Photonic Quantum Computer, Austria; [9]ICREA-Institucio Catalana de Recerca i Estudis Avancats, Spain. We demonstrate that reducing the thickness of few-atom-thick crystalline silver films enhances second-harmonic generation. This effect, mediated by quantum-confined electronic states, enables strong nonlinearities in microscopic interaction volumes, challenging classical predictions.

16:00 -- 18:00
Room 1C
FM5D • Novel Imaging Approaches
Presider: Florian Willomitzer; Univ of Arizona, Coll of Opt Sciences, USA

FM5D.1 • 16:00 (Invited)
Mid-infrared photothermal quantitative phase microscopy for live-cell imaging, Takuro Ideguchi[1]; [1]*Univ. of Tokyo, Japan.* We have developed wide-field mid-infrared photothermal microscopes utilizing quantitative phase imaging techniques. Our latest systems achieve imaging speeds beyond video rate and high spatial resolution, demonstrating wide-field mid-infrared nanoscopy.

FM5D.2 • 16:30 (Invited)
Nonlinear Interferometers - From Fundamentals to Biomedical Imaging and Beyond, Markus Graefe[1]; [1]*Technical Univ. of Darmstadt, Germany.* We present a quantum imaging scheme based on induced coherence in nonlinear interferometers, enabling imaging with undetected light. Spectral separation of illumination and detection allows optimized signal acquisition without detecting the probing light.

FM5D.3 • 17:00
Multi-Modal 3D Imaging of Specular Surfaces via Polarization and Deflectometry, Jiazhang Wang[1], Oliver Cossairt[2], Florian Willomitzer[1]; [1]*Univ. of Arizona, USA;* [2]*Northwestern Univ., USA.* We introduce a multi-modal 3D imaging method for specular surfaces by fusing deflectometric and polarimetric cues. The proposed method yields distinct benefits compared to classical deflectometry and shape from polarization.

FM5D.4 • 17:15
Resolution Beyond λ/10,000 in Single-Shot Optical Localization Metrology, Cheng-Hung Chi[1], Thomas A. Grant[1], Kevin F. MacDonald[1], Nikolay Zheludev[1,2]; [1]*Optoelectronics Research Centre, Univ. of Southampton, UK;* [2]*Hagler Inst. for Advanced Study, Texas A&M Univ., USA.* Optical measurement precision can be improved manifold by (nano)structuring target surroundings to optimize information (not power) flow from target to detector. In this regime, nanowire localization experiments at 640nm achieve variance of ~50 pm ($<\lambda/10^4$).

FM5D.5 • 17:30
Three-dimensional measurement method based on specular reflection field using digitally directed beams, Hiroshi Ohno[1]; [1]*Toshiba Corp, Japan.* A microscale 3D measurement method is proposed that acquires a specular reflection direction field relative to an incident direction field, using an optical system capable of illuminating the surface with digitally directed light beams.

FM5D.6 • 17:45
Robust and Accurate Iterative Normal Map Integration on Irregular Meshes for Single-Camera Deflectometry, Tianyi Wang[1], Jiazhang Wang[1], Florian Willomitzer[1]; *[1]Univ. of Arizona, USA.* We propose a 3D mesh-based integration method for iterative surface reconstruction in phase measuring deflectometry, enabling accurate reconstruction of specular surfaces from non-uniformly sampled data.

16:00 -- 18:15
Room 1D
FM5E • Novel Devices and Methods for Optical Transmitters and Receivers
Presider: Hao Song; Cisco Systems Inc., USA

FM5E.1 • 16:00 (Invited)
Novel Coherent Detection for Optical Fiber Communications, Haoshuo Chen[1]; *[1]Nokia Bell Labs, USA.* We demonstrate surface normal optical coherent Rx array for future parallel optical interconnect. The proposed scheme supports mutlicore fibers and can configured for space and wavelength division multiplexing.

FM5E.2 • 16:30
Experimental Demonstration of Tunable Optical Pattern Recognition by Direct Detection for Amplitude- and for Phase-Encoded Data, Hongkun Lian[1], Abdulrahman Alhaddad[1], Amir Minoofar[1], Gil Bashan[1], Huibin Zhou[1], Wing Ko[1], Muralekrishnan Ramakrishnan[1], Zixun Zhao[1], Yue Zuo[1], Moshe Tur[2], Jonathan Habif[1,3], Alan Willner[1,4]; *[1]Depart. of Electrical Engineering, Univ. of Southern California, USA; [2]Tel Aviv Univ., Israel; [3]Univ. of Southern California, Information Sciences Inst., USA; [4]Dornsife Department of Physics and Astronmy, Univ. of Southern California, USA.* Optical pattern recognition using direct detection is experimentally demonstrated for amplitude- and for phase-encoded data at 2- and 5-Gbaud rates. The optical output power levels below the threshold correspond only to target pattern occurrences.

FM5E.3 • 16:45
Simultaneous Optical Processing of Multiple QPSK Data Channels Using Multiple Tapped Delay Line Functions, Abdulrahman Alhaddad[1,2], Wing Ko[1], Amir Minoofar[1], Hongkun Lian[1], Huibin Zhou[1], Muralekrishnan Ramakrishnan[1], Xinzhou Su[1], Zile Jiang[1], Narek Karapetyan[1], Yingning Wang[1], Ruoyu Zeng[1], Ahmed Almaiman[3], Moshe Tur[4], Jonathan Habif[5], Alan Willner[1,6]; *[1]Univ. of Southern California, USA; [2]Fouad Alghanim & Sons Group of Companies, Kuwait; [3]Electrical Engineering, King Saud Univ., Saudi Arabia; [4]Electrical Engineering, Tel Aviv Univ., Israel; [5]Information Sciences Inst., Univ. of Southern California, USA; [6]Dornsife Department of Physics & Astronomy, Univ. of Southern California, USA.* We experimentally demonstrate simultaneous optical aggregation, convolution, and pattern recognition on two QPSK inputs at 7.5- and 10-Gbaud rates. A single nonlinear wave mixing stage is used to generate the six outputs at different wavelengths.

FM5E.4 • 17:00
Demultiplex OAM Beams Using Hybrid Phase Shift Neural Network, Tongyao Wu[1], Jiachi Ye[1], Abdulaziz Bazammul[1], Qian Cai[1], Hao Wang[1], Hamed Dalir[1], Elham Heidari[1]; *[1]Univ. of Florida, USA.* We propose a hybrid optical-electronic phase shift neural network for

demultiplexing orbital angular momentum beams. Our system achieves 87.25% accuracy with 6 times faster training and 1000× improved energy efficiency compared to all-electronic neural networks.

FM5E.5 • 17:15
A 60 GHz EO Bandwidth Mach-Zehnder Modulator on a Monolithic Silicon Photonic Platform for O-band Datacom, Ming Gong[1]; *[1]GlobalFoundries, USA.* We report a push-pull Mach-Zehnder modulator on a monolithic-SiPh platform with a 60 GHz EO bandwidth. We demonstrate a 2.9 dB TDECQ and 3.7 dB ER in 200 Gbps PAM-4 transmissions with 7-tap FFE.

FM5E.6 • 17:30
Vertical Plasmonic Electro-Absorption Modulator Based on Transparent Conductive Oxides, Marco Dober[1], Giacomo Torti[1], Killian Keller[1], Arnaud Schneuwly[1], Tobias Blatter[1], Laurenz Kulmer[1], Boris Vukovic[1], Dominik Bisang[1], Aditi Chaluvadi[1], Shiro Nishiwaki[2], Yaroslav Romanyuk[2], Yuriy Fedoryshyn[1], Juerg Leuthold[1]; *[1]Inst. of Electromagnetic Fields, ETH Zurich, Switzerland; [2]Laboratory of Thin Films and Photovoltaics, Empa - Swiss Federal Laboratories for Materials Science and Technology, Switzerland.* We present the first proof-of-concept of a vertical plasmonic electro-absorption modulator based on TCOs. We measure a 26 GHz device bandwidth and 64 Gbit/s data rate with less than 5 μm^2 active region footprint.

FM5E.7 • 17:45
Resonant-Peak-Monitorable Si-Photonics-Based Ring Resonator for III-V/Si Integrated Tunable Lasers, Takanori Sato[1], Kohei Matsuda[1], Yuki Ueda[1], Yusuke Sawada[3,2], Takuya Mitarai[3,2], Takuo Hiratani[3,2], Takuya Okimoto[3,2], Tsutomu Ishikawa[3,2], Naoki Fujiwara[3,2], Hideki Yagi[3,2], Kunimasa Saitoh[1]; *[1]Hokkaido Univ., Japan; [2]Transmission Devices Laboratory, Sumitomo Electric Industries, Ltd., Japan; [3]Photonics Electronics Technology Research Association (PETRA), Japan.* We fabricated a resonant-peak-monitorable ring resonator based on Si photonic platform. By employing adiabatic couplers in a Mach-Zehnder interferometer, the broadband low-crosstalk performance of approximately −20 dB can be successfully achieved.

FM5E.8 • 18:00
Broadband Noise-Like Pulse Emission in an Erbium-Doped Fiber Laser with Spectral Filtering, Marco V. Hernandez-Arriaga[1], José León Flores González[1], Rosa Elvia Lopez Estopier[1,2], Yareli Navarro Matínez[1], Erika Escobar[1], Miguel Ángel Bello Jimenez[1]; *[1]Universidad Autónoma de San Luis Potosí, Instituto de Investigación en Comunicación Óptica, Mexico; [2]Secretaría de Ciencias, Humanidades, Tecnología e Innovación (SECIHTI), Mexico.* Broadband noise-like pulses (NLPs) are generated in a figure-eight erbium-doped fiber laser incorporating fiber Bragg gratings as spectral filters. Despite the limited bandwidth of the cavity, continuous NLP and Q-switched mode-locking NLP are observed.

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16:00 -- 18:00
Room 1E
LM5F • Excitons, Polaritons, and Nanolasers
Presider: Markus Raschke; Univ. of Colorado Boulder, USA

LM5F.1 • 16:00 (Invited)
Toward a Rational Understanding of Polariton Chemistry, Wei Xiong[1]; [1]*Univ. of California San Diego, USA.* Mid-IR light embedded in photonic cavities strongly couples to molecular vibrations, forming vibrational polaritons that redistribute energy. 2D-IR studies reveal criteria for polariton-enabled intermolecular transfer and guide photonic design for efficient reaction control.

LM5F.2 • 16:30 (Invited)
Quantum Simulation of Correlated Exciton Phases via Ultrafast Optical Microscopy, Libai Huang[1]; [1]*Purdue Univ., USA.* We investigate non-equilibrium exciton phase transitions in transition metal dichalcogenide moiré superlattices using transient photoluminescence and ultrafast reflectance microscopy, addressing open questions on coherence and dynamics in photoexcited, dissipative quantum many-body systems.

LM5F.3 • 17:00
Dielectric Metasurface for Broadband Excitonic State Control in GaAs Quantum Dots, Sanghyeok Park[1], Kusal Abeywickrama[2], Jaeyeon Yu[1], Hyunseung Jung[1], Emma Renteria[3], Sadhvikas Addamane[1], Oleg Mitrofanov[4], Alisa Javadi[2], Igal Brener[1], Prasad Iyer[1]; [1]*Sandia National Laboratories Albuquerque, USA;* [2]*Univ. of Oklahoma, USA;* [3]*Univ. of New Mexico, USA;* [4]*Univ. College London, UK.* We demonstrate a dielectric metasurface platform that enables broadband enhancement and control of all exciton complexes in a single GaAs quantum dot, facilitating anti-bunched and super-bunched light emission for scalable quantum photonics.

LM5F.4 • 17:15
Comparison and Optimization of Nanolaser's Optical and Electrical Structures for THz Direct Modulation enabled by Spontaneous Decay Rate Speed-Up in Micro/Nano Cavities, Tianyao Huang[1], Xiaofeng Yu[1], Xi Cheng[1], Yitian Zhang[1], Nuo Shi[1], Yingyan Huang[1], Kim Fook Lee[1], Guru P Neupane[1], Seng-Tiong Ho[1]; [1]*Department of Electrical and Computer Engineering, Northwestern Univ., USA.* Various micro/nano laser structures are studied for potential in realizing 100GHz-1THz direct modulation. The spontaneous emission rate enhancements are computed and high-frequency electrical modulation are simulated. We found that plasmonic laser is the best candidate.

LM5F.5 • 17:30
Exciton Many-Body Interaction in a Moiré Fermi-Bose Mixture, Xiaoqin Li[1]; [1]*Univ. of Texas at Austin, USA.* Quantum dephasing dynamics of two types of trions in a hole-doped $MoSe_2$ twisted bilayer are found to depend on the boson density differently, suggesting tunable interactions in moiré superlattices as a new quantum simulator.

LM5F.6 • 17:45
Photonic Crystal Surface Emitting Lasers over the Entire Visible Spectrum based on Colloidal Nanocrystals, Ivo Tanghe[1,2], Tom Vandekerckhove[1,2], Margarita Samoli[1], Amelia Waters[3], Dulanjan Harankahage[3], Mikhail Zamkov[3], Zeger Hens[1], Christian Seassal[4], Hai-Son

Nguyen[4], Dries Van Thourhout[1,2], Pieter Geiregat[1]; *[1]Universiteit Gent, Belgium; [2]imec, Belgium; [3]Bowling Green State Univ., USA; [4]Ecole Centrale de Lyon, France.* We demonstrate visible-wavelength lasing from colloidal nanocrystal-integrated silicon nitride photonic crystal devices. Numerical simulations and Fourier imaging confirm strong agreement between experimental and theoretical photonic band structures in these hybrid, CMOS-compatible systems.

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Tuesday, 28 October

08:00 -- 09:00
Room 2A
FTu1A • Machine Learning Theme: Machine Learning II
Presider: Benjamin Mills; Univ. of Southampton, UK

FTu1A.1 • 08:00 (Invited)
AI for High-Power Laser Based Manufacturing, Present and Future, Priyanka Ghosh[1]; [1]*Manufacturing Technology Centre, UK.* Artificial Intelligence transforms laser-based manufacturing through real-time process monitoring, predictive quality control, adaptive parameter optimisation. Emerging machine learning algorithms promise autonomous defect detection, intelligent beam shaping, and self-optimising manufacturing systems for next-generation precision applications.

FTu1A.2 • 08:30 (Invited)
Inteferometric focal planes: a case study in LLM research, David J. Brady[1]; [1]*Univ. of Arizona, USA.* Interferometric focal planes measure the mutual coherence at every pixel. This case study tracks the evolution of this idea from a unique concept to common knowledge in large language models. Models helped with the math, the background reearch and simulations. They showed extraordinary depth of thought and also extraordinarily weird mistakes.

08:00 -- 09:00
Room 1A
FTu1B • All-photonic Quantum Platforms
Presider: Andrea Blanco-Redondo; Univ. of Central Florida, CREOL, USA

FTu1B.1 • 08:00 (Invited)
Advancements in Manufacturing Platform for Photonic Quantum Computing, Yuliya Akulova[1]; [1]*PsiQuantum, USA.* We will review advancements in photonic components and integration technology established to deliver functionalities of qubit generation, manipulation, detection, and networking. 300-mm volume manufacturing platform is suitable for implementation of fusion-based, fault tolerant quantum computing.

FTu1B.2 • 08:30
Ultra low-loss thin-film BTO-on-insulator integrated photonics, Gwan In Kim[1], Jieun Yim[1], Gaurav Bahl[1]; [1]*Univ of Illinois at Urbana-Champaign, USA.* We demonstrate a new thin-film barium titanate (BaTiO3)-on-insulator integrated photonics platform that exhibits very low propagation loss and access to the large Pockels coefficient. We report the highest-Q BTO micro resonators to date with Qi ≈ 1.35×10^{6}. We test Mach-Zehnder modulators that exhibit $V\pi$ L = 0.54 V cm and confirm r_{eff} = 162 pm/V.

FTu1B.3 • 08:45
Electro-Optic Photonic Ququart Variational Quantum Eigensolver on Lithium-Niobate-on-Insulator, Jinil Lee[1,2], Yong-Su Kim[1,3], Sang-Wook Han[1,3], Hyounghan Kwon[1,3], Hojoong

Jung[1]; *[1]Center for Quantum Technology, Korea Inst. of Science & Technology, Korea (the Republic of); [2]Division of Nano & Information Technology, Korea Univ. of Science and Technology, Korea (the Republic of); [3]Division of Quantum Information, Korea Univ. of Science and Technology, Korea (the Republic of).* A lithium-niobate-on-insulator photonic ququart chip with electro-optic Mach–Zehnder meshes implements a variational quantum eigensolver. For He^{+}–H, it yields −1.0782±0.0023 hartree at 0.9 Å and reconstructs the potential energy curve.

08:00 -- 08:45
Room 1B
FTu1C • Structured Photons
Presider: Ashley Lyons; Univ. of Glasgow, UK

FTu1C.1 • 08:00 (Invited)
Structured light meets structured matter: Encoding and decoding information in non-paraxial light, Eileen Otte[1]; *[1]Univ. of Rochester, USA.* When light interacts with media down to the nanoscale, it becomes spatially structured in various properties. We explore how this interaction enables encoding and decoding of information within non-paraxial structured light for quantum cryptography.

FTu1C.2 • 08:30
Symmetry Protected Biphoton Coherence Time, Xuanying Lai[1,2], Christopher Li[1,2], Alan Zandars[3], Yefeng Mei[4], Shengwang Du[5,3]; *[1]Elmore Family School of Electrical and Computer Engineering, Purdue Univ., USA; [2]Department of Physics and Astronomy, Purdue Univ., USA; [3]Department of Physics, The Univ. of Texas at Dallas, USA; [4]Department of Physics and Astronomy, Washington State Univ., USA; [5]Elmore Family School of Electrical and Computer Engineering; Department of Physics and Astronomy, Purdue Univ., USA.* We demonstrate generation of time-frequency entangled photon pairs from laser-cooled ^{87}Rb atoms with symmetry protected biphoton coherence time. This outcome highlights the pivotal role of symmetry in generating and manipulating and photonic quantum states.

08:00 -- 09:00
Room 1C
FTu1D • Optical Engineering
Presider: Pablo Artal; Universidad de Murcia, Spain

FTu1D.1 • 08:00 (Invited)
From Design to Reality: Real-World Implementations of Aspheres and Freeform Optics in Emerging Applications, Ulrike Fuchs[1]; *[1]asphericon GmbH, Germany.* This talk highlights recent real-world implementations of freeform optics, bridging design and manufacturability. We showcase innovative applications in laser processing, imaging, and sensing, demonstrating how freeforms unlock performance beyond conventional optical systems.

FTu1D.2 • 08:30
Exploring Initial Refractive Lens Designs In a Sandbox-based Learning Environment, Ai Ping Yow[1], Yueqian Zhang[2], Christoph Menke[3], Ralf Wolleschensky[4], Peter Török[5]; *[1]Nanyang Technological Univ., Singapore; [2]Carl Zeiss AG, Germany; [3]Carl Zeiss AG, Germany; [4]Carl*

Zeiss Microscopy GmbH, Germany; [5]Singapore Centre for Environmental Life Science Engineering (SCELSE), Singapore. Machine learning, particularly reinforcement learning, enables the exploration of diverse initial designs for refractive lens systems, overcoming traditional limitations i.e. predefined lens sequence. Preliminary results demonstrate that optimising the generated designs leads to diffraction-limited performance.

FTu1D.3 • 08:45
The Spiral Fourier Transformation as an Analytical Tool for Optics, Jürgen Jahns[1], Waldemar Spiller[1]; *[1]Fernuniversität in Hagen, Germany.* The spiral Fourier Transformation is introduced as a tool for describing wavefields with cylindrical geometry. Combined with AI-techniques, it can be useful for fast simulations of multi-emitter objects such as photon sieves and meta-surfaces.

08:00 -- 09:00
Room 1D
FTu1E • State of the Art Space Division Multiplexing Optical Fiber Links
Presider: Haoshuo Chen; Nokia Bell Labs, USA

FTu1E.1 • 08:00 (Invited)
Stimulated Raman Scattering in Field-Deployed Coupled-Core Multi-Core Fibers, Giammarco Di Sciullo[1,2], Lucas A. Zischler[1,2], Divya A. Shaji[1,2], Ruben S. Luis[3], Robert Emmerich[4], Menno van den Hout[5], Benjamin J. Puttnam[3], Georg Rademacher[6], Chiara Lasagni[7,2], Paolo Serena[7,2], Alberto Bononi[7,2], Tetsuya Hayashi[8], Colja Schubert[4], Chigo Okonkwo[5], Roland Ryf[9], Luca Palmieri[10], Mark Shtaif[11], Andrea Marotta[1,2], Antonio Mecozzi[1,2], Cristian Antonelli[1,2]; *[1]Univ. of L'Aquila, Italy; [2]CNIT National Laboratory of Advanced Optical Fibers for Photonics, Italy; [3]National Inst. of Information and Communications Technology, Japan; [4]Fraunhofer Inst. for Telecommunications HHI, Germany; [5]Eindhoven Univ. of Technology, Netherlands; [6]Univ. of Stuttgart, Germany; [7]Univ. of Parma, Italy; [8]Sumitomo Electric Industries, Ltd., Japan; [9]Nokia Bell Labs, USA; [10]Univ. of Padova, Italy; [11]Tel Aviv Univ., Israel.* We present the first experimental characterization of stimulated Raman scattering (SRS) in coupled-core multi-core fibers.Measurements of the SRS-induced spectral power distortion and Raman gain coefficient in field-deployed fibers are consistent with the modeling of SRS in the regime of strong mode mixing.

FTu1E.2 • 08:30
Multicore vs. Hollow-Core Fibers: Scalability and Capacity in Ultra-Long-Haul Submarine Transmission Scenarios, Werner Klaus[1], Peter Winzer[2], Hideaki Furukawa[1]; *[1]National Inst of Information & Comm Tech, Japan; [2]Nubis Communications, USA.* We compare power-constrained submarine cable capacities of SMF, HCF, and MCF systems highlighting the capacity advantage of MCF. We also investigate the impact of spatial channels, attenuation, and power supply on ultra-long-haul transmission performance.

FTu1E.3 • 08:45
Measuring Return Loss of Multi-Core fiber MPO connectors, Chisato Fukai[1], Ryo Koyama[1], Yukiko Sawano[1], Takui Uematsu[1], Takashi Matsui[1]; *[1]NTT Inc., Japan.* We demonstrate the return loss measurement of multi-core fiber connectors. Opticalcontinuous-wave-reflectometer and optical-time-domain-reflectometer methods unaffected by fanin / fan-out are shown capable

of measuring the return loss of connectors with angled physical contact endfaces.

08:00 -- 09:00
Room 1E
LTu1F • Collective Excitations and QED
Presider: Matthew Graham; Oregon State Univ., USA

LTu1F.1 • 08:00 (Invited)
Magnon-exciton and magnon-photon couplings in CrSBr, Eunice Bae[1]; [1]*Cornell Univ., USA.* Magnon-based hybrid quantum systems are promising candidates for quantum interconnects and quantum sensors, and they offer a rich platform for exploring nonlinear magnonics and cavity–photon interactions. Two-dimensional (2D) van der Waals magnets provide a compact, atomically flat geometry that can be easily integrated into existing quantum circuits, such as superconducting resonators and qubits. Among various 2D magnets, the magnetic semiconductor CrSBr is particularly unique due to its strong spin–exciton [1, 2], spin–lattice [3], and magnon–exciton [4] interactions. In this presentation, I will first discuss magnon-exciton coupling despite their energetical mismatch by orders of magnitude. I will then discuss our recent work demonstrating coherent coupling between antiferromagnetic magnons in CrSBr and microwave photons in a niobium-based-on-chip resonator [5]. This work demonstrates the first step toward integrating layered van der Waals 2D magnets into superconducting microwave circuits, with full access for both microwave and optical probing. Finally, I will discuss how these properties of magnetic semiconductors can be harnessed for spintronic devices and quantum information science.

LTu1F.2 • 08:30 (Invited)
Cavity Electrodynamics of van der Waals Heterostructures, James McIver[1]; [1]*Columbia Univ., USA.* We observe ultrastrong coupling between graphene plasmons and intrinsic THz cavity modes of metallic gates using on-chip spectroscopy, revealing a new pathway to probe and control low-energy electrodynamics in vdW heterostructures.

09:15 -- 10:00
Room 2A
FTu2A • FiO Visionary Session II: Virtual Reality and Augmented Vision
Presider: Tom Hausken; Optica, USA

FTu2A.1 • 09:15 (Visionary)
Historical and Future Perspectives of Virtual and Augmented Reality Systems, Hong Hua[1]; [1]*Univ. of Arizona, USA.* Optical technologies fundamentally play a pervasive role in many of the recent breakthroughs, enabling human-centric virtual and augmented display and human interface technologies. In this talk, I will share historical highlights, demonstrate recent examples and advancements, and discuss emerging technologies and challenges in developing high-performance virtual and augmented reality display systems.

Room 3B
09:15 -- 10:00

Frontiers in Optics + Laser Science 2025
Session Guide

Disclaimer: this guide is limited to technical program with abstracts and author blocks as of 22 October. For updated and complete information with special events, reference the online schedule or mobile app.

LTu2B • Laser Science Visionary Session I
Presider: Matthew Graham; Oregon State Univ., USA

LTu2B.1 • 09:15 (Visionary)
Driving Quantum Matter Out-of-Equilibrium, Prineha Narang[1]; [1]*Univ. of California Los Angeles, USA.* Nature's most fascinating phenomena occur far from equilibrium - from the swirling storms of Jupiter to the dance of quasiparticles in quantum systems. While textbooks might portray physics through the lens of equilibrium, our Universe is dynamic, perpetually seeking but never reaching balance. This lecture will discuss both fundamentals of nonequilibrium dynamics in quantum matter and applications of these in quantum devices. Advances in theoretical understanding and computational approaches to correlated states in quantum matter, paired with leading experiments in ultrafast nonlinear optical spectroscopy now allow us to reveal emergent states created by strongly non-equilibrium external drives. Following a pedagogical introduction to these advances, this lecture will present the latest results in accessing observables in nonequilibrium interactions with coupled dynamics of spins, nuclei and light.

10:30 -- 11:30
Four Seasons Ballroom 1
JTu3A • Joint Plenary Session I
Presider: Alexey Turukhin; Cisco Systems Inc., USA

JTu3A.1 • 10:30 (Plenary)
Superposition, Entanglement and Schrödinger's Cat, David Wineland[1]; [1]*Univ. of Oregon, USA.* Quantum state superpositions and entanglement are important elements in many atomic physics-based experiments and applications. How these features are employed with trapped atomic ions in spectroscopy, clocks, and in the nascent field of quantum computation are briefly described and could lead to an analog of Schrödinger's famous cat.

11:30 -- 13:00
Four Seasons Ballroom 4
JTu4A • Joint Poster Session I

JTu4A.1
Digital Holography for Measurement of Temperature and Heat Transfer Coefficient around Stainless Steel Coated Textile Conductive Yarn, Pramod Pillai[2], Shilpi Agarwal[1]; [1]*Jawaharlal Nehru Univ., India;* [2]*IIT Delhi, India.* In this paper, the application of digital holographic interferometry (DHI) to measure temperature and heat transfer coefficient of stainless steel coated yarn is investigated. The study may find application to design heating fabric and compression bandages.

JTu4A.2
Surface Profiling with Complex Fourier Transform in Single Shot Spectral Interferometry, Pardeep Bhanot[1,2], Sanjit K. Debnath[2,1]; [1]*Academy of Scientific and Innovative Research (AcSIR), India;* [2]*CSIR-Central Scientific Instruments Organisation (CSIR-CSIO), India.* We propose a single frame complex Fourier transform method for surface profiling in

spectrally resolved white light interferometry, which increases the range of measurement by removing the hermitian symmetry of the interferogram signal.

JTu4A.3
Depth imaging by coherence scanning, Amit Yadav[1], Gyanendra Sheoran[2], Rakesh Kumar Singh[1]; *[1]Department of Physics, Indian Inst. of Technology (Banaras Hindu Univ.), India; [2]Department of Applied Sciences, National Inst. of Technology Delhi, India.* We present a technique for depth imaging by coherence scanning and intensity correlation. The object located at a depth behind the scattering wall is estimated, and initial results are presented.

JTu4A.4
Calibrated Attenuation Method for Characterization of Single Photon Detectors, Ali Anwar[1], Loyd J. McKnight[1,2], Sarah McCarthy[1]; *[1]Fraunhofer Centre for Applied Photonics, UK; [2]SUPA Dept. of Physics, Univ. of Strathclyde, Inst. of Photonics, UK.* Characterization of a single photon detector without direct measurement of input photon flux is presented. With calibration of optical power with laser attenuation, the detector is characterized without changing configuration for input photon flux measurement.

JTu4A.5
A High-Speed Single-Pixel Optical Imaging Technique Using Orthogonal Modulators Without Mechanical Scanning, Yohan S. Soares[1,2], Marcelo P. Cionek[1], Marcelo Jean Machado[1], Camille V. Unger[1], Patrick Kilcullen[2], Lino Misoguti[3], Tsuneyuki Ozaki[2], Emerson Cristiano Barbano[1]; *[1]Physics Department, Federal Univ. of Paraná, Brazil; [2]Institut national de la recherche scientifique, Canada; [3]São Carlos Inst. of Physics, Univ. of São Paulo, Brazil.* 2DOIT is a fast optical imaging technique based on orthogonal modulations using two choppers. It eliminates mechanical translation and is limited by the acquisition rate and optics, enabling high-speed video with a single-pixel detector.

JTu4A.6
Unveiling Vibration Features of a Smartphone Piezo-Actuated Audio-Screen with Feedback Interferometry, Carlo Anelli[1], Sabina Merlo[1]; *[1]Department of Electrical, Computer and Biomedical Engineering, Univ. of Pavia, Italy.* For preliminary investigations of vibration modes of a smartphone screen, turned into a next-gen loudspeaker by electrically driven piezoceramic transducers attached to it, we exploited semiconductor laser feedback interferometry. Spatially resolved frequency responses are reported.

JTu4A.7
High-Precision Photonic Testing for Cryogenic Applications Using Advanced Micro Lens Technology and Probe Station System, Quan Yuan[1], Phoenix Dai[1], Beverly N. Boiko[1], Divya Pratap[1], Josh West[1]; *[1]FormFactor Inc, USA.* We present the first demonstration of fiber-coupled micro-lens integration with a 4K chip-scale probe station for cryogenic photonic integrated circuit (PIC) testing. Measurement performance is validated via ring modulator metrics (insertion loss, stability, repeatability), highlighting its suitability and implication for cryo PIC characterization.

JTu4A.8
Augmented Reality and the Teaching of Electricity and Magnetism in Introductory Physics, Matthew Anderson[1], Janet Bowers[1], Dustin Thoman[1], Elizabeth Flynn[1], Adrian Larios[1], India Wishart[1], Luke Anderson[2], Beau Green[2]; *[1]San Diego State Univ., USA; [2]Altoura Inc.,*

USA. In this talk, we will discuss our recent exploration into teaching electricity and magnetism concepts with augmented reality. One key lesson learned is to incorporate aspects of social learning into any mixed reality landscape.

JTu4A.9
Enhancing Photochemical Dissociation Research with an LDLS®-Powered Tunable UV Light Source, Xiaohua Ye[1]; [1]*Energetiq Technology Inc, USA.* LDLS powered tunable UV light source is proposed to facilitate photochemical dissociation research and applications. Its UV intensity, bandwidth and flexibility in its adjustment, and high tuning resolution are optimized to meet photochemical dissociation requirements.

JTu4A.10
Tunable Refractive Liquid Crystal Axicons, Tomasz Jankowski[1], Noureddine Bennis[1], Anna Pakula[2], José Francisco Algorri[3]; [1]*Military Univ. of Technology, Poland;* [2]*Warsaw Univ. of Technology, Poland;* [3]*Univ. of Cantabria, Spain.* This work proposes a refractive liquid crystal axicon to overcome fixed-focus limitations in traditional designs. Numerical modeling and interferometric measurements confirm broadly tunable, highly linear phase profiles suitable for dynamic and precise beam shaping.

JTu4A.11
NanoPhotonics for the Engineering of Functional Thin Films for Solar Fuel Production, Agathe Cavanna[1,2], Nicolas Aimé[1], Arnaud Valour[1], Yves Jourlin[1], Nicolas Crespo-Monteiro[1], Christian Seassal[2], Céline Chevalier[2], Emmanuel Drouard[2], Eric Puzenat[3]; [1]*Institut d'Optique Lab Hubert Curien, France;* [2]*INL, France;* [3]*IRCELYON, France.* Solar H_2 via Nanostructured Sol-Gel

JTu4A.12
Inverse Design for SiN and GeSbS, Rafael Angel Casalins Hernandez[1], Camilo Hurtado[1,2], Samuel Huertas[1], Samuel Serna[2]; [1]*Universidad Nacional de Colombia, Colombia;* [2]*Department of Physics, Photonics and Optical Engineering, Bridgewater State Univ., USA.* We use inverse design to engineer integrated photonic waveguides in SiN and GeSbS, improving the performance and reducing the footprint of couplers and multiplexers, fundamental for sensing and quantum applications.

JTu4A.13
Features of Heat Propagation in a Thermoelectric Sensor of a Single-Photon Detector Containing Superconducting Layers, Lusine Mheryan[1], Astghik Kuzanyan[1], Vahan Nikoghosyan[1], Armen Kuzanyan[1]; [1]*Inst. for Physical Research-Armenia, Armenia.* The results of heat propagation processes in a three-layer Superconducting Thermoelectric Sensor (STS) of a single-photon detector are modeled. Temporal characteristics of temperature equalization were studied, identifying optimal materials and conditions for sensor-layers heat transfer.

JTu4A.14
FlowLens: Flow-based Generative Modeling for Inverse Design of Flat Lens, Abhirupa Saha[1]; [1]*Georgia Inst. of Technology, India.* We introduce FlowLens, a normalizing flow-based generative model for inverse lens design compared to traditional computer vision algorithms like GANs and VAEs. Explicit probabilistic modeling of FlowLens exhibits 1.6× accuracy and 75% higher data efficiency.

JTu4A.15
Prediction of Complex Soliton Supramolecular Dynamics Based on Patch-SM-Transformer, Yuansheng Ma[1,2], Zhi Wang[1,2], Pan Wang[1,2], Yange Liu[1,2]; [1]*Inst. of Modern Optics, Nankai Univ., China;* [2]*Tianjin Key Laboratory of Micro-Scale Optical Information Science and Technology, Tianjin 300350, China, China.* Employing Patch-SM-Transformer network to learn the temporal correlations of time stretched spectra from two parallel adjacent time slot units within the deformed soliton supramolecule, predicting the dynamics of adjacent time slot unit in supramolecule.

JTu4A.16
Quantifying Any Unpolarized Light with the Universal Metric of Degree of Unpolarization (DoUP), Sethuraj Karimparambil Raju[1], Valeria Viteri-Pflucker[1], Nick Vamivakas[1]; [1]*Univ. of Rochester, USA.* The *J*-space and the DoUP metric [Opt. Express 33, 22524–22533 (2025)] quantify how close any statistically unpolarized beam is to full unpolarization, revealing internal differences invisible to conventional Stokes-based analysis.

JTu4A.17
Coherent Laser Power Scaling for Interferometric Applications, Olive Mehrer[1], Mehmetcan Akbulut[1]; [1]*Univ. of Arizona, USA.* We present a novel technique to scale the power of the stimulated Brillouin scattering (SBS) threshold limited narrow-linewidth fiber laser systems while maintaining coherent operation for interferometric imaging applications.

JTu4A.18
Design of a Broadband Spirally Polarized Beam Reflector, Andy N. Black[1]; [1]*Laboratory for Laser Energetics, Univ. of Rochester, USA.* We have designed a reflective device capable of transforming a broadband circularly polarized beam into a spirally polarized beam. Using vector diffraction theory, we observe an enhanced longitudinal polarization of the generated beam at focus.

JTu4A.19
Thermo-optic Modulation of Dynamic Speckle Patterns, Vicente Reyes-Alejo[1], Josue A. Perales-Hernandez[1], Omar A. Arrieta Guerrero[1], Erick Zora-Guzmán[1], Roberto A. Alvarez-Aguirre[1], Jose Guzman-Sepulveda[1]; [1]*CINVESTAV Unidad Monterrey, Mexico.* We demonstrate that the temporal fluctuation rate of dynamic speckle patterns can be controlled by thermo-optic effects in volume scattering, allowing to tune its characteristic time over one order of magnitude while ensuring random realizations.

JTu4A.20
Low-cost Fluorescence Microscopy with Optical Fiber-based Uniform Illumination, Josue A. Perales-Hernandez[1], Jose L. Garcia-Cordero[1,2], Omar A. Arrieta Guerrero[1], Erick Zora-Guzmán[1], Jose Guzman-Sepulveda[1]; [1]*CINVESTAV Unidad Monterrey, Mexico;* [2]*Roche Pharma Research and Early Development Roche Innovation Center Basel, Switzerland.* We present a low-cost fluorescence microscope with multimode optical fiber-based illumination that is based on the superposition of dynamic speckles and extends homogeneously across the field-of-view independently of imaging optics and operating wavelength.

JTu4A.21

Using Bessel Beams for Finding Principal and Focal Planes, Robert E. Parks[1]; [1]*Optical Perspectives Group, USA.* The principal and focal planes of lenses are traditionally found using a nodal bench and rotating the lens about a point until the image is motionless. We use translation to find these planes.

JTu4A.22
Machine learning assisted analysis of optical tomograms, Soumyabrata Paul[1], H. S. Subramania[2], S. Ramanan[1], V. Balakrishnan[1], S. Lakshmibala[1]; [1]*Indian Inst. of Technology Madras, India;* [2]*Telstra Limited, Australia.* We demonstrate both characterization, and classification of quantum states of light, directly from appropriate optical tomograms. Our approach is based on a machine-learning-based program that avoids detailed state reconstruction and any additional classifier network.

JTu4A.23
Unmanned Aerial Vehicle Characteristics Using a Scanning Beamlet Array, J. Keith Miller[1], Eric G. Johnson[1]; [1]*CREOL, Univ. of Central Florida, USA.* This paper introduces a method that leverages frequency diversity in a scanning optical source to extract distinctive features of an unmanned aerial vehicle (UAV) using a single photodetector in a bistatic sensing configuration.

JTu4A.24
High Energy 100 Hz Repetition Rate Cryo-Cooled Ti:Sa Amplifier Pumped by a Cryo Yb:YAG Laser, Hugh Currah[1], Yong Wang[1,2], Tim DeLazzer[3], Buzz Walter[1], Aaron J. Davenport[1], Carmen S. Menoni[1,2], Jorge J. Rocca[1,2]; [1]*Department of Electrical & Computer Engineering, Colorado State Univ., USA;* [2]*XUV Lasers, USA;* [3]*Department of Physics, Colorado State Univ., USA.* We demonstrate the generation of 200 mJ laser pulses at 100 Hz repetition rate from a cryogenically-cooled active mirror Ti:Sapphire amplifier pumped by a frequency doubled diode-pumped cryo-cooled Yb:YAG laser.

JTu4A.25
Techniques to Improve Computation of Zernike Polynomials, Muthu Annamalai[1]; [1]*PanMo LLC, USA.* Typical challenges in using Zernike polynomials include (a) the speed of computing the Zernike moments can be limiting for realtime applications, (b) the computation of higher-order Zernike polynomials can be slow, and precision limited. This paper presents some solutions to these problems.

JTu4A.26
Off-axis Aberrations Improve Resolution, Kevin Liang[1]; [1]*Physics Department, Adelphi Univ., USA.* Compared to a diffraction-limited imaging system with the same aperture, systems with off-axis Seidel aberrations are shown to provide greater object resolution: the Fisher Information for object estimation is improved via shift variance.

JTu4A.27
Solution of the transport of intensity equation by the physics-informed neural network, María de L. Oliva Macías[1], Alfonso P. Vivanco[1], Raúl Castro Ortega[1], Carina Toxqui Quitl[1]; [1]*Óptica, Universidad Politécnica de Tulancingo, Mexico.* Wavefront retrieval by the transport of intensity equation is presented. The phase recovery is achieved by solving the TIE through the Poisson equation using a PINN neural network.

JTu4A.28
High Brightness LDLS® Improves Hybrid Bonding Overlay Metrology in Semiconductor Manufacturing, Xiaohua Ye[1]; [1]*Energetiq Technology Inc, USA.* The LDLS, particularly the EQX-850, is proposed and evaluated for hybrid bonding overlay metrology, with its advantages in resolution, contrast, broadband coverage, and stability demonstrated through both theoretical analysis and experimental validation.

JTu4A.29
Transparency-on-Demand Additive Manufacturing of Glass Micro-Optics, Rongguang Liang[1], Zhihan Hong[1], Piaoran Ye[1], zhongying Ji[1], Jiabin Chen[1], zheng Zhang[1], Douglas Loy[1]; [1]*Univ of Arizona, Coll of Opt Sciences, USA.* We present a 3D printing method enabling local transparency control in glass microstructures by tuning printing and pyrolysis conditions, allowing integrated optical elements like lenses and apertures for compact, multifunctional micro-optical systems.

JTu4A.30
An Optical Double-Image Encryption System Based on Devil's Vortex Fresnel Arrays Used in the Fresnel Transform Domain, Hukum Singh[1], Bhavana Sharma[1]; [1]*NorthCap Univ., India.* It offers a security analysis on the generation of a vortex array, utilizing in the Fresnel Transform (FrT). In this scheme MSE-, PSNR-, SSIM-, entropy-, correlation analysis-, key-sensitivity analysis-, key space-, various attacks were studies.

JTu4A.31
AI-based Analysis of Speckle Pattern Imaging Features for Cow Milk Classification, Irene Bassi[1], Sabina Merlo[1], Cristina Nuzzi[2], Simone Pasinetti[2], Valentina Bello[1]; [1]*Universita degli Studi di Pavia, Italy;* [2]*Università di Brescia, Italy.* This paper presents a method for classifying raw milk samples, differing in nutritional content and originating from 20 different cows, based on the innovative combination of speckle pattern (SP) imaging with artificial intelligence (AI)-based processing.

JTu4A.32
Edge Enhancement In A Single-Pixel Detection, Tanushree Karmakar[1], Satish Satish[1], Rakesh Kumar Singh[1]; [1]*Physics, Indian Inst. of Technology BHU, India.* We present an edge detection technique that recovers an object's Fourier spectra using single-pixel intensity correlation and structured illumination. Edge enhancement is realized by digitally applying a spiral phase filter to the recovered Fourier spectra.

JTu4A.33
Diffractive Processors for Structural Vibration Monitoring, Yuntian Wang[1], Zafer Yilmaz[1], Yuhang Li[1], Edward Liu[1], Eric Ahlberg[1], Farid Ghahari[2], Ertugrul Taciroglu[1], Aydogan Ozcan[1]; [1]*Univ. of California Los Angeles, USA;* [2]*California Department of Conservation, USA.* We introduce a diffractive processor that integrates an optimized diffractive layer with a shallow neural network to remotely measure 3D structural vibrations. We validated this approach using millimeterwave experiments with a four-level laboratory-scale building model.

JTu4A.34
Size and Morphology Investigation of PZT Nanofibers for Energy Harvesting Applications using Digital Holography, Suwan Plaipichit[2], Surawut Wicharn[2], Chokchai Puttharugsa[2],

Patamas Bintachitt[2], Areeya Aeimbhu[2], Prathan Buranasiri[1]; *[1]King Mongkut's Inst. of Tech. Ladkrabang, Thailand; [2]Physics, Srinakharinwirot Univ., Thailand.* Polyvinylidene fluoride fibers composed of piezoelectric lead zirconate titanate under different fabrication conditions were investigated using digital holography technique. Larger PZT content and larger feed rates results in larger diameters, and thicker fibers respectively.

JTu4A.35
Speckle Grain Analysis of Laboratory-Generated Mathieu–Gauss Beams, Alexander Ballesteros Díaz[1], Yezid Torres[1]; *[1]GOTS UIS, Colombia.* We extract speckle grain from single-frame Mathieu–Gauss speckle by tracing a 5 − 5.5 % annulus and locating the first zero of its 1-D autocovariance, obtaining tunable ≈ 9μm grains for adaptive imaging

JTu4A.36
Scattering Medium-based Heuristically Programmable Optical Computing Platform for Machine Learning Inference, Bora Carpinlioglu[1], Ugur Tegin[1]; *[1]Koç Universitesi, Turkey.* We demonstrate an optical computing platform based on a scattering medium whose orientation is optimized via a heuristic algorithm for high performance in machine learning inference. We test thresholding detections a posteriori to increase accuracy.

JTu4A.37
Compressed Spectral-Depth Estimation via a Dual-Dispersive CASSI Architecture, Jorge I. Guaiquil Vidal[1], Vicente Cisternas[1], Edson Mojica[1], Miguel Marquez[2], Pablo Meza[1]; *[1]Universidad de la Frontera, Chile; [2]institut National de la Recherche Scientifique, Canada.* We present DD-CASSI, a dual-arm system that enables snapshot acquisition of both spectral and depth information through complementary coded measurements from different focal planes jointly reconstructed using ADMM optimization with autoencoder-based all-in-focus fusion.

JTu4A.38
Vision System for the Classification of Metal Screws Used in Osteosynthesis, Iván R. Castillo[1], Andrés L. González[1], Jaime E. Meneses[1]; *[1]Universidad Industrial de Santander, Colombia.* Osteosynthesis Screws must be fabricated with precise dimensions to avoid surgical and cost complications. This work proposes a vision system that allows classification of the screw applying perimeter thresholds. An accuracy of 85% was obtained.

JTu4A.39
Analysis of Colour Palette of Indo-Portuguese Polychrome Sculptures from Goa by FTIR Spectroscopy, merrin Anil[2], Shilpi Agarwal[1]; *[1]Jawaharlal Nehru Univ., India; [2]Indian Nation Trust for Art and Cultural Heritage, "INTACH" Conservation Inst., India.* Two Indo-Portuguese sculptures of the 18th century was studied from the collection of the Museum of Christian Art, Goa. While dissimilar in iconography and appearance, FTIR revealed their similarities in material composition.

JTu4A.40
Realization of a single-panel foveated pinhole-based lightfield near eye display, Hyeontaek Lee[1], Junho Lee[1], Heechan Lee[1], Hee-Jin Choi[1]; *[1]Department of physics, Sejong Univ., Korea (the Republic of).* In this paper, we propose a single-panel foveated pinhole-based lightfield near eye display to reduce the number of active pixels by changing the

retinal image resolution at the desired position with no mechanical movement.

JTu4A.41
Spatially Parallel Acquisition and Reconstruction Camera, Dilem Eslik[1], Ugur Tegin[1], Bora Carpinlioglu[1]; [1]*Koç Univ., Turkey.* We demonstrate a compact, low-cost ultrafast imaging technique achieving 685 billion frames per second and a sequence depth of 10 frames using a microlens array and spatial delay optics in a single-shot capture.

JTu4A.42
Observation of bending space-time wave packets, Layton A. Hall[1], Ayman Abouraddy[1]; [1]*Univ. of Central Florida, CREOL, USA.* We observe, for the first time, bending space-time wave packets achieved by sculpting the spatiotemporal spectrum of optical pulses. We produce self-accelerating beams with symmetric transverse profiles that are diffraction-free and travel along power-law curves with arbitrary positive exponents.

JTu4A.43
Frequency Bandwidth Expansion by Modulation Illumination and Phase Retrieval, Masakazu Saito[1]; [1]*Independent, Japan.* We propose a method for expanding the detector frequency band by combining modulated illumination and repetitive phase retrieval, and confirm its effectiveness by numerical simulation.

JTu4A.44
Electric Field distribution of LRSPR Sensor for Early Detection of PC-12 adrenal gland cancer cells, Gundala Vasanthi[1], Balaji Ramachandran[1], Jyothsna Vaadaala[1], Yesudasu Vasimalla[1], Santosh Kumar[1]; [1]*Koneru Lakshmaiah Education Foundation, India.* This study proposes a long-range surface plasmon resonance (LRSPR) biosensor using a BK7 glass–lithium calcium aluminium fluoride/ silver/ aluminium antimonide/ sensing medium multilayer, enabling sensitive, label-free, real-time detection of PC-12 adrenal cancer cells.

JTu4A.45
Surface and Bulk Defect Passivation in MAPbi: Perovskites with Daminozide Effects on Carrier Dynamics and Mobility, Junhan Xie[1]; [1]*ShanghaiTech Univ., China.* This study reveals a previously unidentified mid-IR emissive trapping state in $MAPbI_3$ that differs from conventional Shockley-Read-Hall (SRH) defects, exhibiting unique surface-localized characteristics detectable through transient mid-IR spectroscopy.

JTu4A.46
Polarization Control of Broadband Thz Pulses with Hybrid Metadevice, Rebeca Tudor[1], Salim Hmidi[2], Xavier Ropagnol[3], Octavian-G. Simionescu[1], François Blanchard[2]; [1]*IMT, Romania;* [2]*ETS, Canada;* [3]*INRS-EMT, Canada.* The paper presents a hybrid metadevice for controlling the polarization of broadband THz pulses. This metamaterial offers numerous advantages, such as dispersion compensation, compactness, and cost-effectiveness, making it suitable for a variety of THz applications.

JTu4A.47
Polarization Tunability of X-ray Radiation and Commissioning of the ASU Compact X-ray Light Source, Kevin L. Eckrosh[1], Casey Timms[1], Sean Tilton[1], hao hu[1], Adil Ansari[1], Alex Gardeck[1], Alan Dupre[1], Lucas Malin[1], Rejul Jeswal[1], Mark Holl[1], Sabine Botha[1], Robert A.

Kaindl[1], Arvinder Sandhu[1,2], Aaron LaForge[1], Samuel T. Teitelbaum[1]; *[1]Arizona State Univ., USA; [2]Univ. of Arizona, USA.* The Compact X-ray Light Source (CXLS) is an Inverse Compton Scattering source that can produce synchrotron-like x-ray radiation with sub-picosecond pulses and arbitrary polarization states by varying the polarization of its optical undulator.

JTu4A.48
Femtosecond Laser-Assisted Fabrication of Titanium-Based Polymeric Micro-Ring Resonators for Photonics, Aman Singhal[1], Sumit Saxena[1], Shobha Shukla[1]; *[1]Indian Inst. of Technology Bombay, India.* Micro-ring resonators, vital for photonics, were fabricated using femtosecond laser-assisted titanium-based polymeric resin. The subwavelength structures, with high titanium content, demonstrate the potential of titanium-polymeric systems for advanced photonic device applications.

JTu4A.49
Gaussian beam propagation in AZO/ZnO metamaterials with hyperbolic dispersion, Alexander McLintock[1], Lyuba Kuznetsova[1]; *[1]San Diego State Univ., USA.* Transfer matrix approach was used to characterize Gaussian beam propagation in multilayered AZO/ZnO metamaterials with hyperbolic dispersion. We found that focusing is observed at ~ 10-20 nm propagation distance inside a thin metamaterial film.

JTu4A.50
LumiCare: A Low-Cost Machine Learning-Based Optical Imaging Framework for Non-Invasive Neonatal Hyperbilirubinemia Detection, Favour O. Oni[1], Nifemi Daramola[1], Olateju Olamide[1]; *[1]Achievers Univ., Nigeria.* We present a low-cost, non-invasive method for estimating neonatal bilirubin levels using LAB color analysis and Random Forest regression on skin images, offering accessible jaundice screening for low-resource healthcare environments.

JTu4A.51
Boron Nitride and Arsenic Trisulfide Assisted SPR Sensor for Sensitive Detection of Mercury Ions, Jyothsna Vaadaala[1], Ragini Singh[1,2], Yesudasu Vasimalla[1], Santosh Kumar[1]; *[1]Centre of Excellence for Nanotechnology, Department of Electronics and Communication Engineering,, Koneru Lakshmaiah Education Foundation, India; [2]Department of Biotechnology, Koneru Lakshmaiah Education Foundation, India.* SPR dependent sensor, employed for sensing of Hg^{2+} ions by using boron nitride and arsenic trisulfide. The designed SPR sensor will exhibit excellent sensitivity and stability, suggesting its promising application for environmental mercury monitoring.

JTu4A.53
Nanowire-Enhanced Light Management in Perovskite/Silicon Tandem Solar Cells, Arpan Saha[1]; *[1]Univ. of Dhaka, Bangladesh.* A two terminal perovskite silicon tandem solar cell incorporating embedded silicon nanowires enhances light coupling and absorption, reduces interfacial losses, and achieves 33.3% efficiency with an 18% improvement in short circuit current density compared to planar tandem designs based on FDTD guided optical and electrical simulations.

JTu4A.54

Implementation for Efficient Numerical Computation of Electron Beam Momentum Transfer Driven by Optical Excitations in Large Spherical Nanoparticles, Jorge L. Briseño-Gómez[1], Alejandro Reyes-Coronado[1]; [1]*Universidad Nacional Autónoma de México, Mexico.* This study explores how the electromagnetic field of a swift electron induces optical excitations in nanoparticles. This process generates a scattered electromagnetic field, leading to a net momentum transfer, a possible mechanism for nanomanipulation.

14:00 -- 15:30
Four Seasons Ballroom 4
JTu5A • Joint Poster Session II

JTu5A.1
Development of Advanced Sequential Ray Tracing Simulator and Utilization for Design of hybrid Meta-optic AR Glass, Dohyun Kim[1], Sun-Je Kim[1]; [1]*Soongsil Univ., Korea (the Republic of).* We introduce a sequential ray tracing simulator integrated as a UDS in Zemax Opticstudio, enabling rigorous diffraction efficiency analysis of multiplexed holographic optical elements, significantly advancing full-color hybrid meta-optic AR glasses development.

JTu5A.2
Anisotropy in the elastic response of standard optical fibers characterized via forward Brillouin scattering, Ana I. Garrigues Navarro[1], Martina Delgado-Pinar[1], Antonio Díez[1], Miguel V. Andrés[1]; [1]*Institut Universitari de Ciència dels Materials, Universitat de València, Spain.* Elastic properties of standard single-mode silica optical fiber under axial strain are investigated using forward stimulated Brillouin scattering. We show that the fundamental properties of elastic waves dramatically change due to elastic anisotropy and nonlinear elasticity.

JTu5A.3
Efficient Synergetic Simulation Method for Studying Soliton Molecule Formation on Laboratory Timescales, Sanzida Akter[1], Pradyoth Shandilya[1], Logan Courtright[1], Omri Gat[2], Curtis R. Menyuk[1]; [1]*Univ. of Maryland Baltimore County, USA;* [2]*Hebrew Univ. of Jerusalem (HUJI), Israel.* Solitons with large separations interact slowly in the temporal domain, making numerical approaches unsuitable for laboratory timescale modeling.We present a numerical framework that aims to efficiently model the dynamics of these slow processes.

JTu5A.5
Time Resolved Terahertz Spectroscopy in PbS quantum dots with sub-ps resolution, Giovanni Budroni[1], Zeke Liu[2], Jonathas d. Siqueira[1]; [1]*UNICAMP, Brazil;* [2]*Soochow Univ., China.* In this work we performed OPTP measurements on PbS colloidal quantum dots, extracting photoconductivity spectra, electron mobility just after excitation, and recombination constants, enabling insights into carrier dynamics with sub-picosecond temporal resolution.

JTu5A.6
Nonlinear optical spectroscopy of ternary Nb2O5-modified barium fluoride fluorophosphate glasses, Artur Barbedo[1], Jose Clabel[2], Leandro Olivetti[3], Lino Misoguti[2], Danilo Manzani[3], Cleber Mendonça[2]; [1]*USP-IFSC OPTICA Student Chapter, Brazil;* [2]*Instituto de Física de São Carlos, Brazil;* [3]*Instituto de Química de São Carlos, Brazil.* We investigated the

dispersion of the nonlinear refractive index (n2) between 700 nm and 1500 nm in fluorophosphate glasses modified with Nb2O5, using the tunable femtosecond NER technique. The results reveal a high nonlinear response

JTu5A.7
Towards Terahertz Spectroscopy of Liquid Biosamples: A Focus on Methodology, Deborah Amos Adigun[1], Mikhail Gorbun[1], Aadya Menon[1], Janna Pennanen[1], Georgy Fedorov[1], Polina Kuzhir[1]; [1]*Department of Physics and Mathematics, Univ. of Eastern Finland, Finland.* This study establishes a reliable terahertz time-domain spectroscopy method using porous nitrocellulose membranes to replace cuvettes for liquid biosamples. Experimental transmission spectra and transfer-matrix simulations based on optical constants show optimal fit with potential applications in non-invasive diagnostics of hydrated tissues.

JTu5A.8
Precision THz Characterization: Evaluating Frequency Combs with Rydberg Atoms, Wiktor Krokosz[1,2], Jan Nowosielski[1,2], Bartosz Kasza[1,2], Sebastian Borówka[1,2], Mateusz Mazelanik[1,2], Wojciech Wasilewski[1,2], Michal Parniak[1,2]; [1]*Centre for Quantum Optical Technologies, Univ. of Warsaw, Poland;* [2]*Faculty of Physics, Univ. of Warsaw, Poland.* We utilize the sensitivity of Rydberg six-wave mixing to showcase a novel approach to mapping Terahertz frequency combs with GHz bandwidth, absolute calibration and spectral analysis, offering a new path to the challenging THz regime.

JTu5A.9
Full-Wave Simulation of Kerr Comb Generation Using FDTD, Chenchen Wang[1], Qingyi Zhou[1], Zongfu Yu[1]; [1]*Univ. of Wisconsin-Madison, USA.* We simulate early-stage Kerr frequency comb formation using FDTD, capturing finer spatiotemporal dynamics, and providing a unified, first-principles modeling framework.

JTu5A.10
Optical binding in the evanescent field of an optical nanofiber, Pramitha Praveen Kamath[1], Souvik Sil[1], Viet Giang Truong[1], Sile Nic Chormaic[1]; [1]*Okinawa Inst of Science & Technology, Japan.* Optical nanofibers are a fascinating platform for studying light-matter interactions due to their large evanescent field. This field allows stable trapping, propulsion, and binding of particles due to the strong confinement of the electromagnetic field.

JTu5A.11
Modeling Rydberg Atom-Based Microwave-to-Optical Conversion of THz Frequency Comb, Bartosz Kasza[1], Jan Nowosielski[1], Wiktor Krokosz[1], Mateusz Mazelanik[1], Wojciech Wasilewski[1], Michal Parniak[1]; [1]*Univ. of Warsaw, Poland.* Rydberg sensors offer powerful THz detection, but complex dynamics have prevented modeling. We present an efficient, experimentally validated framework finally capturing their behavior, with applications including microwave-to-optical conversion of THz frequency combs.

JTu5A.12
On-Chip Temporal Interleaving for Versatile Electro-Optic Frequency Comb Generation, Manal Arbati[1], Alexis Bougaud[1], Jérémy Saucourt[1], Bruno Pessoa Chaves[1], Thomas Bunel[2], Sébastien Février[1], Brent E. Little[3], Sai T Chu[4], David J Moss[5], Roberto

Morandotti[6], Arnaud Mussot[2], Benjamin Wetzel[1]; *[1]XLIM Research Inst., France; [2]Physique des Lasers Atomes et Molécules PhLAM, France; [3]QXP Technologies Inc, China; [4]Department of Physics, City Univ. of Hong Kong, China; [5]Optical Sciences Centre, Swinburne Univ. of Technology and the Australian Research Council (ARC) Centre of Excellence in Optical Microcombs for Breakthrough Science, COMBS (CE230100006), Australia; [6]INRS-EMT, Canada.* We study the generation of tunable electro-optic frequency combs that utilize picosecond on-chip interleaving. Experimental results, leveraging machine-learning tools, show selective reshaping of frequency combs in the C-band.

JTu5A.13
Numerical Investigation of the Optical Response of Multilayered Graphene in a Wideband Spectrum of Linearly Polarized Light at Normal Incidence., sylvester k. munyao[1], Edgar Owiti[2], Geoffrey K. Rurimo[1], Christabel M. Isagi[1]; *[1]multimedia Univ. of Kenya, Kenya; [2]Physical sciences, Machakos Univ., Kenya.* Graphene's optical absorption was analyzed using FEM and Kubo formalism. Findings indicate Fermi energy tuning modifies absorption under linearly polarized light, with intraband and interband transitions dominating IR and UV, validating its optical modulator applications.

JTu5A.14
Transforming 50 ps Gain Switched Diode Laser Pulse to Sub-ps Duration using Mamyshev Regenerator, Anshuman Nigam[1,2], C. P. Singh[1,2], bhuvnesh .[1], P. K. Gupta[1], B. N. Upadhyaya[1,2], P. K. Mukhopadhyay[1,2]; *[1]Solid State Laser Section, Advanced Laser Development & Applications Division, Raja Ramanna Centre for Advanced Technology, India; [2]Homi Bhabha National Inst., India.* We present transformation of 50 ps pulses at 1064 nm and 5 MHz rate from a gain switched diode laser to sub-picosecond (~780 fs) pulses using Mamyshev regenerator, Yb-doped fiber amplifiers, and parabolic shaping mechanism.

JTu5A.15
Second-Harmonic Generation in Femtosecond-Laser Microstructured KTP Crystal Under Phase-Mismatched Conditions, Marta Gomez-Gomez[1,2], Nuria Sevilla-Sierra[1,2], Carolina Romero[1,2], Ignacio Lopez-Quintas[1,2], Maria Cinta Pujol[3], Aurora Crego[1,2], Javier R. Vázquez de Aldana[1,2]; *[1]Aplicaciones del Láser y Fotónica, Departamento de Física Aplicada, Universidad de Salamanca, Spain; [2]Unidad de Excelencia en Luz y Materia Estructuradas LUMES, Universidad de Salamanca, Spain; [3]Departament Química Física i Inorgànica, Universitat Rovira i Virgili, Spain.* In KTP crystals, second harmonic generation (SHG) cannot be achieved via birefringent phase-matching at Ti:Sapphire laser wavelength. We demonstrate enhanced SHG under phase-mismatched conditions in femtosecond-laser-induced microstructures, opening new possibilities for integrated nonlinear photonic devices.

JTu5A.16
Analysis of Orbitalization Ellipse by Singular Value Decomposition, Sushil Pokharel[1], Olga Korotkova[1]; *[1]Univ. of Miami, USA.* A comprehensive numerical framework using singular value decomposition is presented to study the geometric structure of light beams in OAM space, aiding the optimization of optical systems employing high-dimensional OAM carrying beams.

JTu5A.17
Determination of Enantiomeric Excess using Cylindrical Vector Vortex Beams, Ankita Karmakar[1], Bibek K. Patra[1], Maruthi M. Brundavanam[1]; *[1]Indian Inst. of Technology Kharagpur,*

India. We have proposed and experimentally demonstrated a common path and stable technique to determine the enantiomeric excess of an enantiomeric solution from the rotation of the lobes of the projected cylindrical vector vortex beams.

JTu5A.18
Effect of Random Linear Polarization Basis on the Classical Non-Separability of a Vector Vortex Beam using Brewster Effect, Bibek K. Patra[1], Ankita Karmakar[1], Maruthi M. Brundavanam[1]; [1]*Indian Inst. of Technology Kharagpur, India.* The degree of classical non-separability of a vector vortex beam is investigated using the Brewster effect under the choice of a random linear polarization basis. The results may be useful in refractive index sensing.

JTu5A.19
Adaptive Laser Shaping for Next-Generation Ultrafast Electron and X-ray Instrumentation, Hao Zhang[1,2], Randy Lemons[2], Jack Hirschman[2], Nicole Neveu[2], River Robles[2], Paris Franz[2], Benjamin Mencer[2], Nick Sudar[2], Mathew Britton[2], Kurtis Borne[2], Zhen Zhang[2], Kirk A. Larsen[2], Justin Baker[1], Chad Pennington[1], Razib Obaid[2], David Cesar[2], Ji Qiang[3], James Cryan[2], Joseph Robinson[2], Agostino Marinelli[2], Sergio Carbajo[2]; [1]*Univ. of California, Los Angeles, USA;* [2]*SLAC National Accelerator Laboratory, USA;* [3]*Lawrence Berkeley National Laboratory, USA.* We explore spatio-temporal laser shaping through dispersion-managed nonlinear synthesis, to enable high-power, high-brightness, on-demand generation and control of attosecond-scale electron and X-ray beams.

JTu5A.20
Synthesis and Optical Properties of a Luminescent Material with Simultaneous Upconversion and Downconversion, Rupesh Talewar[1], Trenton Jones[1,2], Kriti Akarapu[1,3], B.R. Reddy[1]; [1]*Alabama A&M Univ., USA;* [2]*Sparkman High School, USA;* [3]*James Clemens High School, USA.* Optical properties of Er^{3+} doped and Er^{3+}/Yb^{3+} co-doped $Zn_2P_2O_7$ (ZPO) phosphors have been synthesized via solid state reaction. Detailed spectroscopy measurements revealed energy transfer upconversion emission from the sample.

JTu5A.21
A new optomechanical interaction and a model with non-trivial classical dynamics, Satyam S. Jha[1,2], Lev Deych[1,2]; [1]*CUNY Queens College, USA;* [2]*Physics, CUNY Graduate Center, USA.* We introduce a novel optomechanical coupling arising in degenerate optical cavities due to symmetry breaking mediated by mechanical motion. Hamiltonian dynamics of this model without external pumping exhibits a bifurcation leading to complex nonlinear behavior.

JTu5A.22
Time Crystals and Nonequilibrium Dissipative Phase Transitions Mediated by Squeezed Bath, Zhenghao Zhang[1], QINGTIAN MIAO[1], Girish S. Agarwal[1]; [1]*Texas A & M Univ., USA.* We investigate a driven collective-spin system coupled to a squeezed vacuum reservoir. Squeezing enhances the sharpness of the dissipative phase transition near the critical point and alters the Liouvillian spectrum in a non-monotonic way.

JTu5A.23
Asymmetric Airy pulse inversion phenomenon induced by the interaction between the gain-induced group-velocity and third-order dispersions, Lucien Mandeng Mandeng[1,2],

Souang Kemedane Boukar[3,4], Clément Tchawoua[3]; *[1]NATIONAL ADVANCED SCHOOL OF ENGINEERING, Cameroon; [2]NASEY OPTICA CHAPTER, NATIONAL ADVANCED SCHOOL OF ENGINEERING OF YAOUNDE, Cameroon; [3]Laboratory of Mechanics, Materials and Structures, Department of Physics, Faculty of Science, Univ. of Yaoundé I, Yaoundé, Cameroon, Cameroon; [4]Department of Physics, Univ. of Adam Barka, Abéché, Chad, Chad.* In a semiconductor optical amplifier (SOA), the dispersion gain generates a group-velocity dispersion (GVD) allowing asymmetric inversion under dominant positive third-order dispersion (TOD). This inversion exhibits a progressive amplification of the Airy pulse main lobes.

JTu5A.24
3D nanometer scale density of inertial fusion energy polymer foams revealed through x-ray ptychographic tomography, Taylor J. Buckway[1], Emma Rasmussen[1], Jenna Hancock[1], Levi Hancock[1], Neil B. Alexander[2], Junjing Deng[3], Si Chen[3], Luxi Li[3], Arianna E. Gleason[4], Richard L. Sandberg[1]; *[1]Brigham Young Univ., USA; [2]General Atomics, USA; [3]Argonne National Laboratory, USA; [4]Stanford Univ., USA.* Ptychographic tomography was used to image the nanometer scale density distribution of polymer foams at the Advanced Photon Source synchrotron. These foams may be key to increasing fusion yield for proposed inertial fusion energy applications.

JTu5A.25
Selective Focusing of Vortex Beams with Tunable Orbital Angular Momentum States, Kapil K. Gangwar[1], Swapnil Chitriv[1], Gufran S. Khan[1], P. Senthilkumaran[1]; *[1]Indian Inst. of Technology Delhi, India.* Vortex beams with tunable topological charge and selective axial focusing are demonstrated using the Alvarez-Lohmann concept. This method allows precise manipulation of orbital angular momentum and focal depth, enabling versatile applications in structured beam shaping.

JTu5A.26
Visualization of plasmonic behavior of gold nanoparticles using Dark-Field microscopy, Carolina Mendoza Luna[1], Arturo Plata[1], Rogelio Ospina[1]; *[1]Universidad Industrial de Santander, Colombia.* We assembly a dark field microscopy configuration for visualization of plasmonic phenomena in gold nanoparticles, fabricated by Pulse Laser Ablation technique in Liquid, to make a description of optical and plasmonic behavior of this nanostructures

JTu5A.27
Time-transformation approach applied on nonlinear dynamics of Airy pulses in dynamic media, Lucien Mandeng Mandeng[1,2], Clément Tchawoua[3]; *[1]NATIONAL ADVANCED SCHOOL OF ENGINEERING, Cameroon; [2]NASEY OPTICA CHAPTER, NATIONAL ADVANCED SCHOOL OF ENGINEERING OF YAOUNDE, Cameroon; [3]Laboratory of Mechanics, Materials and Structures, Department of Physics, Faculty of Science, Univ. of Yaoundé I, Yaoundé, Cameroon, Cameroon.* We compare the time transformation approach (TTA) with the split-step Fourier method on the of Airy pulses evolution. TTA proves faster, mapping the full output electric field to the input via the medium's transit time.

JTu5A.28
Changing the Reflectivity of A Glass Surface Through Interference Between Two Linearly Polarized Laser Beams, Cristian Bahrim[1], Rishi Bharadwaj[1]; *[1]Lamar Univ., USA.* Two linearly polarized cw-TEMoo lasers irradiating a glass surface align its surface dipoles for acting as a

diffraction grating and coherently reflecting light. We show that an assisting voltage can change the surface's reflectivity significantly.

JTu5A.29
Phase Cycling Beyond Perturbative Limits: Exact Solutions for Nonlinear Response, Rishabh Tripathi[1], Krishna Kumar Maurya[1], Pradeep Kumar[1], Bhaskar De[1], Rohan Singh[1]; [1]*IISER Bhopal, India.* We present exact simulations of nonlinear optical signals under high-intensity excitation using phase-cycling, validating with experiments and showing accurate modeling beyond perturbative limits without pulse shape or order truncations.

JTu5A.30
Evaluation and accuracy comparison of terahertz imaging using machine learning, Limin ZHAO[1], Suguru Yamauchi[2], Shin-ichiro Yanagiya[2,3], Hidetoshi Ohno[2], Masao Nagase[2], Yasuo Minami[1]; [1]*Nihon Univ., Japan;* [2]*Tokushima Univ., Japan;* [3]*Inst. of Post-LED Photonics, Tokushima Univ., Japan.* Large-area graphene obtained through SiC pyrolysis was imaged using terahertz time domain spectroscopy. Machine learning was employed to classify the samples, and the accuracy of identification was evaluated for each method and dataset.

JTu5A.31
All-optical detection of microwave and mm-wave radiation using warm Rydberg atoms, Mateusz Mazelanik[1], Sebastian Borówka[1], Wojciech Wasilewski[1], Michal Parniak[1]; [1]*Uniwersytet Warszawski, Poland.* We present a wideband continuous microwave and mm-wave detection method using warm Rydberg atoms, enabling photon counting over a 57 dB range, reaching the 4 K noise equivalent temperature, and allowing all-optical and phase-sensitive detection.

JTu5A.32
Circularly Polarized Ultra-Intense Laser Pulses Generated with an All-Reflective Phase Retarder Mirror and Its Application for Electron Acceleration, Aaron J. Davenport[1], Nathaniel Westlake[2], Chip Durfee[2], Carmen S. Menoni[1], Shoujun Wang[1]; [1]*Electrical and Computer Engineering, Colorado State Univ., USA;* [2]*Physics, Colorado School of Mines, USA.* We report on the design, manufacturing and characterization of a four-mirror reflective phase retardation system based on the phase-shifting mirror technique. Tests at the ALEPH laser demonstrate the acceleration of electrons with the l=800 nm, 47 fs circularly polarized beam.

JTu5A.33
Investigating the Thermo-Optic Coefficient of Zinc-Telluride Glass with Different Concentrations of Praseodymium Using the X-scan Technique, Abdulatif Y. Hamad[1], Marissa Feldhake[1], Eric Voss[1]; [1]*Southern Illinois Univ. Edwardsvill, USA.* We used the x-scan technique to determine the thermal diffusivity and the thermo-optic coefficient of praseodymium doped zinc-tellurite glass. We found that the thermal diffusivity is equal to 28 x10^{-4} cm^2/s and the average dn/dT =-1.79x10^{-5} K^{-1}.

JTu5A.34
Raman Spectroscopy and DFT Calculations on Malonic and Crotonic Acids for Application in the Synthesis of Luminescent Dyes and Pigments, Kashika Khatri[1], Aparajita Bandyopadhyay[2,3], Amartya Sengupta[1]; [1]*Department of Physics, Indian Inst. of Technology*

Delhi, India; [2]JW Goethe Univ., Physikalisches Institut, Germany; [3]TeraHertz Imaging and Spectroscopy Lab, Indian Inst. of Technology Delhi, India. Raman spectroscopy and DFT calculations were performed on malonic and crotonic acids. Vibrational mode analysis offers insights into functional group behavior relevant to the development of optically active organic molecules such as dyes and pigments.

JTu5A.35
Quantitative Comparison of Many-Body Interaction Models Using Two-dimensional Coherent Spectrscopy, Pradeep Kumar[1], Bhaskar De[1], Rishabh Tripathi[1], Rohan Singh[1]; *[1]Physics, Indian Inst. of Science Education and Research, Bhopal, India.* We compare modified optical Bloch equations and the anharmonic oscillator model for phenomenologically modeling many-body interactions using two-dimensional coherent spectroscopy. Both approaches yield similar 2D spectral lineshapes consistent with experimental observations.

JTu5A.36
Quantum Thermodynamic Cycles and Non-Equilibrium Work in Confined Systems, Cler T. Garcez[1], Norton G. de Almeida[1]; *[1]Universidade Federal de Goiás, Brazil.* We present a theoretical analysis of quantum thermodynamic cycles based on confined quantum systems, addressing work, heat, and efficiency under out-of-equilibrium conditions. Our results contribute to foundational understanding in emergent quantum technologies and hybrid systems.

JTu5A.37
Integrated Time-Domain Physical Unclonable Functions for Secure Authentication, Hitaisini H. Sahoo[1], Daan Ruiter[1], Lars v. Hoeven[1], Daan Stellinga[1], Matthijs C. Velsink[1], Pepijn W. Pinkse[1]; *[1]Universiteit Twente, Netherlands.* We demonstrate integrated time-domain physical unclonable functions (tPUFs) using ring resonators. Their unclonability and secure communication via single-mode optical readout are experimentally validated, offering robust, compact solutions for authentication and asymmetric cryptography.

JTu5A.38
Multiband Femtosecond Entangled Light Sources by High-and Low-gain Parametric Down-Conversion, Karel Veselsky[1,2], Ashley Driesbach[1], Sanjit Karmakar[1], Chen-Ting Liao[1]; *[1]Indiana Univ., Bloomington, USA; [2]FNSPE, Czech Technical Univ. in Prague, Czechia.* Multiband, quantum-entangled, femtosecond light sources are developed using a CEP-stabled Yb laser system. Second- and third-harmonic of the 1030 nm pump produces wavelength-tunable, entangled sources at 686nm, 810nm, 1030nm, and 1414 nm via parametric down-conversion.

JTu5A.39
Photon-mediated Three- and Four-Body Interactions Between Atomic Momentum States in a High-Finesse Optical Cavity, Eliot Bohr[1], Chengyi Luo[2], Chitose Maruko[1], Leah Huzjak[1], Haoqing Zhang[1], James Thompson[1]; *[1]Univ. of Colorado at Boulder JILA, USA; [2]California Inst. of Technology, USA.* We demonstrate photon-mediated three- and four-body interactions between atomic momentum states using laser-dressed atoms in a high-finesse optical cavity. The resulting all-to-all interactions are relevant for quantum simulation and future entanglement-enhanced metrology.

JTu5A.40

Hours-long lasing and progress toward ultra-narrow linewidth lasers in a laser-cooled strontium cavity-QED system, Zhijing Niu[1], Cameron Wagner[1], Vera Schäfer[3], Dylan J. Young[1], Eric Y. Song[1], Helmut Ritsch[2], James Thompson[1]; *[1]Univ. of Colorado at Boulder JILA, USA; [2]Institut für Theoretische Physik, Universität Innsbruck, Austria; [3]Max-Planck-Institut für Kernphysik, Germany.* We report hours-long continuous lasing between momentum states with laser-cooled strontium atoms in a ring cavity. We will also describe progress toward continuous superradiance on a millihertz linewidth optical transition for realizing ultra-narrow linewidth lasers.

JTu5A.41
Fiber-based two-photon interferometry demonstrating quantum advantage, Romain Dalidet[1], Anthony Martin[1], Gregory Sauder[1], Sébastien Tanzilli[1], Laurent Labonté[1]; *[1]Université Côte d'Azur, France.* We demonstrate a genuine quantum advantage using a fully fibered Mach-Zehnder interferometer at telecom wavelengths, exploiting two-photon entangled states.

JTu5A.42
Preliminary Results on Improved Interaction Rates in Release-Free Optomechanical Crystals Using Inverse Design, David Hambraeus[1], Paul Burger[1], Johan Kolvik[1], Philippe Tassin[1], Raphaël Van Laer[1]; *[1]Chalmers Tekniska Högskola, Sweden.* We report early results on inverse-designed release-free optomechanical crystals,
a possible path to thermally robust microwave-to-optics transducers. We demonstrate the,
to our knowledge, highest vacuum optomechanical interaction rate for release-free systems
at 770 kHz

JTu5A.43
Polarization States of Nonlinear Thomson Scattering, Yance Sun[1], Kimberly Barr[1], Jacob Fuller[1], Andrew Jones[1], Nuno Sá[2], Michael Ware[1], Justin Peatross[1]; *[1]Brigham Young Univ., USA; [2]Univ. of the Azores, Portugal.* We measure the polarization state of nonlinear Thomson scattering from relativistically driven free electrons in an intense laser focus. We characterize relative phases between orthogonally polarized components of harmonics scattered into the emission sphere.

JTu5A.44
Angular Distribution of Ions Accelerated by Irradiation of Nanowire Arrays with Laser Pulses of Relativistic Intensity, Nashad Rahman[1], Jaden Hoechstetter[1]; *[1]Colorado State Univ., USA.* We measured the energies and angular distribution of protons accelerated in the interaction of ultra-intense laser pulses with arrays of nanowires, demonstrating that in these targets ions are also acceleration along the nanowire radial direction.

JTu5A.45
Graphene Microring Modulator for Activation Functions in Optical Neural Networks, Haiqi Guan[1], Wei Cheng[2], Jiagui Wu[3], Junjia Wang[1]; *[1]Southeast Univ. (China), China; [2]National Univ. of Defense Technology, China; [3]Southwest Univ., China.* By utilizing the power-dependent nonlinearity of graphene–silicon hybrid-integrated microring modulator, a nonlinear activation layer for ONN is constructed, demonstrating excellent training results. The trained network achieved 97% MNIST detection accuracy.

JTu5A.46

Development and application of a dual Mach-Zehnder interferometer with coreless fiber for load detection in tubular structures, Julian M. Estudillo-Ayala[1], M Beato-Dominguez[1], Adriana B. Gasca[1], D Torres-Gonzalez[1], J.C Hernandez-Garcia[1], Juan M. Sierra Hernandez[1], J.R. Reyes-Ayona[1], Roberto Rojas[1]; *[1]Universidad de Guanajuato, Mexico.* This work details the design and fabrication of a double Mach-Zehnder interferometer using coreless fiber, demonstrating fringe modulation changes and its application in load detection on a rectangular tubular profile

JTu5A.47
Experimental Verification of Mesopic Adaptation Coefficient Computation under LED Illumination, Simran Malik[1], Dinesh Ganotra[1]; *[1]Indira Gandhi Delhi Tech Univ for Women, India.* This paper experimentally verifies mesopic adaptation coefficient calculations using an indoor lamp, confirming the Newton-Bisection method's accuracy and supporting the CIE MES2 fixed-point method's practicality for real-world low-light conditions.

JTu5A.48
Enhancing Viral Growth Imaging/Tracking: Endoscope for Internal Fluorophore Imaging, Liam A. O'Sullivan[1], Nathan Youngblood[1], Paul Duprex[1]; *[1]Univ. of Pittsburgh, USA.* Current fluorescent imaging is often destructive, preventing long-term studies in a single animal. We introduce a novel endoscope for continuous in vivo fluorescent protein imaging, with sensitivity sufficient for longitudinal animal experimentation.

JTu5A.49
Aluminium antimonide/2D material-based SPR biosensor for detection of Biological and Chemical Samples, Manikanta Jetti[1], Jyothsna Vaadaala[1], Yesudasu Vasimalla[1], Suman Maloji[1], Santosh Kumar[1]; *[1]KL Univ., India.* This article explores a surface plasmon resonance (SPR) sensor for the detection of long-range biological and chemical samples employing barium gallium selenide, mercury gallium sulfide and 2D materials.

JTu5A.50
Identification of Ablation Zones via Spectral Analysis Following Microwave Treatment of Ex Vivo Liver and Lung, Andrea L. Pacheco Tobo[1], Isabella Redondi[1], Giulia Rustioni[1], Alessia Tagliabue[1], Giorgia Vitale[1], Pegah Dehbozorgi[2], Thomas Bocklitz[2,3], Paola Saccomandi[1]; *[1]Politecnico di Milano, Italy; [2]Friedrich-Schiller-Univ., Germany; [3]Leibniz Inst. of Photonic Technology (Leibniz-IPHT), Germany.* Hyperspectral imaging combined with K-means clustering was employed to identify and characterize the most relevant spectral features of the main ablation zones in ex-vivo lamb lung and liver, within the 500 – 1000 nm wavelength range.

JTu5A.51
Optimized Extraction of Brain Neuronal Electrical Activity Recorded By A Diamond Magnetometer, Prashant patro[1], Prabhat Anand[1], Siva Sankar Thummala[1], Varsha Sharma[1], Avik Ghose[1], Sourav Chatterjee[1], Luca Troise[2], Ulrik L. Andersen[2], Alexander Huck[2]; *[1]TCS Research, TATA consultancy services, India; [2]Center for Macroscopic Quantum States (bigQ), Department of Physics, Technical Univ. of Denmark, Denmark.* We demonstrate optimized feature extraction from the recordings of a diamond magnetometer, where the biomagnetic signal exists orders of magnitude below the noise floor, towards enabling efficient monitoring of neuronal activity in mammalian tissues.

JTu5A.52
Non-paraxial focusing by microlenses, Rafael Angel Casalins Hernandez[1], Roman Castañeda[1]; [1]*Universidad Nacional de Colombia, Colombia.* Monochromatic non-paraxial focusing by spherical micro-lenses under arbitrary spatial coherence is discussed. The focal volume and its dependence of some setup parameters are illustrated.

JTu5A.53
Quantum-Sourced Verifiable Randomness Beacon Using an SPDC Heralded Single-Photon QRNG with a 50:50 Beam Splitter, Utkarsh K. Singh[1], Sahil Saini[1], Devnath Dhirhe[1]; [1]*Defence Inst. of Advanced Technology, India.* We present a publicly verifiable randomness beacon using a heralded SPDC single-photon QRNG and a 50:50 beamsplitter, with von Neumann debiasing, SHA-256 extraction, and hash-chained epochs, passing all NIST SP 800-22 tests for strong randomness.

JTu5A.54
Fabrication of Plasmonic Microstructures Employing Laser Induced Microbubbles, Anand D. Ranjan[1], Anurit Dey[2], Roshan Tiwari[1], Ayan Banerjee[1]; [1]*Indian Inst of Science Ed & Res, Kolkata, India;* [2]*Neuroscience and Biomedical Engineering, Aalto Univ., Finland.* We present a laser-assisted bottom-up fabrication method to deterministically assemble metal nanoparticles into continuous, uniform plasmonic microtracks on glass by coordinating surface chemistry, power modulation, and vertical confinement.

JTu5A.55
Second Harmonic Generation in Stochastically Structured Beams, André L. Della Valentina[1], Ricardo Rego Bordalo Correia[1], Amanda Kronhardt Fritsch[2], Antonio Z. Khoury[2]; [1]*Univ Federal do Rio Grande do Sul, Brazil;* [2]*Instituto de Física, Universidade Federal Fluminense, Brazil.* Second harmonic generation (SHG) was studied using Sudoku-like beams in a Fresnel structure. A schematic model was developed to explore the sensitivity of the beam's central intensity region to nonlinear effects. In addition, this work aimed to correlate the phase patterns of the fundamental beam with the structure of the SHG beam.

JTu5A.56
Structure Estimation in Single Molecule Localization Microscopy Using Parametric and Deep Learning Methods, Pranjal Choudhury[1], Bosanta Ranjan Boruah[1]; [1]*Indian Inst. of Technology Guwahati, India.* We present a least-squares and deep learning-based approach for reconstructing intracellular structures from SMLM data. This simplified method enables accurate geometric estimation, complementing probabilistic techniques and supporting downstream tasks like spatial quantification.

Room 2A
15:30 -- 17:00
FTu6A • Machine Learning Theme: Machine Learning III
Presider: Chenkai Mao; Stanford Univ., USA

FTu6A.1 • 15:30 (Invited)

Multi-Scale Photonic Inverse Design, Optimization and Sensitivity Analysis for Advanced Optical IO, Dylan McGuire[1], Federico Duque Gomez[1], Ahsan Alam[1], Jens Niegemann[1], Sanjay Gangadhara[1]; [1]*Ansys, Inc., Canada.* Next generation fibre-to-chip interfaces with aggressive coupling efficiency targets require multi-scale, multi-physics simulation to design and optimize while remaining robust for manufacturing. Advances in inverse design and ML for photonic simulation are key to delivering these results.

FTu6A.2 • 16:00 (Invited)
MAISY: an AI Guided Deep Learning Software Package for the Design and Fabrication of Next-Generation Meta-Optics, Ighodalo Idehenre[1]; [1]*Core4ce, USA.* MAISY is a software tool to streamline the process of generating/storing scientific data, training neural networks, and deploying them to inverse design. We present its real world application in the nano-scale meta-optic space.

FTu6A.3 • 16:30 (Invited)
Algorithm Driven Approaches to Nanophotonic Systems Design, Jonathan Fan[1]; [1]*Stanford Univ., USA.* I will discuss emergent data-driven and physics-based algorithmic paradigms that combine high-speed fullwave solvers, optimizers, and multi-agentic frameworks to accelerate and automate the design of freeform nanophotonic systems, with an emphasis on metasurfaces.

15:30 -- 17:30
Room 1A
FTu6B • Virtual Reality and Augmented Vision Theme: VR and Augmented Vision II
Presider: Groot Gregory; Synopsys, Inc, USA

FTu6B.1 • 15:30 (Invited)
Design of Holographic Display Systems Based on Artificial Intelligence, Suyeon Choi[1]; [1]*Stanford Univ., USA.* This talk will discuss an AI-driven paradigm shift in holographic display design, covering Neural Holography, Gaussian Wave Splatting, and novel AR/VR displays with compact form factors.

FTu6B.2 • 16:00 (Invited)
Headset-less Multi-focal Immersive Display with AI Generated Content, Yushin Kim[1]; [1]*Brelyon, USA.* We discuss the design principles and applications around Brelyon's headset-less multi-focal virtual display, which provides natural immersion using optical hardware and computational techniques. It integrates computer vision and AI to auto-generate multi-focal content to optimize visual bandwidth.

FTu6B.3 • 16:30 (Invited)
Optical See-through Holographic 3D Near Eye Display with Occlusion Support, Jae-Hyeung Park[1], Woongseob Han[1], Chanseul Lee[1]; [1]*Seoul National Univ., Korea (the Republic of).* We introduce our recent work on occlusion-capable optical-see-through holographic AR near eye display which significantly enhances the visibility, realism, and quality of 3D holographic virtual images by using a dynamic mask and optimized CGHs.

FTu6B.4 • 17:00 (Invited)

Progress in High Peformance Large-FoV Diffractive Optical Waveguide Technology, Kehan Tian[1], Holly Wu[1]; [1]*Goertek Optical Technology Co. Ltd., China.* Diffractive optical waveguide technology, especially SRG (Surface Relief Grating) has made significant progress over the past five years. This presentation will review different diffractive optical waveguide technologies with emphasis on the high performance large-FoV waveguide.

15:30 -- 17:00
Room 1B
FTu6C • Quantum Sensing and Imaging
Presider: Eileen Otte; Univ. of Rochester, USA

FTu6C.1 • 15:30 (Invited)
Fluorescence lifetime and bio-sensing with entangled photons and single-photon cameras, Daniele Faccio[1], uboldi lorenzo[2], Giulio Cerullo[2], Euan Millar[1], Raul Mendoza[1], Ashley Lyons[1], Caroline Müllenbroich[1], Richard Cogdell[1], Vytautas Zickus[1], Godfrey Smith[1], Eline Huethorst[1], Edoardo Charbon[3]; [1]*Univ. of Glasgow, UK;* [2]*Politecnico Milano, Italy;* [3]*EPFL, Switzerland.* We will overview fluorescence lifetime sensing techniques based on entangled photons and quantum cameras with applications in the measurement of photosynthesis and optical-electrophysiology for cardiomyocyte and neuronal dynamics.

FTu6C.2 • 16:00
Rydberg Fluorescence Imaging of Electric Field in Plasma, Mykhailo Vorobiov[1], Robert Behary[1], Nicolas DeStefano[1], Edward Thomas[2], Saikat C. Thakur[2], Saskia Mordijck[1], Charles Francher[3], Neel Malvania[3], Seth Aubin[1], Eugeniy Mikhailov[1], Irina Novikova[1]; [1]*College of William & Mary, USA;* [2]*Auburn Univ., USA;* [3]*MITRE Corporation, USA.* Our method measures electric fields in dilute plasmas non-perturbatively with Rydberg electromagnetically induced transparency in rubidium. We detect Stark shifts in fluorescence for spatial profiling.

FTu6C.3 • 16:15
Rydberg fluorescence imaging for electron beam characterization, Robert Behary[1], Nicolas DeStefano[1], Todd Averett[1], Mykhailo Vorobiov[1], William Torg[1], Alexandre Camsonne[2], Shukui Zhang[2], Charles Francher[3], Neel Malvania[3], Eugeniy Mikhailov[1], Seth Aubin[1], Irina Novikova[1]; [1]*William & Mary, USA;* [2]*Jefferson Lab, USA;* [3]*The MITRE Corporation, USA.* We use properties of Rydberg atoms in an atomic vapor to reconstruct the profile of an electron beam in an all optical nearly non-invasive measurement.

FTu6C.4 • 16:30
Quantum sensing with Rydberg atoms enhanced by quantum error correction, Stanislaw Kurzyna[1], Bartosz Niewelt[1], Mateusz Mazelanik[1], Wojciech Wasilewski[1], Rafal Demkowicz-Dobrzanski[1], Michal Parniak[1]; [1]*Univ. of Warsaw, Poland.* We combine the capabilities of Rydberg atoms to both sense external fields and process quantum information. The presented protocol uses an error-correcting operation to protect the sensor information against photon loss.

FTu6C.5 • 16:45
Continuous-wave Interferometry at the Heisenberg Limit, Hudson A. Loughlin[1], Melissa Guidry[1], Jacques Ding[1,2], Masaya Ono[1,3], Malo le Gall[1,4], Benjamin Lou[1], Eric Oelker[1], Xinghui

Yin[1], Vivishek Sudhir[1], Nergis Mavalvala[1]; [1]*Massachusetts Inst. of Technology, USA;* [2]*Laboratoire Astroparticule et Cosmologie, France;* [3]*Univ. of Tokyo, Japan;* [4]*Ecole Polytechnique, France.* We present an experiment to reach the fundamental quantum limit of interferometry. We outline the theory and demonstrate it experimentally with phase-locked squeezed light, double homodyne readout, and an optimal phase estimator.

15:30 -- 17:00
Room 1C
FTu6D • Frontiers in OCT
Presider: Chao Zhou; Washington Univ. in St Louis, USA

FTu6D.1 • 15:30 (Invited)
Deep Ultraviolet Microscopy for Stain-Free Tissue Imaging and Cytology Diagnostics, Rongguang Liang[1], Jiabin Chen[1], Ruilin You[1]; [1]*Univ of Arizona, Coll of Opt Sciences, USA.* We present recent advances in deep ultraviolet imaging for high-resolution, stain-free diagnostics, highlighting self-calibrating Fourier ptychographic microscopy, confocal and dark-field modalities, and cytology analysis for practical tissue imaging and point-of-care applications.

FTu6D.2 • 16:00 (Invited)
Advances in Optical Coherence Elastography, Zhongping Chen[1]; [1]*Univ. of California Irvine, USA.* Optical coherence elastography (OCE) has emerged as a powerful, non-invasive imaging technique for mapping tissue biomechanics with micrometer-scale resolution. Recent advances by our group have significantly expanded the application of OCE to critical ocular tissues, including the cornea, lens, retina, sclera, and optic nerve head (ONH). These advancements provide critical insights into the biomechanical changes associated with conditions such as keratoconus, glaucoma, presbyopia, and retinal degeneration. Our work not only enhances the fundamental understanding of ocular biomechanics but also opens new avenues for early diagnosis, disease progression monitoring, and treatment evaluation. The impact of these advances extends to clinical ophthalmology, where OCE-based elastography promises to revolutionize the assessment of ocular health and therapeutic interventions.

FTu6D.3 • 16:30 (Invited)
Ultrahigh-Speed Optical Coherence Tomography and Its Photonic Integrations, Chao Zhou[1]; [1]*Washington Univ. in St Louis, USA.* Improving imaging speed has been a major driving force for optical coherence tomography (OCT) development. Recent technical advances to achieve ultrahigh imaging speed, *e.g.,* space-division multiplexing OCT and photonic integrated circuit-based OCT, will be presented.

15:30 -- 17:00
Room 1D
FTu6E • Advances in Optical Fiber Design and Methods
Presider: Chisato Fukai; NTT Corporation, Japan

FTu6E.1 • 15:30 (Invited)
Advances in silicon core optical fibers: extending their reach in nonlinear applications, Anna C. Peacock[1]; [1]*Univ. of Southampton, UK.* Recent advances in the

fabrication and application of silicon-core fibers will be reviewed. Focus will be placed on developments directed towards achieving low-loss transmission and efficient device designs for use in broadband nonlinear fiber systems.

FTu6E.2 • 16:00
Gas-Stop Design for Hollow-Core Fiber Systems, Ailing Zhong[1], Stanislav Zvanovec[1], Natalie Wheeler[2], Francesco Poletti[2], Radan Slavik[2], Matej Komanec[1]; *[1]Czech Technical Univ. in Prague, Czechia; [2]Univ. of Southampton, UK.* We propose a gas-stop design for connecting hollow-core fibers with 96% efficiency, providing a low-loss solution for a cascaded gas cell construction. This approach supports scalable, robust HCF systems for gas sensing or nonlinear optics.

FTu6E.3 • 16:15
Mode Selective Automated Few-mode Fiber Coupling with Numerical Mode Decomposition, Raymond Anchordoquy[2,1], Catherine Saladrigas[1], Juliet Gopinath[1,2]; *[1]Electrical, Computer, and Energy Engineering, Univ. of Colorado Boulder, USA; [2]Physics, Univ. of Colorado Boulder, USA.* A method of automated free-space coupling into arbitrary guided modes of few-mode fiber is investigated. Using a novel realtime noise-resistant mode decomposition technique, we experimentally demonstrate high-purity selective excitation of PM_{01} and PM_{11} fiber modes.

FTu6E.4 • 16:30
On Inverse Design of Dual-Mode Exchangers and Improvement Through Symmetry, Joshua J. Wong[1], Joel Slaby[1], Robert Pesch[1], Stephen E. Ralph[1]; *[1]Georgia Inst. of Technology, USA.* We demonstrate foundry-compatible mode converters with record low insertion loss of 0.25 dB across O-band for mode division multiplexing. Inverse design methods are compared, trading off performance for computation cost.

FTu6E.5 • 16:45
Robust Edge Coupling Fiber Attach Techniques, Joel Slaby[1], Jacob Hiesener[1], Joshua J. Wong[1], Michael Hoff[1,2], Connor Ryan[2], Rick Stevens[2], Stephen E. Ralph[1]; *[1]Georgia Inst. of Technology, USA; [2]Lockheed Martin Advanced Technology Labs, USA.* We developed scalable fiber attach process suitable for mid-volume production of arbitrary edge-coupled systems, demonstrated on double and single ribbon fibers. Optimized key challenges in module preparation, fiber alignment, and fiber attachment for attach robustness.

15:30 -- 17:00
Room 1E
LTu6F • Coupling and Dynamics in Materials
Presider: Xiaoqin Li; Univ. of Texas at Austin, USA

LTu6F.1 • 15:30 (Invited)
Light-Enhanced Electron-Phonon Coupling in an Excitonic Insulator Candidate, Shuolong Yang[1]; *[1]Univ. of Chicago, USA.* Electron-phonon coupling is a fundamental interaction driving quantum many-body phenomena such as superconductivity and charge-density waves. We use femtosecond time-resolved photoemission spectroscopy to elucidate how ultrafast excitation enables a transient enhancement of electron-phonon coupling.

LTu6F.2 • 16:00
Landau Levels Modulate Moiré-Lattice Hot Carriers in Low Twist-Angle Bilayer Graphene, Safayet Ahmed[1], Spencer Thorp[1], Yuechen Wang[2], Luzhao Sun[3], Albrecht Jander[4], Matt Graham[1]; *[1]Department of Physics, Oregon State Univ., USA; [2]Center for Nanochemistry, College of Chemistry and Molecular Engineering, Peking Univ., China; [3]Beijing Graphene Inst., China; [4]School of Electrical Engineering and Computer Science, Oregon State Univ., USA.* Transient absorption microscopy resonantly probes near-magic angle ~2° twisted bilayer graphene to reveal a 4-fold enhancement over monolayer, with a magnetic-field-induced transition at 6T from √B-periodic Dirac-Landau levels to a linearly B-dependent massive fermion behavior.

LTu6F.3 • 16:15
Detecting the Conduction Band Structure and Non-Equilibrium In-gap State in $CrSiTe_3$, Richa Sapkota[1,2], Long Chen[3], Haidong Zhou[3], Henry C. Kapteyn[1], Shunye Gao[1], Margaret Murnane[1]; *[1]Univ. of Colorado Boulder, USA; [2]JILA, USA; [3]Univ. of Tennessee, Knoxville, USA.* Using time- and angle-resolved photoelectron spectroscopy, we studied the unoccupied states of the van der Waals compound $CrSiTe_3$ in the paramagnetic phase, clearly revealing its conduction band structure and a nonequilibrium in-gap state.

LTu6F.4 • 16:30 (Invited)
Ultrafast Photoinduced Charge Transfer in Mixed-Dimensionality Nanoscale Heterostructures, Jeffrey L. Blackburn[1]; *[1]National Renewable Energy Lab, USA.* This presentation will discuss ultrafast photoinduced dynamics in tailored “mixed-dimensionality” heterostructures – between 2D transition metal dichalcogenides and 1D semiconducting SWCNTs – designed to shuttle charges, spins, and excitons in defined directions.

17:15 – 18:15
Room 2A
JTu7A • Joint Postdeadline Session

JTu7A.1 • 17:15
GravComb: A Quantum-Enhanced Frequency-Comb Gravitational Wave Detector, Stephen Eikenberry[1], Jean-Claude Diels[2], Eric Vanstryland[1], Paula do Vale Pereira[3], Jaesung Lee[4], Kendall Ackley[6], Johannes Eichholz[5], Sergey Klimenko[7]; *[1]Univ. of Central Florida, CREOL, USA; [2]Physics, Univ. of New Mexico, USA; [3]MAE, Univ. of Central Florida, USA; [4]ECE, Univ. of Central Florida, USA; [5]Physics, Australia National Univ., Australia; [6]Physics, Univ. of Warwick, UK; [7]Physics, Univ. of Florida, USA.* We present GravComb – a meter-scale concept for a deci-Hz gravitational wave detector based on recent advances in laser frequency combs coupled with optical parametric oscillator technology.

JTu7A.2 • 17:30
Electrically reconfigurable non-volatile metasurface in the visible spectrum with an inverse designed heater, Virat tara[1], Khoi Phuong Dao[2], Jessie Wei[3], Juejun Hu[2], Arka Majumdar[1,3]; *[1]Electrical and Computer Engineering, Univ. of Washington, USA; [2]Materials Science and Engineering, Massachusetts Inst. of Technology, USA; [3]Department of Physics, Univ. of Washington, USA.* We experimentally demonstrate an electrically tunable metasurface using Sb_2S_3 in the visible spectrum. We also experimentally realize an inverse designed

resistive heater for uniform heating and switching of the phase change material Sb_2S_3.

JTu7A.3 • 17:45
Transparent and Flexible Wafer-Scale Silicon-Photonics Fabrication Platform, Tal Sneh[1], Andres Garcia Coleto[1], Thomas Dyer[2], Milica Notaros[1], Kevin Fealey[2], Jelena Notaros[1]; [1]*Massachusetts Inst. of Technology, USA;* [2]*New York Center for Research, Economic Advancement, Technology, Engineering, and Science, USA.* We develop and characterize the first 300-mm wafer-scale platform and fabrication process for transparent and mechanically-flexible photonic wafers and chips, demonstrating high mechanical robustness, high optical transparency, and low optical distortion.

JTu7A.4 • 18:00
Three Dimensional Optical Transfer Function for a Telecentric Optical Imaging System, Oluwasegun J. Ibiyemi[1], Thomas k. Gaylord[1]; [1]*Georgia Inst. of Technology, USA.* A new method to generate the three dimensional Optical Transfer Function is presented. The Superposed Grating Diffracted Spectrum (SGDS) approach avoids the missing cone problem and includes higher order Bragg and non-Bragg Diffraction. Preliminary results show improved phase accuracy and no low frequency artifacts

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Wednesday, 29 October

08:00 -- 09:00
Room 2A
FW1A • AI and Data-driven for Imaging
Presider: Nanguang Chen; National Univ. of Singapore, Singapore

FW1A.1 • 08:00
End-to-End Designed OCT Endomicroscopy for Ultrahigh Resolution Deep Tissue Imaging, Di Mei[1], chao xu[1], ruiyang zhang[1], Tinghua zhang[1], zhihan hong[2], Wu Yuan[1]; *[1]Chinese Univ. of Hong Kong, Hong Kong; [2]School of Mechanical Engineering, Shnghai Jiao Tong Univ., China.* Traditional optical coherence tomography (OCT) endoscope faces the resolution and depth of focus (DOF) trade-off and image quality degradation by aberrations. An end-to-end designed OCT endoscope is developed using 3D printed refractive-diffractive surfaces to extend the DOF and a deconvolution neural network to correct abberations.

FW1A.2 • 08:15
Learning-based digital twin for high-resolution fiber endoscopy towards brain cancer diagnostics, Tijue Wang[2,1], Jakob Dremel[2,1], Sven Richter[3,1], Witold Polanski[3,1], Ortrud Uckermann[3,1], Ilker Eyüpoglu[3,1], Robert Kuschmierz[2,1], Juergen W. Czarske[2,1]; *[1]TU Dresden, Else Kröner Fresenius Center for Digital Health, Germany; [2]TU Dresden, Laboratory of Measurement and Sensor System Technique, Germany; [3]TU Dresden, Department of Neurosurgery, Germany.* Fiber endoscopy for rapid cancer diagnosis is vital but suffers from low resolution. We propose a digital twin of neural network for endoscopic imaging, enabling high-resolution image reconstruction from limited data of brain tumor tissues.

FW1A.3 • 08:30 (Invited)
Data-Driven Approach Towards High Quality Image Reconstruction for Optical Mammography, Gordon Ko[1], Jiulong Liu[3], Hui Ji[1], Nanguang Chen[1,2]; *[1]National Univ. of Singapore, Singapore; [2]National Univ. of Singapore (Suzhou) Research Inst., China; [3]Inst. of Computational Mathematics and Scientific/Engineering Computing, Chinese Academy of Sciences, China.* We have developed a data-driven approach to address the challenges faced by conventional reconstruction algorithms in optical mammography. Deep learning networks are integrated into the reconstruction process to achieve remarkably improved image quality.

08:00 -- 09:00
Room 1A
FW1B • Nonlinear and Topological Photonics
Presider: Amirhassan Shams-Ansari; DRS Daylight Solutions, USA

FW1B.1 • 08:00 (Invited)
Optical loss modulation for robust localization of light, Andrea Blanco-Redondo[1]; *[1]Univ. of Central Florida, CREOL, USA.* We show how optical loss, which usually leads to dissipation, can create strong light localization. Our demonstration, using programmable integrated photonics, highlights loss as a powerful control knob of the topological properties of electromagnetic modes.

FW1B.2 • 08:30
Ideal Optical Antimatter using Complex Frequency Excitation, Olivia Long[1], Peter B. Catrysse[1], Seunghoon Han[2,3], Shanhui Fan[1]; *[1]Stanford Univ., USA; [2]Samsung Advanced Inst. of Technology, Korea (the Republic of); [3]Semiconductor R&D Center, Korea (the Republic of).* We show that passive, lossy materials with positive index at real frequencies can be used to realize optical antimatter, as well as engineer arbitrary ε, μ, under complex frequency excitation.

FW1B.3 • 08:45
Fundamental-Mode Phase-Matching for Nonlinear Optics in Spontaneously-Oriented Organic Films Waveguides, Pierre-Luc Thériault[1], Stéphane Kéna-Cohen[1]; *[1]Engineering Physics, Polytechnique Montréal, Canada.* We demonstrate efficient second-order nonlinear interactions in strip-loaded waveguides using spontaneously-oriented organic films. Their large anisotropy enables fundamental-mode phase-matching, which provides an inherently large modal overlap, overcoming a key challenge in integrated photonics.

08:00 -- 09:00
Room 1B
FW1C • Quantum Computing
Presider: Robert Fickler; Tampereen Yliopisto, Finland

FW1C.1 • 08:00 (Invited)
Free-Space Optical Quantum Memory based on Multipass Cells, Guo Yu[1], Anindya Banerji[1], Chin Jia Boon[1], Arya Chowdhury[1,2], Pranay Tiwari[2], Alexander Ling[1,2]; *[1]Centre for Quantum Technologies, Singapore; [2]Department of Physics, National Univ. of Singapore, Singapore.* We present a quantum memory based on multipass cell architecture which enables tunable storage of quantum information with high efficiency and high fidelity. In this talk, I will discuss our implementation and present some of our recent results.

FW1C.2 • 08:30
Hybrid Boson Sampling: Achieving Quantum Advantage in a Multimode Cavity via Interacting Cold Atoms and Photons, Vitaly Kocharovsky[1]; *[1]Texas A&M Univ., USA.* We propose a hybrid boson sampling scheme merging cavity-QED and quantum-gas technologies. It overcomes limitations of separate, photon or atom, schemes and reveals quantum advantage. Squeezing/entanglement is self-generated inside a multimode cavity via atom-photon interactions.

FW1C.3 • 08:45
Mutually Unbiased Bases at Exceptional Points, Emroz Khan[1]; *[1]City Univ. of New York, USA.* We demonstrate how distinct quantum measurement bases evolve through interaction with the environment and can non-unitarily connect with each other at exceptional point degeneracies, leading to a non-Hermitian gate operation that does not require rotation.

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08:00 -- 09:00
Room 1C
FW1D • Manufacturing
Presider: Ulrike Fuchs; asphericon GmbH, Germany

FW1D.1 • 08:00 (Invited)
Manufacturing for Optical Systems for Space, Kate Medicus[1]; [1]*Ruda Optical Inc., USA.* In this presentation, I take a broad definition of manufacturing to include all the work needed to produce an optical system that is ready for space. Hint – The hard part isn't the light!

FW1D.2 • 08:30
Angle Robust Polarization selective Bragg mirrors, Hyosim Yang[1], Ki Young Lee[1], Chloe F. Doiron[1], Alexander Cerjan[1]; [1]*Sandia National Laboratories Albuquerque, USA.* We propose polarization-selective Bragg mirrors composed of triangular pillars with alternating dielectric layers, designed to yield symmetry bandgaps that enable broadband spectral distinction between orthogonal polarizations, invariant to incidence angle within the plane.

FW1D.3 • 08:45
Window-based Optimization for Shaping the Optical Response of 2D Metasurfaces, Yiwen Fan[1], Daniel K. Nikolov[1], Nick Vamivakas[1], Jannick P. Rolland[1]; [1]*Univ. of Rochester, USA.* We extend our window-based optimization framework from 1D focusing (71% efficiency improvement) to 2D metasurface arrays and arbitrary intensity synthesis, maintaining computational scalability for large-aperture designs with strong near-field coupling effects.

08:00 -- 09:00
Room 1D
FW1E • Ultrafast Lasers and Applications I
Presider: James van Howe; Augustana College, USA

FW1E.1 • 08:00
Tabletop Soft X-Ray Laser for Magnetic Imaging at Transition Metal M Edges, Byron Fritch[1], Yong Wang[1], Kristen S. Buchanan[1], Jorge J. Rocca[1]; [1]*Colorado State Univ., USA.* We demonstrate a tabletop soft x-ray laser operating at 18.9, 20.3, and 22.0 nm to be used for magnetic imaging. The soft x-ray laser is driven by an all diode-pumped joule-level Yb:YAG laser.

FW1E.2 • 08:15
Post-Compression of High-Energy Laser Pulses by Splitting, Broadening by Free Propagation in Air, and Recombining, Tarkan Takil[1], Vladimir Savichev[2], Vladimir Chvykov[2], Federico Furch[3], Oscar Martinez[4,5], Tong Zhou[6], Jorge J. Rocca[1,2]; [1]*Physics, Colorado State Univ., USA;* [2]*Electrical and Computer Engineering, Colorado State Univ., USA;* [3]*Max Born Inst., Germany;* [4]*Universidad de Buenos Aires, Argentina;* [5]*Consejo Nacional de Investigaciones Científicas y Técnicas, Argentina;* [6]*Lawrence Berkeley National Laboratory, USA.* We demonstrate post-compression of 120mJ pulses by splitting and recombining of pulses spectrally broadened by free propagation in air. Pulses were compressed from 5.5ps to 1.4ps with 80% efficiency.

FW1E.3 • 08:30

Reflection and Scattering of Infrared Radiation from Free Space Laser Breakdown in Air, Kristofer C. Meehan[1], Jose Chirinos[1], Xianglei Mao[1], Vassilia Zorba[1,2]; *[1]Lawrence Berkeley National Laboratory, USA; [2]Mechanical Engineering, Univ. of California, Berkeley, USA.* Ultrafast lasers are empowering tools for standoff material analysis. Here, we explore the use of laser produced plasmas as remotely-generated free space reflection and scattering elements to dramatically enhance infrared spectral signature collection.

FW1E.4 • 08:45
2 TW Few-Cycle Beamline Using Large Bore, Hollow-Capillary Fiber Spectral Broadening, Kiyoshi Yamamoto[1], Alexander R. Meadows[1], Josiah Shaw[1], Aparajit Chandrasekaran[1], Vladimir Chvykov[1], Reed Hollinger[1], Bruno E. Schmidt[2], Jorge J. Rocca[1]; *[1]Colorado State Univ., USA; [2]Few-Cycle Inc., Canada.* We demonstrate 2.1 TW, 2.6 cycle laser pulses for relativistic laser-matter irradiation at intensities up to 6.5×10^18 W/cm2. Spectral broadening of 23.5 mJ pulses occurs in a pressure gradient, 1 mm bore, helium-filled hollow-capillary fiber.

08:00 -- 09:00
Room 1E
LW1F • Quantum Sensing and Hybrid Quantum Systems
Presider: Alex Burgers; Univ. of Michigan, USA

LW1F.1 • 08:00 (Invited)
Massively multiplexed covariance magnetometry using ensembles of diamond quantum sensors, Zeeshawn Kazi[1], Kai-Hung Cheng[1], Faranak Bahrami[1], Dominick Corradino[2], Jakob Prettenthaler[1], Jaiden Edelman[2], Divik Verma[1], Jared Rovny[1], Tian-Ming Fu[1], Nathalie P. de Leon[1]; *[1]Electrical and Computer Engineering, Princeton Univ., USA; [2]Physics, Princeton Univ., USA.* Nitrogen vacancy centers in diamond enable high-sensitivity, nanoscale magnetometry, but typically measure local magnetic fields. Here, we measure magnetic noise dynamics at many positions simultaneously, enabling reconstruction of non-local correlation functions.

LW1F.2 • 08:30
Ultracoherent GHz Diamond Lamb Wave Spin-Mechanical Resonators for Quantum Spin-Mechanics, Xinzhu Li[1], Shuhao Wu[1], Lexington Mandachi[1], Hailin Wang[1]; *[1]Univ. of Oregon, USA.* Diamond Lamb wave resonators with a GHz frequency and a linewidth less than 100 Hz and with sideband coupling to silicon vacancy centers are demonstrated, opening a path to the quantum regime of spin-mechanics.

LW1F.3 • 08:45
Four-Photon Entanglement-Enhanced Interference in a Fiber Temperature Sensor, Gregory R. Krueper[1], Austin Campbell[1], Michael Grayson[2], Lynden K. Shalm[2], Juliet Gopinath[1]; *[1]Univ. of Colorado Boulder, USA; [2]National Inst. of Standards and Technology, USA.* We present a practical demonstration of entanglement-enhanced sensing in a fiber-optic temperature sensor. By including information from number-resolved four-photon interference, we report a temperature sensitivity of 30 μ°C / rt. Hz.

Frontiers in Optics + Laser Science 2025
Session Guide

Disclaimer: this guide is limited to technical program with abstracts and author blocks as of 22 October. For updated and complete information with special events, reference the online schedule or mobile app.

09:15 -- 10:00
Room 2A
FW2A • FiO Visionary Session III: Space Optics
Presider: Zachary Lapin, USA

FW2A.1 • 09:15 (Visionary)
Ultra-precise Optical Instruments, Opening New Horizons, John Conklin[1]; [1]*Univ. of Central Florida, CREOL, USA.* Advancements in precision laser metrology and accelerometry over the next two decades will enable new observations from space that will answer fundamental questions about our changing climate, the existence of life on distant planets, and the fundamental nature of our universe. This presentation is a preview of what is to come in satellite geodesy, precision coronagraphy, and gravitational wave observation.

09:15 -- 10:00
Room 3B
LW2B • Laser Science Visionary Session II
Presider: Hailin Wang; Univ. of Oregon, USA

LW2B.1 • 09:15 (Visionary)
That's How The Light Gets In...And Out! Quantum Technologies with Crystal Defects, Mete Atatüre[1]; [1]*Univ. of Cambridge, UK.* Defects are what gives diamond colour. They also offer a route towards solid-state quantum technologies. Today, there is a growing list of material platforms, whose defects can couple to quantum light in an integrated and scalable way. This talk will highlight recent advances in harnessing these atomic-scale quantum systems for applications ranging from quantum networks to sensors.

10:30 -- 11:30
Four Seasons Ballroom 1
JW3A • Joint Plenary Session II
Presider: Xiaoqin Li; Univ. of Texas at Austin, USA and Hailin Wang; Univ. of Oregon, USA

JW3A.1 • 10:30 (Plenary)
Laser-Atom Interactions: From Spin Squeezing to Quantum Computers, Vladan Vuletić[1]; [1]*Massachusetts Inst. of Technology, USA.* Atom-light interactions are at the heart of atomic and quantum physics, enabling a wide range of applications from precision measurements to quantum information processing. Many of these applications rely on, or benefit from, quantum entanglement. Professor Vladan Vuletić will discuss two such applications, spin squeezing and Rydberg array quantum computing with neutral atoms.

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11:30 -- 13:00
Four Seasons Ballroom 4
JW4A • Joint Poster Session III

JW4A.2
A linear-birefringence exceptional point in a Fabry-Perot cavity made of supermirrors, Juman Kim[1], Jisung Seo[1], Kyungwon An[1]; *[1]Physics and Astronomy, Seoul National Univ., Korea (the Republic of).* We have observed a linear-birefringence exceptional point in a ultrahigh-finesse Fabry-Perot cavity made of supermirrors with intrinsic birefringence by introducing polarization-dependent diffraction loss with a knife edge and changing the relative mirror orientation.

JW4A.3
Temperature-Induced Variation of Emission Angle in Third-Order Quasi-phase matched Spontaneous Parametric Down Conversion, Sohan S. Bisht[1], Bhaskar Kanseri[1]; *[1]Indian Inst. of Technology Delhi, India.* We demonstrate non-collinear third-order type-0 SPDC in a 10 μm PPKTP crystal. Non-collinear emission and cone angle are analyzed via Sellmeier-based simulations, enabling both type-0 and type-2 SPDC by tuning pump polarization and temperature.

JW4A.4
Numerical Modeling of $^{171}Yb^{+}$ Qubit Control, Abigail E. Iyer[1], Christine Steenkamp[1,2], Nancy Payne[1]; *[1]Stellenbosch Univ., South Africa; [2]National Inst. for Theoretical and Computation Sciences, South Africa.* We numerically model the interaction between an ytterbium-171 ion and lasers using rate equations. The model is used to analyse hyperfine state population dynamics to optimize efficiency and timescales of quantum control processes used experimentally.

JW4A.5
Ultrafast Transient Absorption Spectroscopic Imaging for Material and Defect Characterization in Quantum Materials, Torben L. Purz[1], Anton Vakulenko[1], Jie Pan[1], Patrick J. Treado[1], Eric W. Martin[1]; *[1]MONSTR Sense Technologies, USA.* Spatial heterogeneities, including defects and strain, impact the performance and electronic and quantum properties of semiconductors. Here, we present rapid transient reflection imaging to map ultrafast dynamics and defects in 2D materials and silicon carbide.

JW4A.6
Kelvin-Helmholtz Instability in a Phase-Separated Three-Component Bose-Einstein Condensate, SUSOVAN GIRI[1], Arpana Saboo[1], Hari Sadhan Ghosh[1], Vipin Bohra[1], Sonjoy Majumder[1]; *[1]Indian Inst. of Technology Kharagpur, India.* We study Kelvin-Helmholtz instability at two interfaces of a phase-separated three-component BEC, revealing how velocity shear induces nonlinear interface destabilization and pattern formation within a mean-field framework.

JW4A.7
Polariton Cascade Phonon Laser, Ignacio A. Papuccio[1,2], A. A. Reynoso[1,2], A. E. Bruchhausen[1,2], A. S. Kuznetsov[3], P. V. Santos[3], G. U. Usaj[1,2], A. Fainstein[1,2]; *[1]Centro Atomico Bariloche and Instituto Balseiro, Comisión Nacional de Energía Atómica (CNEA) - Universidad Nacional de Cuyo (UNCUYO), Argentina; [2]Instituto de Nanociencia y Nanotecnología (INN-Bariloche), Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET),,*

Argentina; [3]Paul-Drude-Institut für Festkörperelektronik, Leibniz-Institut im Forschungsverbund Berlin, Germany. We demonstrate a quantum cascade phonon laser based on polariton condensates cascading through engineered energy levels, emitting coherent phonons at 20–100 GHz. This enables integrated, multimode phonon sources for ultrafast optomechanical applications.

JW4A.8
Vanadium Disulfide Quantum Sheets as a New Subwavelength Platform for Nonlinear Nanophotonics, Hasana J. EK[1], Amrutha S[1], Dhanusmith A V[1], Chandrasekharan K[1]; *[1]National Inst. of Technology Calicut, India.* We report, for the first time, the synthesis and optical characterization of VS_2 quantum sheets, showing strong UV absorption, visible photoluminescence, and reverse saturable absorption, highlighting their potential for optical limiting and nanophotonic applications.

JW4A.9
High-Power, Broadband, Deep-IR Femtosecond Optical Parametric Oscillator Based on $CdSiP_2$, Kiran K. Panigrahi[1], Bhanu Chauhan[2], K.T. Zawilski[3], P.G. Schunemann[3,5], M. Ebrahim-Zadeh[4,5], S. Chaitanya Kumar[2]; *[1]Tata Inst. of Fundamental Research, 1 Homi Bhabha Road, Colaba, India; [2]Tata Inst. of Fundamental Research, 36/P Gopanpally, India; [3]BAE Systems, Incorporated, MER15-1813, P.O. Box 868, USA; [4]ICFO-Institut de Ciencies Fotoniques, Spain; [5]Institucio Catalana de Recerca i Estudis Avancats (ICREA), Spain.* We report a femtosecond optical parametric oscillator (OPO) based on $CdSiP_2$ (CSP) delivering 179 mW at 6912 nm and 380 mW at 1224 nm. The system exhibits high power stability and a record 405 nm idler bandwidth—the broadest ever generated from a CSP femtosecond OPO.

JW4A.10
Two-Photon Absorption and Spatial Self-Phase Modulation in $CdSiP_2$ at 1 µm, Kiran K. Panigrahi[1], Dibakar Pal[1], K.T. Zawilski[3], P.G. Schunemann[3], M. Ebrahim-Zadeh[4,5], S. Chaitanya Kumar[2]; *[1]Tata Inst. of Fundamental Research, 1 Homi Bhabha Road, Colaba, India; [2]Tata Inst. of Fundamental Research, 36/P Gopanpally, India; [3]BAE Systems, Incorporated, MER15-1813, P.O. Box 868, USA; [4]ICFO-Institut de Ciencies Fotoniques, Spain; [5]Institucio Catalana de Recerca i Estudis Avancats (ICREA), Spain.* We report nonlinear transmission and Z-scan studies in $CdSiP_2$ at 1 µm, revealing polarization-dependent two-photon absorption and spatial self-phase modulation, important for evaluating power limits in high-intensity frequency conversion applications.

JW4A.11
Antibunching Properties of Superposed Coherent Squeezed States, Eric Seglem[1], Reeta Vyas[1]; *[1]Univ. of Arkansas (Fayetteville), USA.* Antibunching properties of states formed from superpositions of squeezed coherent states are studied. The even squeezed coherent cat states mostly show bunching, while the odd cat states show antibunching in a large parameter range.

JW4A.12
Purcell Enhanced Nanospectroscopy of Dark Excitons and Trions in WSe_2 by Tip-Enhanced Photoluminescence, Sean Driskill[1], Benjamin G. Whetten[1], James C. Hone[2], Markus B. Raschke[1]; *[1]Department of Physics, Univ. of Colorado Boulder, USA; [2]Department of Mechanical Engineering, Columbia Univ., USA.* Using Purcell enhanced nanospectrocopy,

applied DC bias fields, and nanomechanical strain, we activate emission of dark excitons and trions at room temperature while simultaneously tuning emission to measure competing relaxation processes in WSe_2.

JW4A.13
Doping ZnO for Visible and Infrared Absorption: A Computational Approach, Vicente J. Cisternas[1,2], Eduardo Cisternas[1], Pablo Meza[2]; *[1]Department of Physics, Universidad de La Frontera, Chile; [2]Department of Electrical Engineering, Universidad de La Frontera, Chile.* Density functional theory calculations on ZnO doped with metallic impurities reveal impurity induced states enhancing optical absorption. Ag, Pd, Cu, In, and Sn are promising for photovoltaic applications, photodetector arrays, and complementary p–n junctions.

JW4A.14
Single-photon scattering in waveguide QED: two small atoms vs. a single giant atom problem, Glenn Ochsner[1], Amgain Nishan[1], Imran M. Mirza[1]; *[1]Miami Univ., USA.* We report how self-interference from a single giant atom impacts the transport properties of a single photon as compared to that of two small atoms coupled with the same waveguide quantum electrodynamics (QED) setup.

JW4A.15
Polarization Mode Dispersion Mitigation using Dual-Wavelength Headers in Quantum Wrapper Networks, James van Howe[1], Gamze Gül[2], Gregory Kanter[2], Prem Kumar[2]; *[1]Augustana College, USA; [2]Northwestern Univ., USA.* Through simulation, we show how polarization mode dispersion has 3-10x less impact in quantum wrapper networking when dual-wavelength references are used to probe the birefringence of the fiber link under test.

JW4A.16
Tripartite Entanglement Engineering Via Concurrence Triangle in a Coupled Atom-Resonator System., Abhishek Mandal[1], Joy Ghosh[1], Maruthi M. Brundavanam[1], Shailendra Kumar Varshney[1]; *[1]Indian Inst. of Technology Kharagpur, India.* This work demonstrates entanglement generation in a coherently driven cou pled atom-resonator three body system. We probe the quantifiable quantum correlations by concurrence triangle which provide geometric interpretations of potential quantum archi tecture in mutipartite network.

JW4A.18
Quantum image distillation without nonlinear crystals, Naru Yoneda[1], Kanako Yoshimura[1], Osamu Matoba[1]; *[1]Kobe Univ., Japan.* Quantum image distillation (QID) can separate classical and quantum information, but requires an entangled light source.In this paper, QID with the temporal fluctuation of an LED caused by a low current supply is proposed.The experimental results indicated that the proposed method can realize QID without a quantum light source.

JW4A.19
Squeezed Light at Visible Wavelengths for Quantum-Enhanced Biological Imaging, Vishal Navani[1], Tomis Prajapati[1], Gautam Das[2], V. Narayanan[1]; *[1]Indian Inst. of Technology Jodhpur, India; [2]Department of Physics, Lakehead Univ., Canada.* We present a theoretical investigation of Kerr-based squeezing at 515 nm for quantum-enhanced biological imaging. By employing squeezed light as the illumination source, noise can be suppressed below the shot-noise limit, which enables a higher signal-to-noise ratio without increasing the optical power.

JW4A.20
Second-order correlation for the classical and quantum light sources using Timepix Camera, Tomis Prajapati[1], Shreyansh Agarwal[1], Paras N. Prasad[2], V. Narayanan[1]; [1]*Indian Inst. of Technology Jodhpur, India;* [2]*Chemistry, State Univ. of New York at Buffalo, USA.* We implemented an experimental aspect of the second-order intensity-intensity correlation function for a coherent light source, employing the high-resolution Timepix (Tpx3Cam) camera to precisely measure photon arrival times and spatial distribution.

JW4A.21
Quartic Soliton in Saturable Nonlinear Media, TIYAS DAS[1], Anuj P. Lara[1], Samudra Roy[1]; [1]*Department of Physics, Indian Inst. of Technology Kharagpur, India.* We theoretically establish a novel branch of quartic soliton that exhibits bistability in a saturable nonlinear media. A realistic waveguide structure is proposed that can excite such unique pulse.

JW4A.22
Discrete Soliton Dynamics in Symmetrically Chirped Waveguide Array, Anuj P. Lara[1], Samudra Roy[1]; [1]*Department of Physics, Indian Inst. of Technology Khargpur, India.* We investigate the discrete soliton dynamics in a symmetrically chirped one-dimensional nonlinear waveguide array with a quadratic chirping. Using a semi-analytical approach, we establish the soliton dynamics in this waveguide array.

JW4A.23
Measurement of the DC Stark-Shift on the $3s^2 3p^2\ {}^3P_1 \rightarrow 3s^2 3p 4s\ {}^3P_0$ Transition in Silicon, Mirela Gearba-Sell[1], Grant Clarno[1], Blake Eastman[1], Luke Phillips[1], Delaney Finley[1], Annabelle Towles[1], Randy Knize[1], Jerry Sell[2]; [1]*US Air Force Academy, USA;* [2]*Energy and Photonics Consulting, Inc., USA.* Laser cooling and trapping of silicon could provide a novel avenue to manipulate individual silicon atoms. We perform dc Stark-shift spectroscopy on a silicon atomic beam at 252.4 nm to measure the differential scalar polarizability.

JW4A.24
Persistence of Synchronized Chaos in Larger Arrays of Coupled Semiconductor Lasers, Zhanning Liu[1], Herbert G. Winful[1]; [1]*Electrical Engineering and Computer Science, Univ. of Michigan, USA.* Synchronized chaos has previously been predicted and observed in a small number (2 or 3) of mutually coupled lasers. Here we show numerically that this phenomenon can occur in larger arrays with as many as 11 lasers and is quite robust.

JW4A.25
Investigation of Kerr Nonlinearity in Plasmonic Waveguide System-Based Multifunctional Logic Device, Sohan Yadav[2], Amit Prakash[2], Lokendra Singh[1]; [1]*Graphic Era (Deemed to be Univ.), India;* [2]*Electronics and Communication Engineering, national Inst. of technology, India.* Compact, fast AND, OR, and half adders are made possible by MIM plasmonic waveguides by optical interference, which makes integrated nano-photonic circuit construction easier by omitting phase modulators and filters.

JW4A.26
Silicon Carbide-Titanium Dioxide-based Plasmon Sensor for Alpha-Fetoprotein Detection, Jyothsna Vaadaala[1], Ragini Singh[2], Yesudasu Vasimalla[1], Santosh Kumar[1]; [1]*Centre*

of Excellence for Nanotechnology, Department of Electronics and Communication Engineering, Koneru Lakshmaiah Education Foundation, India; [2]Department of Biotechnology, Koneru Lakshmaiah Education Foundation, India. SPR enables label-free quantitative detection of alpha-fetoprotein. Plasmon sensors exhibit the phenomenon of distinct resonance, which is highly sensitive to changes in the surface refractive index. This allows for real-time, label-free, and ultra-sensitive detection of molecular interactions.

JW4A.27
Neural Network Based Topology Optimisation for Metasurfaces, Lincoln Clark[1], Ann Roberts[1], Lukas Wesemann[1]; *[1]Univ. of Melbourne, Australia.* Parameterisation of a metasurface in topology optimisation affects both the optical performance and critical dimension of a design. We compare pixel-based parameterisations with neural network parameterisations for the design of nonlocal computational metasurfaces.

JW4A.28
High-Contrast Multiphoton Speckle Patterns enhance optical sectioning and super-resolution, Pau Riera Rodriguez[1], Byungjae Hwang[2], Kristina Irsch[2], Rafael Piestun[1]; *[1]Univ. of Colorado Boulder, USA; [2]Vision Inst. – Sorbonne Univ., INSERM, CNRS, France.* We propose a computational imaging technique utilizing two-photon fluorescence, leading to high-contrast speckle patterns. When applied to speckle illumination microscopy, it enhances optical sectioning and 3D super-resolution.

JW4A.29
Mid-Infrared Grating Coupled SPR Sensor for Selective Detection of Waterborne Organic Pollutants, Seshi R. Taniparthi[2], Greeshma Bandreddy[2], Jyothsna Vaadaala[2], Santosh Kumar[2], Sourabh Jain[1]; *[1]Electronics and Communication Engineering, Indian Inst. of Information Technology Bhopal, India; [2]Electronics and Communication Engineering, Koneru Lakshmaiah Education Foundation, India.* A CMOS-compatible mid-infrared grating-coupled SPR sensor is proposed for real-time, label-free detection of organic pollutants in water. Operating near 3µm, the proposed sensor achieves a sensitivity of 750nm/RIU across refractive index changes typical of contaminated samples.

JW4A.30
Highly sensitive silicon-based mid-infrared detectors for sensing gas of very low concentration, Ching-Fuh Lin[1], Cheng-Lin Chen[1], Yao-Han Dong[1], Xi-Rui Wang[1]; *[1]National Taiwan Univ., Taiwan.* Si-based MIR sensor enables sensitive detection of low-concentration gases for breath and indoor VOC monitoring.

JW4A.31
Quantitative Chiral Analysis of Phenylalanine Enantiomers Using Terahertz Spectroscopy, Rajat Kumar[1], Federica Piccirilli[2], Andrea Perucchi[3], Prasanta Kumar Datta[1]; *[1]Indian Inst. of Technology Kharagpur, India; [2]Area Science Park, Italy; [3]Elettra Sincrotrone Trieste, Italy.* This study employs THz spectroscopy for qualitative differentiation of pheny lalanine enantiomers in the 0.6–3 THz range and quantitative detection down to 250 mM, advancing the precise characterization of chiral molecules and detection of biomolecules.

JW4A.32

Creating Single-Mode Squeezed Vacuum States for Entanglement-Based Quantum Sensing, Kristina A. Meier[1], Robert Hill[1], Katarzyna Krzyzanowska[1], Tyler Volkoff[1], Raymond Newell[1], Nicholas Dallmann[1]; *[1]Los Alamos National Laboratory, USA.* We present creation of single-mode squeezed vacuum states at near-infrared wavelengths. We will entangle these states to perform tabletop quantum illumination demonstrations in a thermal background to further explore our team's theoretical findings.

JW4A.33
Visualization of Optical Field Profiles in Metallo-dielectric Structures from underlying Dispersion Relation, Guo Chen[1], Partha P. Banerjee[1]; *[1]Univ. of Dayton, USA.* The complex electric field within a periodic metallo-dielectric multilayer structure is computed and visualized. The field distribution is determined from the effective propagation constant obtained by solving the underlying dispersion relation.

JW4A.35
Tunable Plasmonic Graphene Terahertz Metasurfaces for Sensing Applications, Miara Khafagy[1], Abdelrahman M. Ghanim[1,2], Mohamed A. Swillam[1]; *[1]American Univ. in Cairo, Egypt; [2]Physics, Ain Shams Univ., Egypt.* A tunable THz plasmonic sensor using graphene-based metasurfaces enables sensitive refractive index detection. It offers stable, selective performance with ~5 THz/RIU sensitivity and controlled resonance, suitable for biomedical, industrial, and chemical sensing.

JW4A.36
Spectral Evaluation of Turbine Oil Viscosity Based on Maxwell-Garnett Composite Medium Theory, Iuliia Riabenko[1,2], Jeff Manthorpe[3], Ron Miller[2]; *[1]V. N. Karazin Kharkiv National Universit, Ukraine; [2]Department of Mechanical and Aerospace Engineering, Carleton Univ., Canada; [3]Department of Chemistry, Carleton Univ., Canada.* This work introduces a spectroscopic technique to evaluate kinematic viscosity in turbine oil based on effective medium theory, enabling real-time, non-destructive sensing of additive concentration and density-dependent viscosity changes.

JW4A.37
Cascaded SU-8 based Microring Resonator for Intensity-Based Optical Detection of Soil Macronutrients, Suman K. Pal[1], Pranabendu Ganguly[1], Shyamal Kumar Das mandal[1]; *[1]IIT Kharagpur, India.* A cascaded SU-8 microring resonator was designed for refractive index sensing using intensity-based detection. The setup eliminates the need for an OSA by enabling accurate spectral shift detection via a photodetector.

JW4A.38
Active Noise Attenuation Using Integrated Parallel Fiber Interferometers, Kalipada Chatterjee[1], Rajan Jha[1]; *[1]Indian Inst of Technology Bhubaneswar, India.* Here, we propose an optical technique based on the parallel integration of fiber modal interferometers for real time controllable attenuation of noise frequency components in optical measurements. This further enhances the output signal-to-noise ratio (SNR).

JW4A.39
Design of Highly Sensitive Photonic Crystal Fiber Magnetic Field Sensor with Infiltrated Magnetic Fluid, Putha Kishore[1], Vijayalakshmi Mandava[1]; *[1]IIITDM, Kurnool, India.* A magnetic

field sensor based on selectively infilled photonic crystal fiber with magnetic fluids is proposed. The sensor exhibits a linear relationship between magnetic field strength and peak wavelengths and reported a high sensitivity of 30 nm/Oe for y-polarized mode.

JW4A.40
Near-Field Imaging of Polariton Dark States, Richard L. Puro[1], June Yim[2], Matthew Sheldon[2], Markus B. Raschke[1]; *[1]Univ. of Colorado Boulder, USA; [2]Univ. of California Irvine, USA.* Vibrational strong coupling is investigated through nano-FTIR spectroscopy and imaging. We find spectroscopic signatures of “dark states” becoming optically detectable via an external probe. The results may enable direct optical control of polariton dark states.

JW4A.41
Plasmonic Band Gaps in DVD-Based Metallic Gratings, Farzana Alam[1], Shamaar R. Howard[1], MD A. RAB[1], Natalia Noginova[1]; *[1]Norfolk State Univ., USA.* We demonstrate plasmonic band gaps in silver gratings from DVD discs. Experiment and COMSOL simulations confirm anti-crossing behavior, showing a low-cost platform for plasmonic dispersion and band-structure prototyping.

JW4A.42
Design and Probing for Pathogenic Bacteria Detection Using a Label-Free SPR Biosensor, Sandeep Boddu[1], Jyothsna Vaadaala[1], Yesudasu Vasimalla[1], Santosh Kumar[1]; *[1]KI Univ., India.* This article presents a surface plasmon resonance (SPR) sensor, which is a label-free and real-time applicable device, employing the Potassium tantalite, Cadmium gallium sulfide and 2D materials, this sensor is used for Pathogenic Bacteria detection.

JW4A.43
Light-Induced Currents in Ultrastable Tunnel Junctions, Yuankai Tang[1], Saurav Prakash[2], Proloy Nandi[2], Ariando Ariando[2], Amit Agarwal[3,4], Hayk Harutyunyan[1]; *[1]Department of Physics, Emory Univ., USA; [2]Department of Physics, National Univ. of Singapore, Singapore; [3]Department of Engineering, Univ. of Cambridge, UK; [4]Kyung Hee Univ., Korea (the Republic of).* Tunneling nanogaps provide a promising platform to study light-matter interactions. In this work, we successfully fabricate ultrastable ITO (indium–tin-oxide)/Lu_2O_3/Au tunnel junctions to investigate the mechanisms behind light-induced tunneling currents.

JW4A.44
Ultrasensitive Surface Plasmon Resonance Sensor for Brain Tumor Diagnosis, Sandeep Boddu[1], Jyothsna Vaadaala[1], Yesudasu Vasimalla[1], Santosh Kumar[1]; *[1]KI Univ., India.* This article presents a surface plasmon resonance (SPR) based photonic biosensor, which is a real time applicable device, employing a BK-7 prism, silver, Tellurium dioxide, and Aluminium antimonide for the detection of Brain tumors.

JW4A.45
Optical Characterization of InGaN Nanowires Addressing the Green Spectral Gap, Mohsen Esmaeilzadeh[1,3], Pablo Tieben[1,3], Soumyadip Chatterjee,0009[4], Apurba Laha[4], Andreas W. Schell[2,1]; *[1]Physikalisch Technische Bundesanstalt (P, Germany; [2]Inst. of Semiconductor and Solid State Physics, Johannes Kepler Univ. Linz, Austria; [3]Institut for Festkörperphysik, Leibniz Universität Hannover,, Germany; [4]Department of Electrical Engineering, Indian Inst. of Technology Bombay, India.* We investigate the morphology,

structure, and optical emission of InGaN nanowires grown on Si via MBE. Results reveal spatial variations in Indium distribution, strongly influencing emission wavelengths and intensities, especially within the green gap region.

JW4A.46
Evaluation of a Semiconductor Optical Amplifier for Free Space Optical Communication Applications, Charlotte K. Duda[1], Chadwick Lindstrom[2], Francisco Fonta[1], Benjamin Stuhl[1], Aaron D. Cross[3], Julie Smith[2]; *[1]Space Dynamics Laboratory, USA; [2]Space Vehicles Directorate, Air Force Research Laboratory, USA; [3]Leidos, Inc., USA.* Laboratory waveform characterization of a high-power C-band semiconductor optical amplifier demonstrates its suitability for replacing the Er:fiber amplifier in an optical communications system, yielding substantial improvements in wall-plug efficiency and reduced complexity.

JW4A.47
Mobile Orbital Domains: Addressing Dynamic Topology Challenges in Satellite Networks, Zilong Ye[2,1], Philip Ji[2], Giovanni Milione[2], Ting Wang[2]; *[1]California State Univ. Los Angeles, USA; [2]NEC Labs America, USA.* We analyze satellite trajectories and identify satellite backbone networks with stable inter-satellite connections. We propose organizing satellites into mobile orbital do- mains, to reduce control and management complexity caused by satellite movement and dynamic network topology.

JW4A.48
Multilayer SPR Biosensor Structure for Enhanced Sensing of MM-231 Breast Cancer Cells, Gundala Vasanthi[1], Balaji Ramachandran[1], Jyothsna Vaadaala[1], Yesudasu Vasimalla[1], Santosh Kumar[1]; *[1]Koneru Lakshmaiah Education Foundation, India.* This study introduces a surface plasmon resonance sensor using a BK7/ silver–silicon nitride–blue phosphorene/tungsten diselenide/ black phosphorus structure, optimized via the transfer matrix method at 633 nm for highly sensitive MM-231 breast cancer detection.

JW4A.49
Silicon Waveguides for Single-Photon Sensing of Toxic NO_2 and Flammable CH_4 through Correlated Photon Pairs Interconnecting Telecommunication and Mid-Infrared Bands, Abhishek K. Pandey[1], Deepak Jain[1], Catherine Baskiotis[2]; *[1]Indian Inst. of Technology Delhi, India; [2]De Vinci Higher Education, De Vinci Research Center, Paris, France, France.* We propose to use four-wave mixing for correlated photon pairs generation allowing the interconnection of Mid-Infrared band and Telecom bands using Silicon waveguides especially designed for gas sensing.

JW4A.50
Nonlinear Amplification in an All-PM Linear Cavity Erbium-Doped Fiber Laser System, Gao Zebin[1], Weijie Sheng[1], Siwei Peng[1], Hong Jin[1], Qian Li[1]; *[1]Peking Univ., China.* We presents nonlinear amplification in an all-PM linear cavity Erbium-doped fiber laser, achieving 178 fs pulses, 142 nm spectral coverage, and 4.08 nJ pulse energy.

JW4A.51
Wavelength Tunable Dispersion-Managed Yb-Doped Fiber Laser Based on All-PM Linear Cavity with Phase Bias, Hong Jin[1], Kaiyan Huang[1], Siwei Peng[1], Yiming Zhang[2], H. Y. Fu[2], Yongliang Zhang[3], Dongmei Huang[4], Qian Li[1]; *[1]Peking Univ. Shenzhen, China; [2]Tsinghua*

Shenzhen International Graduate School, China; [3]Shenzhen Han's Semiconductor Equipment Technology Co., Ltd, China; [4]The Hong Kong Polytechnic Univ., China. We demonstrate an all-PM linear cavity Yb-doped fiber laser with phase bias, achieving wavelength tuning ranging from 1027 to 1051 nm by translating an intracavity slit under near zero dispersion regimes.

JW4A.52
High-Mobility, Low-Loss ITO Films Enabled by Sequential ALD Pretreatment and Magnetron Sputtering, Jialiang J. Li[1], Chenxingyu Huang[2], Jinhui Ke[1], Hong Jin[1], H. Y. Fu[2], Lei Lu[1], Qian Li[1]; *[1]Peking Univ., China; [2]Tsinghua Univ., China.* We investigated atomic layer deposition pretreatment on magnetron-sputtered indium tin oxides. Via this composite process, we achieved an obvious increase in mobility and a significant reduction in extinction coefficient compared to conventional indium tin oxide.

JW4A.53
Dual-Wavelength Broadband ENZ Optical Modulator Operating at 850 nm and 1550 nm, Jinhui Ke[1], Chenxingyu Huang[2], Jialiang J. Li[1], Hong Jin[1], H. Y. Fu[2], Qian Li[1]; *[1]Peking Univ. Shenzhen, China; [2]Tsinghua Shenzhen International Graduate School, China.* We design and simulate an epsilon-near-zero (ENZ) optical modulator based on a SiC-on-insulator (SiCOI) platform, which responds at both 850 nm and 1550 nm wavelengths, and exhibits an equivalent modulation bandwidth >100 GHz.

14:00 -- 15:30
Four Seasons Ballroom 4
JW5A • Joint Poster Session IV

JW5A.1
Tone-Based Modulation and Demodulation Architectures for Beaconless Optical Inter-Satellite Links, Kwon-Seob Lim[1], Manseok Uhm[1], DONGPIL CHANG[1]; *[1]Satellite Payload Research Section, Electronics and Telecommunications Research Inst., Korea (the Republic of).* This paper presents AM tone modulation and demodulation methods for SDA OCT compliance, supporting beaconless PAT under low-SNR conditions below –15 dB. Envelope Detection, Analog, and Fully Digital Lock-in Amplifiers are comparatively evaluated.

JW5A.2
All-Optical Image Encryption Using Deep Learning for Secure AR Data Streams, Poonam Yadav[1]; *[1]Northcap Univ., India.* This paper presents a deep learning-based all-optical image encryption framework for real-time, secure AR data transmission, offering low latency, enhanced security, and computational offloading using diffractive optics and adversarially trained neural networks.

JW5A.3
OSNR Estimation using IQ Histograms and Machine Learning in Gridless WDM systems, Camilo A. Anacona[1], Hanna I. Colorado Martínez[1], Cesar A. Montoya Ocampo[1], Jhon J. Granada Torres[1]; *[1]Universidad de Antioquia, Colombia.* We propose an OSNR estimation method combining I-Q histogram-based feature extraction and machine learning, suitable for Nyquist-WDM systems with linear interchannel interference and guardbands ≤ 0 GHz,

experimentally validated on a 3×16 gridless setup.

JW5A.4
Capillary Absorption Spectroscopy of Molecular Hydrogen with Hollow Core Optical Fibers, Laura Munera[1], Kyle Fetter[1], Benjamin Steavenson[1], Daniel I. Pineda[1], Andrew Fahrland[2], Emre Ozen[2], Jason Kriesel[2]; *[1]Univ. of Texas at San Antonio, USA; [2]Opto-Knowledge Systems, Inc., USA.* A scanned-wavelength laser absorption spectroscopy technique near 2.12 µm, based on hollow core optical fiber technology, is shown to enable calibration-free measurement of molecular hydrogen in gas mixtures relevant to chemical processes of multiple industries.

JW5A.6
Aluminum-Coated Fattening Michelson Interferometer as Wavelength Selective Filter on a Laser Cavity, Adriana B. Gasca[1], Juan M. Sierra Hernandez[1], Sigifredo Marrujo[1], Roberto Rojas[1], Julian M. Estudillo-Ayala[1], Natali Mancera-Campos[1], Marco A. Contreras-Teran[1], Marco Bianchetti[1]; *[1]Universidad de Guanajuato, Mexico.* In this experimental study, an aluminum-coated Fattening Michelson Interferometer is demonstrated as a wavelength-selective filter in a linear cavity with a dual-wavelength with a side mode suppression ratio (SMSR) of 45 dB.

JW5A.7
Envelope Monitor for Silicon Photonic RF Signal Processing Circuit, Trisha Bora[1], Thomas R. Clark[1]; *[1]Michigan State Univ., USA.* In this paper, we propose an RF signal processing circuit using a phase modulator and multi-ring resonator optical filters. The circuit provides parallel analog processing of the signal with application in microwave and millimeter-wave systems.

JW5A.8
Vector torsion sensor based on coated aluminum tapered capillary hollow core fiber, Cipriano Guzmán Cano[1], Laura G. Martínez Ramírez[1], Sigifredo Marrujo García[1], Marco Bianchetti[1], Juan M. Sierra Hernandez[1], Vladimir P. Minkovich[2], Iván Hernández-Romano[1]; *[1]Universidad de Guanajuato, Mexico; [2]Centro de Investigaciones en Optica, Mexico.* A Mach-Zehnder torsion sensor based on a tapered section of a capillary hollow core fiber that is capable of distinguishing the twist direction. Aiming to increase the sensitivity, a layer of aluminum film was deposited.

JW5A.9
Direct Tracking of State-of-Polarization Fluctuations in Fiber due to Polarization Mode Dispersion Using Machine Learning, Ely M. Eastman[3], Hyouin Liu[1], Anirudh Ramesh[3], Joaquin Chung[2], Eric Chitambar[1], Rajkumar Kettimuthu[2], Prem Kumar[3]; *[1]Electrical and Computer Engineering, Univ. Of Illinois, USA; [2]Data Science and Learning Division, Argonne National Laboratory, USA; [3]Center for Photonic Communication and Computing, Northwestern Univ., USA.* We use machine learning to predict polarization state changes of C-band signals due to polarization mode dispersion. We track signals separated by 5 nm with an average error of 0.072 in the three Stokes parameters.

JW5A.10
Strain and temperature-insensitive modal analysis-based all-in-fiber directional torsion sensor., Cipriano Guzmán Cano[1], Laura G. Martínez Ramírez[1], Adriana B. Gasca[1], Iván Hernández-Romano[1], Vladimir P. Minkovich[2], Edgar O. Zamorategui-Navarrete[1], Sigifredo

Marrujo[1]; [1]*Guanajuato Univ., Mexico;* [2]*Centro de Investigaciones en Óptica, Mexico.* An easy-to-construct, all-fiber, modal analysis-based, directional torsion sensor, insensitive to strain and temperature, fabricated with tapered capillary hollow core fiber (CHCF), is proposed and experimentally demonstrated

JW5A.11
Focusing Cavity-Resonator-Integrated Guided-Mode Resonance Filter for Ultra-Compact CWDM Light Source, Keisuke Ozawa[1], Keisuke Sakatani[1], Kenji Kintaka[2], Junichi Inoue[1], Shogo Ura[1]; [1]*Kyoto Inst. of Technology, Japan;* [2]*National Inst. of Advanced Industrial Science and Technology, Japan.* A wavelength-selective retroreflector based on guided-mode resonance for transverse-magnetic-polarized diverging wave is shown for the first time. Two-dimensional grating is used to control reflection bandwidth. The retro-reflectance of 56% is estimated by a numerical simulation.

JW5A.12
Beyond the optical amplification on C-band via a short tri-doped tellurite fiber, Danilo H. Spadoti[1], Iago C. Pinto[2], Victor A. Rivera[3], Younès Messaddeq[2]; [1]*IESTI, Universidade Federal de Itajubá, Brazil;* [2]*2Centre d'Optique Photonique et Lasers, Pavillon d'Optique-Photonique,, Laval Univ., Canada;* [3]*3Instituto de Física de São Carlos, USP, Brazil.* This paper presents enhanced emission intensity and spectral broadening across the C-, L-, and U-telecommunication bands in a 30 cm multimode tri-doped tellurite fiber.

JW5A.13
High-Sensitivity Temperature Detection via Polycarbonate-Coated Fiber Bragg Gratings, Saikat Mondal[1], Partha Roy Chaudhuri[1]; [1]*Indian Inst. of Technology Kharagpur, India.* We present a high-performance temperature sensor utilizing fiber Bragg grating coated with elastomeric polycarbonate, resulting in enhanced sensitivity (0.058 nm/°C) attributed to its significant thermal expansion, with sensitivity affected by the coating radius.

JW5A.14
Polarization-Dependent Interference in an Asynchronous Dual-Polarization Power Division Multiplexing Scheme, Meredith Caveney[1], C. Alex Kaylor[1], Stephen E. Ralph[1]; [1]*Georgia Inst. of Technology, USA.* We propose a flexible dual-polarization analog power division multiplexing scheme with variable baud rates and power ratios. We demonstrate how polarization mismatch, OSNR, baud rate, and power ratio together impact BER under full spectral overlap.

JW5A.15
Quantum Random Number Generation From Fiber Guided Single Photons, Muhammed S. Kodakkaden[1]; [1]*Qatar Centre for Quantum Computing, College of Science and Engineering, Hamad Bin Khalifa Univ., Qatar.* We demonstrated a QRNG using single photons from a quantum dot coupled to an optical nanofiber. The system generates certified random bits through path-encoded qubit states verified by NIST statistical tests.

JW5A.16
Applicability of Neon Eye Tracking System in Highly Digitalized Work Environments, Tatjana Pladere[1], Linda Krauze[1], Aiga Svede[1], Reinis Alksnis[2], Henrijs Kalkis[3,4], Zenija Roja[4], Jevgenijs Viznuks[4]; [1]*Department of Optometry and Vision Science, Univ. of Latvia,*

Latvia; [2]Statistical Research and Data Analysis Laboratory, Univ. of Latvia, Latvia; [3]Faculty of Economics and Social Sciences, Univ. of Latvia, Latvia; [4]Department of Human Factors and Work Environment, Univ. of Latvia, Latvia. The Neon eye tracking system was tested in a highly digitalized workplace. Observed changes in saccadic behavior suggest the system's potential for use in monitoring risks associated with sustained visual and cognitive demands in occupational environments.

JW5A.17
Leakage of Light and its Relation to the Stiles-Crawford Effect, Amy Fitzpatrick[1], Brian Vohnsen[1]; *[1]Univ. College Dublin, Ireland.* Many hypotheses fail to provide complete explanations of the Stiles-Crawford effects of the first and second kind. Here, using a macroscopic model, we describe absorption in the photoreceptors in terms of leakage and cross-talk.

JW5A.18
Engineering Structured Spatiotemporal Light Fields for Biomedical Imaging Applications, Kefu Mu[1], Hsiao-Chih Huang[1], Chen-Ting Liao[1], Hui M. Leung[1]; *[1]Indiana Univ., Bloomington, USA.* We highlight recent advances in mode-entangled structured light that enable us to explore quantum-mimicry strategies for improved imaging sensitivity, as well as the design of propagation-invariant space-time wave packets to achieve extended depth-of-field in optical imaging.

JW5A.19
2.5D Low Refractive Index Designer Color Router for High-Transmission Image Sensor, Cheng-Feng Pan[1,2], Hao Wang[3], Bochang Wu[1,2], Joel K.W. Yang[1]; *[1]Singapore Univ. of Technology & Design, Singapore; [2]National Univ. of Singapore, Singapore; [3]Beihang Univ., China.* Using low refractive index materials and two-photon lithography, we inverse designed high-efficiency color routers with up to 97% energy utilization, validated by superior low-light imaging performance compared to Bayer filters.

JW5A.20
Towards Quantum Enhanced Real-Time Sensing of Protein Binding Kinetics, Mrunal Kamble[1,2], Evan Humberd[3], Tian Li[3,4], Girish Agarwal[1,5]; *[1]Department of Physics and Astronomy, Texas A&M Univ., USA; [2]Inst. for Quantum Science and Engineering, USA; [3]Department of Chemistry and Physics, Univ. of Tennessee at Chattanooga, USA; [4]UTC Research Inst., USA; [5]Department of Biological and Agricultural Engineering, Texas A&M Univ., USA.* We demonstrate that the two-mode bright squeezed light in combination with surface plasmon resonance technique leads to a 60% improvement in the sensitivity of measuring kinetic parameters of the time-dependent protein-binding process.

JW5A.22
Label-Free High-Contrast Imaging of Pollen for Feature Detection, anand kumar[1], ANUJ SAXENA[1], SACHIN DHAWAN[1], Siddharth Runkh[1], Lovey Lovey[1], Mukesh Khare[1], Satish K. Dubey[1], Dalip S. Mehta[1]; *[1]Indian Inst. of Technology Delhi, India.* This article proposes label-free high-contrast imaging of different pollen with a low-cost LED-based near-field illumination system for small feature detection. In addition, a comparative study with a bright field (BF) microscope has been performed.

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Disclaimer: this guide is limited to technical program with abstracts and author blocks as of 22 October. For updated and complete information with special events, reference the online schedule or mobile app.

JW5A.23
Development of Approach for Assessing Visual Performance and Comfort in Multifocal Augmented Reality, Tatjana Pladere[1], Edvards Apsitis[1], Aleksis Abols[2,3], Gunta Krumina[1]; *[1]Univ. of Latvia, Latvia; [2]Vidzeme Univ. of Applied Sciences, Latvia; [3]Lightspace Technologies, Latvia.* Perceived image resolution, image distance, and comfort in multifocal augmented reality were assessed at three display luminance levels. Higher luminance was associated with improved performance, although substantial individual variations were observed in user experience.

JW5A.24
From Waveguiding to Leakage: Understanding the Optics of Retinal Photoreceptors, Brian Vohnsen[1], Amy Fitzpatrick[1], Aishwarya Babu[1], Chiara M. Mariani[1], Sunil Chaubey[1]; *[1]Univ. College Dublin, Ireland.* Photoreceptors direct light from inner segments via the mitochondria-rich ellipsoid to visual pigments in outer segments. Here, mode leakage and optical lensing is more accurate than waveguiding. We report on electromagnetic modeling of this transition.

JW5A.25
Hypoxia-Induced Alterations Probed by Advanced Imaging in *In Vitro* and *In Vivo* Models, Manikanth Karnati[1], Gagan Raju[1], Shreya Shahapur[1], Edwin Pious[1], Guan Y. Zhuo[2], Nirmal Mazumder[1]; *[1]Department of Biophysics, Manipal School of Life Sciences, Manipal Academy of Higher Education, India; [2]Inst. of Biophotonics, National Yang Ming Chiao Tung Univ., Taiwan.* This study investigates hypoxia-induced neuronal damage using cobalt chloride in mice and L929 cells. Histological and immunofluorescence analyses confirmed dose-dependent HIF-1α expression and tissue degeneration, establishing effective in vitro and in vivo hypoxic models.

JW5A.26
Probing Collagen Structure and Metabolism in Ductal Carcinoma with SHG and TPF Microscopy, Gagan Raju[1], Sindhoora K. Melanthota[1], Guan-Yu Zhuo[2], Nirmal Mazumder[1]; *[1]Department of Biophysics, India; [2]Inst. of Biophotonics, National Yang Ming Chiao Tung Univ., Taipei 11221, Taiwan, Taiwan.* This study uses label-free multiphoton microscopy to visualize collagen structure and metabolic changes in ductal carcinoma tissue, revealing extracellular matrix degradation and metabolic shifts characteristic of tumor progression compared to normal breast tissue.

JW5A.27
Quantitative Phase-Based Lifetime Imaging of Hypoxia-Driven Biochemical Changes in Mouse Brain Tissue, Gagan Raju[1], Guan-Yu Zhuo[2], Nirmal Mazumder[1]; *[1]Department of Biophysics, India; [2]Inst. of Biophotonics, National Yang Ming Chiao Tung Univ., Taipei 11221, Taiwan, Taiwan.* Label-free multiphoton fluorescence lifetime imaging is used to assess metabolic alterations in both NTS and hippocampal regions of mouse brains after hypoxia induction, revealing distinct phase-based lifetime distribution shifts compared to control tissues.

JW5A.28
All-Optical Image Encryption via Deep Learning for Secure AR Data, Poonam Yadav[1]; *[1]Northcap Univ., India.* This paper presents a deep learning-powered all-optical encryption system for secure, real-time AR data transmission, combining neural networks and

diffractive optics to meet the low-latency, high-speed demands of next-generation augmented reality applications.

JW5A.29
Design and Modeling of Cu/TiO_2(core/shell) Nanoparticles for High Performance SERS Substrates: A Pathway to Food Contamination Detection, Manish Jangid[1], Vijay Janyani[1]; *[1]MNIT JAIPUR, India.* This study presents a Cu/TiO_2 nanoparticle-based SERS substrate for detecting food contaminants with high sensitivity (>10^6 EF). The core-shell design ensures stability and surface modification, enhancing on-site food safety monitoring via nanotechnology.

JW5A.30
Quantum-Coherent Probing and Control with IR-Antenna-Coupled Molecular Vibrations, Máté Garai[1], Richard Puro[1], Roland Wilcken[1], Wei Zhang[1], Christophe Galland[2], Markus B. Raschke[1]; *[1]Univ. of Colorado Boulder, USA; [2]Swiss Federal Inst. of Technology Lausanne, Switzerland.* Intramolecular vibrational energy redistribution presents a fundamental limit to coherence in molecular systems. When coupled to resonant infrared nanostructures, both molecular and photonic states offer pathways to examine and potentially control vibrational relaxation and coherence.

JW5A.31
Multifunctional Temperature Sensing Based on Up-Conversion FIR Technique in Doped Tellurite Fiber, Tonglei Cheng[1]; *[1]Univ. of Southampton, Optoelectronics Research Centre, UK.* We present a miniaturized fiber-optic temperature sensor using fluorescence intensity ratio in Er^{3+}/Yb^{3+}co-doped tellurite fiber. It achieves 0.0128 K^{-1} sensitivity, maintains stability under harsh conditions, and demonstrates practical applicability in CPU and skin temperature monitoring.

JW5A.32
Plasmonic Metasurface for enhanced PEC Water Splitting, Muhammad Haris[1,2], Klaudijus Midverisa[1,2], Ammara Anwar[3], Mohamed Ahmed Baba[1], Gvidas Klyvis[1], Asta Tamuleviciene[1,2], Tomas Tamulevicius[1,2], Sigitas Tamulevicius[1,2]; *[1]INST. OF MATERIALS SCIENCE(KTU), Lithuania; [2]Physics, Kaunas Univ. of Technology, Lithuania; [3]Physics, Forman Christian College (A Chartered Univ.), Pakistan.* The Photocathode FTO/$CuBi_2O_4$/$Au_{(Metasurface)}$ manifested the ABPE% of 0.17% with the highest kinetics till -4$mAcm^{-2}$ at low onset potential of -1.18$V_{(Ag/AgCl)}$ by endorsing expeditious photogenerated hot electron distribution and their sleek mobility towards electrode surface

JW5A.33
Generating Third Harmonics with Graphene Metasurface via Electromechanical Tuning, Mitali Sahu[1], Partha Roy Chaudhuri[1]; *[1]Indian Inst. of Technology Kharagpur, India.* We propose a voltage tunable nonlinear graphene metasurface that utilizes electromechanical actuation to modulate THz third-harmonic output, offering a compact, reconfigurable platform for dynamic control in THz spectroscopy, imaging, and nonlinear photonics.

JW5A.35
Ultra-thin transparent metal heater for free-space optics based on tunable materials, Hongyi Sun[5,1], Yi-siou Huang[5,1], Junyeob Song[2], Christopher Whittington[3,6], Sharon

Weiss[3], Amit Agarwal[4], Carlos Rios Ocampo[5,1]; *[1]Inst. for Research in Electronics and Applied Physics, Univ. of Maryland at College Park, USA; [2]National Inst. of Standards and Technology, USA; [3]Department of Electrical and Computer Engineering, Vanderbilt Univ., USA; [4]Department of Engineering, Univ. of Cambridge, UK; [5]Department of Materials Science & Engineering, Univ. of Maryland, College Park, USA; [6]Interdisciplinary Materials Science Program, Vanderbilt Univ., USA.* We demonstrate ~12-nm-thick silver-based heaters with transparency in the visible and near-infrared and high electrical conductivity. Our devices enable the reversible switching of $Ge_2Sb_2Se_4Te$ and VO_2, demonstrating amplitude and phase modulation, and a reliable response.

JW5A.36
Single cycle optical nonlinearity of transparent conducting oxides, Ieng Wai Un[2], Subhajit Sarkar[3], Yonatan Sivan[1]; *[1]Ben-Gurion Univ., Israel; [2]South China Normal Univ., China; [3]SRM Inst. of Science and Technology, India.* We model the optical and electronic response of transparent conducting oxides to a single cycle intense pulse. This enables interpreting recent experimental observation of the strength of the nonlinear response, and its unexpected rapid relaxation.

JW5A.37
Unraveling Ultrafast Demagnetization Dynamics in Nickel Film Using 3TM and m3TM Model, Debkanta Ghosh[1], Chitra Dolai[1], Shailab Singh Bodra[1], Prasanta Kumar Datta[1]; *[1]Indian Inst. of Technology Kharagpur, India.* Ultrafast demagnetization dynamics in 10 nm Ni thin film is studied experimentally using TR-MOKE within 3TM and m3TM frameworks. Results reveal sub-picosecond quenching driven by spin-flip scattering, with substrate effects influencing femtosecond magnetization recovery processes.

JW5A.38
Fiber-seeded, Efficient, 24 mJ, 1 kHz Ho:YLF Amplifier for Pumping Mid-IR OPCPA, Grzegorz Golba[1], Will Hettel[1], Rachel Larsen[1], Gabriella Seiffert[1], Margaret Murnane[1], Henry C. Kapteyn[2], Michaël Hemmer[1]; *[1]Univ. of Colorado Boulder, USA; [2]KMLabs, USA.* We report a 24 mJ, 1 kHz Ho:YLF chirped pulse amplifier with >35% efficiency, featuring a room-temperature regenerative amplifier and a cryogenic booster amplifier for mid-IR OPCPA pumping.

JW5A.39
Observation of optical meta-diffraction using space-time wave packets, Layton A. Hall[1], Ayman Abouraddy[1]; *[1]Univ. of Central Florida, CREOL, USA.* We demonstrate, for the first time, that spatio-temporally structured optical fields can provide a platform for realizing meta-diffraction, where the diffraction exponent can be arbitrarily tuned to be any real number in the Fresnel regime.

JW5A.40
Dispersion-Controlled Wave Propagation in Topological Photonic Crystal, Geetanjali Jena[1], R.K. Varshney[1], Dibakar R. Chowdhury[2]; *[1]Department of Physics, Indian Inst. of Technology Delhi, India; [2]School of Engineering, Anurag Univ., India.* We experimentally demonstrate a surface wave topological photonic crystal depicting its broad application prospects to achieve dispersion-less robust transmission and cavity-induced localized dispersion for strong electric field confinement and high Q resonance feature.

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Disclaimer: this guide is limited to technical program with abstracts and author blocks as of 22 October. For updated and complete information with special events, reference the online schedule or mobile app.

JW5A.41
A novel Label-Free Surface Plasmon Resonance (SPR) Biosensor for Ultrasensitive Cortisol Detection, Mogal M. Tabassum[1], Jyothsna Vaadaala[1], Yesudasu Vasimalla[1], Santosh Kumar[1]; *[1]KLUniv., India.* This article presents a novel ultrasensitive surface plasmon resonance sensor, which is a label- free and real-time applicable device, employing the bismuth ferrite, Aluminium antimonide and 2D materials for Cortisol detection.

JW5A.42
UV Triggered Two Color Interferometric Measurement of Electrostatic Discharge, James M. Clemson[1], Ben Trillet[1], Calvin Bavor[1], Sarah Hinnegan[1], Cameron Clarke[1], Claudia Schrama[1,2], Daniel Adams[1], Chip Durfee[1]; *[1]Colorado School of Mines, USA; [2]Physics, Laboratory for Ultrafast X-ray and Electron Microscopy, Univ. of Pavia, Italy.* We develop a technique for using UV triggered, two color interferometry to measure the radial distributions of the ionization ratio and neutral density of a spark at arbitrary points in its temporal evolution.

JW5A.43
Low-Cost Birefringent LiNbO3 Microlens for Wearable Optics, AMIRALI NIKEGHBAL[1], Md Rabiul Hasan[1], Seungbeom Noh[1], Hanseup Kim[1], Carlos Mastrangelo[1]; *[1]Univ. of utah, USA.* We fabricated a concave Z-cut LiNbO3 microlens via low-cost CNC machining, achieving –37.2 D optical power, ~225 nm surface roughness, 2 µm profile deviation, <0.2 µm wavefront error, and Strehl ratio >0.9.

JW5A.44
Hexagonal Light Lattices for Nonlinear Refractive Control, vikas mishra[1], ajay kumar[1]; *[1]IIT Delhi, India.* We create high contrast hexagonal patterns by simulating visible-light three-beam interference. Through refractive index modification, we improve nonlinear response in LiNbO3 by adjusting beam angles and amplitude matrices.

JW5A.45
Kinetics of Photoinduced and Plasmon-induced Voltages in Permalloy Films, MD A. RAB[1], Farzana Alam[1], Shamaar R. Howard[1], Natalia Noginova[1]; *[1]Norfolk State Univ., USA, Bangladesh.* Magneto-dependent photovoltages were observed in permalloy films on a prism under pulsed laser excitation. Resonant and off-resonant conditions showed distinct kinetics. Simulations revealed loss gradients influencing the polarity and strength of signals.

JW5A.46
Photon Pair Generation from Spontaneous Parametric Down Conversion using Electronic Intersubband Nonlinearities, Jaeyeon Yu[1], Tomas Santiago-Cruz[1], Raktim Sarma[1], Ravyn Malatesta[1], Anthony Rice[1], Sadhvikas Addamane[1], Alexey Belyanin[2], Igal Brener[1]; *[1]Sandia National Laboratories Albuquerque, USA; [2]Texas A&M Univ., USA.* We report the first experimental observation of photon pair generation via spontaneous parametric down-conversion at near-infrared wavelengths using resonant optical nonlinearities supported by electronic intersubband transitions in n-doped GaN/AlN-based multi-quantum well heterostructures.

JW5A.47

Accessing the Molecular Fluctuations by Optical Spectroscopy, Angika Bulbul[1], K. Burak Ucer[1], Evan Kumar[1], Keith Bonin[1], Ajay Ram Srimath Kandada[1]; *[1]Physics, Wake Forest Univ., USA.* We are developing an optical spectroscopy technique using photon-counting to quantify fluctuations in material responses. While traditional intensity-based methods fail to capture these fluctuations, this approach reveals variations in optical transition cross-sections in molecular chromophores.

JW5A.48
Structured Light with Orbital Angular Momentum for Probing Turbid Tissue-like Scattering Medium, Nawal Mohamed[1]; *[1]Aston Univ., UK.* We investigate structured light with Orbital Angular Momentum (OAM) in turbid tissue-like scattering medium, demonstrating OAM retains phase coherence under multiple scattering, enabling high-precision biomedical diagnostics and refractive index sensing in complex biological environments.

JW5A.49
Exploring Non-Equilibrium Phase Transitions in a Strontium Cavity-QED System, Seth Hew Peng Chew[1], Eric Y. Song[1], Dylan J. Young[1], Joyce Kwan[1], Zhijing Niu[1], Cameron Wagner[1], Vera Schäfer[2,1], Sanaa Agarwal[1,5], Diego Barberena[3,1], Edwin Chaparro[1,5], Anjun Chu[4,1], Robert J. Lewis-Swan[6,1], Asier P. Orioli[1,5], Diego F. Padilla[1,5], David Wellnitz[1,5], Jeremy T. Young[7,1], Haoqing Zhang[1,5], Ana Maria Rey[1,5], James Thompson[1,8]; *[1]Univ. of Colorado at Boulder JILA, USA; [2]Max Planck Inst. for Nuclear Physics, Germany; [3]Univ. of Cambridge, UK; [4]Pritzker School of Molecular Engineering, USA; [5]Center for Theory of Quantum Matter, USA; [6]Center for Quantum Research and Technology, USA; [7]Univ. of Amsterdam, Netherlands; [8]National Inst. of Standards and Technology, USA.* Using a strontium cavity QED apparatus, we first explore dynamical phases of BCS superconductors and perform time-resolved spectral gap spectroscopy. We also observe the continuous dissipation-induced superradiant transition in the cooperative resonance fluorescence (CRF) model.

JW5A.50
Ultrafast Structured Light through Nonlinear Frequency Generation in an Optical Enhancement Cavity, Walker M. Jones[1], Melanie A. Reber[1]; *[1]Univ. of Georgia, USA.* We report a new method to generate ultrafast structured light. An ultrafast laser is coupled to the higher order modes of a cavity with a nonlinear crystal and, through autocorrelation-style setup, outputs shaped ultrafast light.

JW5A.51
An Optical Double-Image Encryption System Based on Devil's Vortex Fresnel Arrays Used in the Fresnel Transform Domain, Hukum Singh[1]; *[1]Applied Sciences, School of Engineering, Tezpur Univ., India.* It offers a security analysis on the generation of a vortex array, utilizing in the Fresnel Transform (FrT). In this scheme MSE-, PSNR-, SSIM-, entropy-, correlation analysis-, key-sensitivity analysis-, key space-, various attacks were studies.

JW5A.52
Active Beam Stabilization for Ptychography, Hyrum C. Taylor[1], Taylor J. Buckway[1], Richard Sandberg[1]; *[1]Brigham Young Univ., USA.* We demonstrate active beam stabilization, and show that when used, the results of ptychographic imaging are improved qualitatively and with a 33% resolution improvement for visible light. We use two motorized mirrors and two cameras.

JW5A.53
Investigations into New Approaches for the Synthesis, Transfer, and Device Fabrication of 2D MoS_2, Muhammad Tariq[1,2]; [1]*Ohio Univ., USA;* [2]*NQPI, USA.* We present a novel chemical vapor deposition method for growing two-dimensional MoS_2 and its transfer technique, followed by optical and electrical characterization, for fabricating nanoelectronics and optoelectronic devices.

JW5A.54
Nonlinear Conversion Efficiency for Dielectric Metasurface from MWIR to SWIR with Nanoantenna's Shape-dependence, Hosna Sultana[1]; [1]*Univ. of Oklahoma, USA.* Dielectric metasurfaces offer nonlinear conversion due to strong light confinement and resonance resulting from the nanoantenna's shape and periodicity. Here, the third-harmonic conversion efficiency for MWIR to SWIR is investigated using a Germanium nanoantenna.

15:30 -- 16:30
Room 2A
FW6A • Space Optics Theme: Earth-Sensing LIDARs
Presider: Zachary Lapin, USA

FW6A.1 • 15:30 (Invited)
Technical Progress on the NUVIEW Space-Based LiDAR Mapping System, Kristian L. Damkjer[1]; [1]*NuView, USA.* NUVIEW is developing the first commercial LiDAR constellation to produce annual global 3D maps of Earth's surface. Recent technical advances across our primary Earth observation mission and completed ESA Pre-Phase A lunar study are discussed.

FW6A.2 • 16:00 (Invited)
Photon by Photon: Enabling the Next Era of Earth-sensing LiDAR Space Systems, Nicole Liu[1]; [1]*European Space Agency, France.* Driven by user needs and technology trends, ESA's FutureEO advances next-generation spaceborne LiDAR by maturing lasers, detectors, and spectrometers. New applications are explored through mission studies, with technologies demonstrated in the Aeolus and EarthCARE missions.

15:30 -- 17:00
Room 1A
FW6B • Ultrafast Lasers and Applications II
Presider: Christina Jörg; RPTU Kaiserslautern-Landau, Germany

FW6B.1 • 15:30 (Invited)
Coherent VUV-to-Soft X-ray Sources using Guided-Wave Upconversion of Ultrafast Lasers, Henry C. Kapteyn[1,2]; [1]*KMLabs, USA;* [2]*JILA and Department of Physics, Univ. of Colorado, USA.* Structured hollow fibers provide new opportunities for upconverting light to shorter wavelengths. I will discuss work toward a high-flux comb source at 148.4 nm for the Thorium-229 nuclear clock, and for soft x-ray HHG.

FW6B.2 • 16:00

Low-Threshold Fifth-Harmonic Generation From an Ytterbium Laser Through Four-Wave Mixing in Hollow-Core Antiresonant Fibers, Adomas Alisauskas[1], Robbie Mears[2], Mohammed Sabbah[1], Kerrianne Harrington[2], William J. Wadsworth[2], James M. Stone[2], Tim A. Birks[2], John Travers[1]; *[1]School of Engineering and Physical Sciences, Heriot Watt Univ., UK; [2]Centre for Photonics and Photonic Materials, Univ. of Bath, UK.* Deep ultraviolet light at 206 nm is generated with 22% pump-to-idler efficiency by four-wave mixing the third and fundamental harmonics of an ytterbium pulsed laser in an 11 µm core argon-filled antiresonant fiber.

FW6B.3 • 16:15
Ultrafast Filamentation for Water Purification of Chemical Contaminants, Lauren A. Ibon[1], Noah Talisa[1], Luke Skala[1], Hannah Clark[1], Mallory Solazzo[1]; *[1]Johns Hopkins Applied Physics Lab, USA.* Plasma-based water treatment is promising for chemical degradation in water; however, cost and infrastructure are still issues. We demonstrate direct laser-induced plasma formation in water to breakdown 100% of chemical contamination in 24 hrs.

FW6B.4 • 16:30
Broadband Omni-resonant Field Enhancement of Ultrashort Pulses in Planar Cavities, Abbas Shiri[1], Kenneth Schepler[1], Ayman Abouraddy[1]; *[1]CREOL, Univ. of Central Florida, USA.* We show that the peak intensity of a broadband ultrafast pulse coupled to a planar Fabry-P{\'e}rot cavity in an omni-resonant configuration can exceed the intensity of a focused conventional pulse of equal energy and bandwidth.

FW6B.5 • 16:45
Comparison of Multi-Pass Cell and Anti-Resonant Hollow Core Fiber Mid-IR Self-Compression, Gabriella Seifert[1], Will Hettel[1], Grzegorz Golba[1], Drew Morrill[1], Rodrigo Martin Hernandez[2], Víctor Wilfried Segundo Staels[2], Fei Yu[3], Jonathan Knight[3], José Ignacio San Román García[2], Margaret Murnane[1], Henry C. Kapteyn[1], Michaël Hemmer[1]; *[1]Univ. of Colorado Boulder, USA; [2]Universidad de Salamanca, Spain; [3]Univ. of Bath, UK.* We report self-compression to the few-cycle regime of 3-µm wavelength pulses with few hundreds of µJ energy in a multi-pass cell and an anti-resonant hollow core fiber. We contrast both methods and discuss scalability.

15:30 -- 17:00
Room 1B
FW6C • Integrated Photonics
Presider: Bienvenu Ndagano; INRS-Energie Mat & Tele Site Varennes, Canada

FW6C.1 • 15:30 (Invited)
Quantum-enhanced Second Harmonic Generation Beyond the Spontaneous Parametric Down-conversion Regime, Thomas Dickinson[1,2], Ivi Afxenti[3], Giedre Astrauskaite[4], Lennart Hirsch[3], SAmuel Nerenberg[4], Ottavia Jedrkiewicz[5], Daniele Faccio[4], Caroline Müllenbroich[4], Alessandra Gatti[5], Matteo Clerici[1,3], Lucia Caspani[1,2]; *[1]Como Lake Inst. of Photonics, Dipartimento di Scienza e Alta Tecnologia, Università dell'Insubria - Como, Italy; [2]Inst. of Photonics, Univ. of Strathclyde, UK; [3]James Watt School of Engineering, Univ. of Glasgow, UK; [4]School of Physics and Astronomy, Univ. of Glasgow, UK; [5]Istituto di Fotonica e Nanotecnologie, CNR, Italy.* We report quantum-enhanced second harmonic generation driven

by parametric down-conversion (PDC), with efficiencies exceeding that of classical light up to pumping intensities ~10 times larger than the standard classical/quantum boundary (1 PDC photon per mode).

FW6C.2 • 16:00
Active control of frequency conversion in thin-film lithium niobate via on-chip polarization management, Junhyung Lee[1,2], Sunghyun Moon[1], Changhyun Kim[1], Yongchan Park[1,2], Minho Choi[1,3], Hansol Kim[1], Dae-Hwan Ahn[1,4], Hyeon Hwang[5], Min-Kyo Seo[5], Hojoong Jung[1], Hyounghan Kwon[1]; *[1]Korea Inst. of Science & Technology, Korea (the Democratic People's Republic of); [2]Korea Univ., Korea (the Republic of); [3]Hanyang Univ., Korea (the Republic of); [4]KIST school, Korea (the Democratic People's Republic of); [5]KAIST, Korea (the Democratic People's Republic of).* We demonstrate a monolithic TFLN platform with integrated polarization control and feedback-stabilized SHG. Arbitrary input states are adaptively converted for optimal conversion, enabling reconfigurable, input-independent nonlinear photonic circuits with over 37 dB extinction.

FW6C.3 • 16:15
High-Brightness Bell Source Generation on a Thin-Film Lithium Niobate Integrated Circuit, Hansol Kim[1], Changhyun Kim[1], Minho Choi[1,2], Junhyung Lee[1,3], Yongchan Park[1,3], Sunghyun Moon[1], Jinil Lee[1,4], Hyeon Hwang[5], Min-Kyo Seo[5], Yoon-Ho Kim[6], Yong-Su Kim[1,7], Hojoong Jung[1], Hyounghan Kwon[1,7]; *[1]Center for Quantum Technology, Korea Inst. of Science & Technology, Korea (the Republic of); [2]Department of Artificial Intelligence Semiconductor Engineering, Hanyang Univ., Korea (the Republic of); [3]School of Electrical Engineering, Korea Univ., Korea (the Republic of); [4]Division of Nano and Information Technology, KIST school, Korea Univ. of Science and Technology, Korea (the Republic of); [5]Department of Physics, Korea Advanced Inst. of Science and Technology (KAIST), Korea (the Republic of); [6]Department of Physics, Pohang Univ. of Science and Technology (POSTECH), Korea (the Republic of); [7]Division of Quantum Information, KIST School, Korea Univ. of Science and Technology, Korea (the Republic of).* We demonstrate a compact, high-brightness polarization-entangled Bell state source on thin-film lithium niobate (TFLN), achieving 508.5 MHz/mW with high purity of 0.901, concurrence of 0.9, and fidelity of 0.944, enabling scalable quantum photonics.

FW6C.4 • 16:30
Realizing a non-classical light source with a chip-scale atomic beam via cavity-QED, Braden J. Larsen[1,2], Hagan Hensley[1,2], Gabriela Martinez[3,2], Alexander Staron[3,2], William R. McGehee[3], John Kitching[3], James Thompson[1,3]; *[1]JILA, USA; [2]Univ. of Colorado Boulder, USA; [3]National Inst. of Standards and Technology, USA.* Here, we demonstrate the feasibility of interfacing chip-scale atomic beam sources with high-finesse optical cavities to realize integrated cavity-QED systems. By leveraging the nonlinearity of atoms, we use this platform to generate non-classical light.

FW6C.5 • 16:45
Quantum Packaging: Wafer-Level Fabrication of All-Dielectric Vapor Cells for Optically Addressed Rydberg Atom Electrometry, Hunter S. Shillingburg[1], Alexandra Artusio-Glimpse[2], Adil Meraki[2,4], Guy Lavelle[3], Miao Liu[3], Chad Eichfeld[3], Nikunjkumar Prajapati[2], Matthew Simons[2], Glenn Holland[5], Christopher Holloway[2], Vladimir Aksyuk[5], Daniel Lopez[1,5]; *[1]Electrical Engineering and Computer Science, Pennsylvania State Univ., USA; [2]Electromagnetic Fields*

Group, National Inst. of Standards and Technology, USA; [3]Materials Research Inst., Penn State Univ., USA; [4]Physics Department, Univ. of Colorado Boulder, USA; [5]Microsystems and Nanotechnology Division, National Inst. of Standards and Technology, USA. We present a technique for fabricating all-glass, microfabricated vapor cells for Rydberg-atom electrometry, enabling durable, low-loss millimeter-wave and microwave quantum sensing. This process ensures long-term vacuum stability and robust Rydberg excitation for miniaturized quantum sensors.

15:30 -- 17:00
Room 1C
FW6D • Machine Learning and Quantum Technology
Presider: Lars Buettner; TUD Dresden Univ. of Technology, Germany

FW6D.1 • 15:30 (Invited)
Deep Learning-based Mode Decomposition in Multimode Fibers: A Paradigm Shift from Data-driven to Physics-driven, Jiali Sun[1], Qian Zhang[1], Juergen W. Czarske[1]; *[1]Technische Universität Dresden, Germany.* We present a physics-informed deep learning approach for mode decomposition in both simulated and kilometer-long multimode fibers, providing a scalable framework for inverse 3D imaging, optical system analysis, classical and quantum communication, and sensing.

FW6D.2 • 16:00
Machine Learning Framework for Semiconductor Chips Anti-Counterfeiting Using a Plasmonic Physically Unclonable Function, Daksh Kumar Singh[1,2], Blake Wilson[1,2], Yuheng Chen[1,2], Rohan Ojha[1], Michael Bezick[1], Alexandra Boltasseva[1,2], Vladimir M. Shalaev[1,2], Alexander V. Kildishev[1]; *[1]Elmore Family School of Electrical and Computer Engineering, Purdue Univ., USA; [2]Quantum Science Center, Oak Ridge National Lab, USA.* We present RAPTOR, a machine learning-based method for semiconductor anti-counterfeiting that utilizes plasmonic physically-unclonable functions. RAPTOR achieves an accuracy of 97.6% in detecting adversarial tampering, demonstrating high robustness against both environmental degradation and malicious attacks.

FW6D.3 • 16:15
Neural-network Generated Quantum State Can Mitigate the Barren Plateau in Variational Quantum Circuits, Zhehao Yi[1], Rahul Bhadani[1]; *[1]Univ. of Alabama in Huntsville, USA.* We find that using neural networks to generate quantum states can effectively alleviate the barren plateau phenomenon present in random variational quantum circuits.

FW6D.4 • 16:30
Polarization agnostic continuous variable quantum key distribution, Brian P. Williams[1], Nicholas A. Peters[1]; *[1]Oak Ridge National Laboratory, USA.* We present a polarization agnostic encoding method for continuous-variable quantum key distribution in which the receiver measures valid Gaussian modulated coherent state quadratures even when the signal polarization is ``scrambled'' during transmission.

FW6D.5 • 16:45

Real-Time Detection of Clear Air Turbulence Using Quantum Wind LiDAR, Daniel Lum[1], Christopher Miller[1], Brandon Rodenburg[1], Bradford Snios[1], Anthony DiCarlo[1], Michael Stenner[1]; [1]*The MITRE Corp., USA.* Clear-air turbulence is exceedingly difficult to detect at an airliner's cruising altitude. Existing detection frameworks may provide up to a 40-second warning. We present a detection framework to extend that warning out to ~2 minutes.

15:30 -- 17:00
Room 1D
FW6E • Next-Generation Optical Fiber Transmission Systems and Networks
Presider: Giovanni Milione; NEC Laboratories America Inc., USA

FW6E.1 • 15:30 (Invited)
Open and Disaggregated Optical Networks: From Vision to Reality, Andrea D'Amico[1], Giovanni Milione[1]; [1]*NEC Laboratories America, Inc., USA.* Open and disaggregated optical networks can potentially reshape the telecom landscape. This talk offers a reality check on adoption status, key challenges, and future directions, highlighting how openness can enable more scalable and flexible infrastructure.

FW6E.2 • 16:00 (Invited)
Optical Communication and Sensing Over Submarine Cables, Yue Hu[1]; [1]*Nokia, USA.* We assess the feasibility of using subsea telecom cables as distributed seismic sensors for detecting sub-Hz polarization and phase changes through potential DSP enhancements for enabling early life saving earthquake and tsunami detection.

FW6E.3 • 16:30
480 Gb/s Super-Rated Coherent TWDM PON Enabled by Colorless Receiver and Optical Frequency Comb, Haipeng Zhang[1], Surie Jia[2]; [1]*CableLabs, USA;* [2]*Fairview High School, USA.* This work demonstrates a 480 Gb/s coherent TWDM PON using optical frequency comb and colorless coherent receiver. Experimental validation confirms robust bidirectional transmissions without performance degradation from neighboring WDM channels in a distributed ODN.

FW6E.4 • 16:45
Quantization Techniques for Transformer-Based Nonlinear Equalizer in Coherent Optical Links, Prankush Agarwal[1], Naveenta Gautam[1], C. Alex Kaylor[1], Stephen E. Ralph[1]; [1]*Georgia Inst. of Technology, USA.* We apply quantization to Transformer-based NLEs in experimental coherent optical links, reducing the numerical precision of model parameters to achieve up to 3.2× model size reduction, 1.5× faster inference with ≤ 0.07 dB Q-factor penalty.

Frontiers in Optics + Laser Science 2025
Session Guide

Disclaimer: this guide is limited to technical program with abstracts and author blocks as of 22 October. For updated and complete information with special events, reference the online schedule or mobile app.

15:30 -- 17:00
Room 1E
LW6F • Quantum Optics and Silicon Quantum Photonics
Presider: Marina Radulaski; Univ. of California Davis, USA

LW6F.1 • 15:30 (Invited)
Rethinking Resonance Fluorescence: Fundamental Insights and Emerging Quantum Technologies, Arno Rauschenbeutel[1]; [1]*Humboldt Universität zu Berlin, Germany.* Resonance fluorescence reveals surprising quantum interference effects and photon-pair emission. I present two experiments: one uncovers simultaneous two-photon scattering, the other generates narrow-band, time-bin entangled photon pairs—advancing both fundamental understanding and quantum technology applications.

LW6F.2 • 16:00
Quantum-dot single-photon source based on a two-dimensional photonic crystal nanocavity integrated on a Si photonics platform, Akinari Fujita[1], Natthajuks Pholsen[4], Sangmin Ji[4], Toshihiro Kamei[3], Makoto Okano[3], Masahiro Kakuda[4], Satoshi Iwamoto[2,4], Yasuhiko Arakawa[4], Yasutomo Ota[1,4]; [1]*Department of Applied Physics and Physico-Informatics, Keio Univ., Japan;* [2]*Research Center for Advanced Science and Technology, The Univ. of Tokyo, Japan;* [3]*National Inst. of Advanced Industrial Science and Technology, Japan;* [4]*Inst. for Nano Quantum Information Electronics, The Univ. of Tokyo, Japan.* We demonstrate an on-Si quantum-dot single-photon source based on a two-dimensional photonic crystal nanocavity, which efficiently mediates the quantum emission into an underlying Si waveguide. Bright single-photons propagating in the Si waveguide were observed.

LW6F.3 • 16:15 (Invited)
Optically interconnected spin qubit registers in silicon photonics, Alp Sipahigil[1,2]; [1]*Univ. of California Berkeley, USA;* [2]*Berkeley Lab, USA.* I will present progress on realizing spin qubit registers in silicon photonics. Topics include: (i) demonstration of a three-qubit register with T centers, (ii) multiplexed operation in cavity arrays, (iii) decoherence sources limiting photonic indistinguishability.

LW6F.4 • 16:45
Propagation loss analysis of optical parametric amplifier for ultra-fast homodyne-measurement and all-optical feedforward enabling high-speed quantum computation, Takahiro Kashiwazaki[1], Taichi Yamashima[1], Asuka Inoue[1], Takushi Kazama[1], Mamoru Endo[2,3], Takeshi Umeki[1], Akira Furusawa[2,3]; [1]*NTT Corporation, Japan;* [2]*The Univ. of Tokyo, Japan;* [3]*Riken, Japan.* We investigate the effect of the propagation loss and gain per unit length of an optical parametric amplifier with quantum light input for ultra-fast feedforward operation.

Frontiers in Optics + Laser Science 2025
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17:30 -- 18:00
Room 2A
FW7A • Space Optics Theme: Space-based Laser Communications
Presider: Zachary Lapin, USA

FW7A.1 • 17:30 (Invited)
Optical Amplifiers: from Undersea Repeaters to Laser Terminals in Space, Stratos Kehayas[1]; [1]*Gooch & Housego, USA.* Optical amplifiers revolutionized terrestrial networks and are now becoming vital parts of laser-based satellite communications. In this presentation we review the journey of qualifying 1550nm amplifiers and present development efforts in miniaturization and power scaling.

FW7A.2 • 18:00 (Invited)
Withdrawn.

17:30 -- 19:00
Room 1A
FW7B • Hybrid Integrated Quantum Photonic Systems
Presider: Tzu-Yung Huang; Nokia Bell Labs, USA

FW7B.1 • 17:30 (Invited)
Wafer-Scale Quantum Photonics in Silicon Carbide, Marina Radulaski[1]; [1]*Univ. of California Davis, USA.* Developing wafer-scale fabrication processes, we integrate near infrared color centers in silicon carbide, NV centers and divacancies, with photonic devices for applications in quantum light sources, quantum repeaters and all-photonic quantum simulators at scale.

FW7B.2 • 18:00
Scalable Butt-Coupled Integration of 800 nm Lasers on Silicon Nitride using Micro-Transfer Printing, Max Kiewiet[1,2], Stijn Cuyvers[1,2], Maximilien Billet[1,2], Konstantinos Akritidis[1,2], Valeria Bonito Oliva[1,2], Gaudhaman Jeevanandam[2], Sandeep Saseendran[2], Manuel Reza[2], Pol Van Dorpe[2], Roelof Jansen[2], Joost Brouckaert[2], Günther Roelkens[1,2], Kasper Van Gasse[1,2], Bart Kuyken[1,2]; [1]*Universiteit Gent, Belgium;* [2]*imec, Belgium.* We demonstrate micro-transfer printed 800 nm GaAs-based lasers on a SiN platform using a scalable butt-coupling method. We show continuous-wave lasers with 4 mW output power and passive mode-locking with a 519 Hz radio-frequency linewidth.

FW7B.3 • 18:15
493 nm Integrated Electro-optics on Thin-film Lithium Niobate Platform, Nicholas Achuthan[1], Xudong Li[1], Leticia Magalhaes[1], Xinrui Zhu[1], Hana Warner[1], Xiangying Zuo[1], Sophie W. Ding[1], Keith Powell[1], Dylan Renaud[1], Daniel Assumpcao[1], Michael Pushkarsky[2], Amirhassan Shams-Ansari[2], Marko Loncar[1]; [1]*Harvard Univ., USA;* [2]*DRS Daylight Solutions, USA.* We demonstrate integrated thin-film lithium niobate multimode interferometers, tunable directional couplers with heaters, and electro-optic modulation at 493 nm with over 50 GHz bandwidth, enabling scalable, high-speed beam control for barium ion quantum systems.

FW7B.4 • 18:30
Towards Release-free Intermodal Acousto-optic Modulation at Visible and UV Wavelengths., Oscar Jaramillo[1], Karan K. Mehta[1]; [1]*Cornell Univ., USA.* We present an inter-modal acousto-optic modulator designed to operate near λ ~ 405 nm, leveraging acoustic modes confined and co-localized with a buried optical waveguide. We demonstrate the acoustic waveguiding concept, predicted to enable opto-mechanical coupling coefficient g ≈ 2 (μW)^(-1/2) mm^-1.

FW7B.5 • 18:45
Magnetic position finding with an NV integrated photonic circuit, Joseph Smith[1]; [1]*Univ. of Sheffffield, UK.* We demonstrate the coupling of a set of site-defined NV sensors to foundry-optimised silicon nitride photonics in an all-integrated device. The site-defined NV sensors record the position of an magnetised needle.

17:30 -- 19:00
Room 1B
FW7C • Light-matter Interactions
Presider: Bereneice Sephton; Univ degli Studi di Napoli Federico II, Italy

FW7C.1 • 17:30 (Invited)
High-Efficiency Microwave-Optical Transduction to Enable the Quantum Internet, Silvia Zorzetti[1]; [1]*Fermilab, USA.* A key frontier in Quantum Information Science (QIS) is the development of low-noise interconnections between quantum processing units (QPUs) and quantum sensors. High-efficiency microwave–optical transduction is a pivotal technology for enabling distributed quantum networks, with broad applications in computing, sensing, and communications. This talk will present a comprehensive analysis and recent experimental progress in quantum transduction, achieved by coupling superconducting cavities to electro-optic optical cavities. Originating from research at the DOE Fermi National Accelerator Laboratory and the SQMS Quantum Research Center, this work advances transformational technologies in quantum computing and sensing by leveraging superconducting devices with long coherence times.

FW7C.2 • 18:00
Towards Quantum-Enhanced Electron Beam Profiling Via Atomic Magnetometry, Nicolas DeStefano[1], Todd Averett[1], Shukui Zhang[2], Alexandre Camsonne[2], Seth Aubin[1], Eugeniy Mikhailov[1], Irina Novikova[1]; [1]*College of William & Mary, USA;* [2]*Thomas Jefferson National Accelerator Facility, USA.* We are developing a quantum-enhanced atomic magnetometer via four-wave mixing and nonlinear magneto-optical rotation in Rb atoms for non-invasive profiling of an electron beam in 2 dimensions.

FW7C.3 • 18:15
Long-wavelength Transitions in Yb Atom Arrays for Quantum Science, Chun-Wei Liu[1], Saiwei Nie[1], Eesha Banerjee[1], Micah Davidson[1], Alex P. Burgers[1]; [1]*Univ. of Michigan, USA.* We present progress towards a fully-atomic cavity QED system for novel quantum architectures, by demonstrating arrays of Yb atoms trapped in optical tweezers and calculating the expected cooperativity of cavities constructed from closely-spaced atom arrays.

FW7C.4 • 18:30
Experimental Application of Variational Quantum Noise Spectroscopy to Nitrogen Vacancy Centers, Connor J. Desrosiers[1,3], Nanako Shitara[2,3], Andrés Montoya-Castillo[2], Shuo Sun[1,3]; *[1]Univ. of Colorado at Boulder JILA, USA; [2]Chemistry, Univ. of Colorado Boulder, USA; [3]Physics, Univ. of Colorado Boulder, USA.* We experimentally apply Variational Quantum Noise Spectroscopy(VQNS) to single nitrogen vacancy centers in diamond, reconstructing quantum noise spectra to validate VQNS as an experimental method of quantum noise spectroscopy.

FW7C.5 • 18:45
Semiconductor Quantum Optics with Coulomb Many-Body Correlations: Dynamics of Photons, Excitons, and Biexcitons, Hendrik Rose[1], Stefan Schumacher[1,2], Torsten Meier[1]; *[1]Universität Paderborn, Germany; [2]Univ. of Arizona, USA.* A microscopic many-body approach describing semiconductor nanostructures excited by quantum light is presented. The coupled dynamics of photons and electronhole-pair excitations highlights the importance of a microscopic modeling, in particular the relevance biexcitonic continuum states.

17:30 -- 19:00
Room 1C
FW7D • Advanced Sensing Technologies
Presider: Krishangi Krishna; Brown Univ., USA

FW7D.1 • 17:30
Light for Life: Harnessing Microbubbles for Patterning, Sensing, & Bio-Interface Engineering, Anand D. Ranjan[1], Anurit Dey[2], Ayan Banerjee[1]; *[1]Ilser Kolkata, India; [2]Neuroscience and Biomedical Engineering, Aalto Univ., Finland.* Light serves as a tool to generate laser-induced microbubbles that enable precise biomolecule patterning, sensitive biosensing, and bio-interface engineering. This real-time approach advances the fabrication of diagnostic platforms, overcoming the limitations of the slow, random assembly typical of conventional bottom-up methods.

FW7D.2 • 17:45
Deep learning-assisted chemiluminescence point-of-care assay for high-sensitivity troponin testing, Gyeo-Re Han[1], Artem Goncharov[1], Merve Eryilmaz[1], Shun Ye[1], Hyou-Arm Joung[1], Rajesh Ghosh[1], Emily Ngo[1], Yena Lee[1], Kevin Ngo[1], Elizabeth Melton[2], Omai Garner[1], Dino Di Carlo[1], Aydogan Ozcan[1]; *[1]Univ. of California, Los Angeles, USA; [2]Univ. of California, Davis, USA.* We report a deep learning-integrated chemiluminescence vertical flow sensor that enables rapid and cost-effective troponin detection for point-of-care testing, demonstrating sensitivity and precision consistent with clinical guidelines.

FW7D.3 • 18:00
Low-Power Femtosecond Optical Trapping for Quantitative Cell Indentation via Digital Videography, Krishangi Krishna[1], Gannon Lemaster[1], Zhaowei Jiang[1], Anita Shukla[1], Kimani C. Toussaint[1]; *[1]Brown Univ., USA.* We present a femtosecond optical tweezers platform for low-power cellular indentation based on digital videography. By eliminating both continuous-wave

lasers and photodiodes, the system minimizes photodamage and enables scalable, multiplexed mechanical probing of biostructures.

FW7D.4 • 18:15
Particle Sizing of Native Aerosols with Coherence-gated DLS, Erick Zora-Guzmán[1], Vicente Reyes-Alejo[1], Josue A. Perales-Hernandez[1], Omar A. Arrieta Guerrero[1], Roberto A. Alvarez-Aguirre[1], Jose Guzman-Sepulveda[1]; [1]*CINVESTAV Unidad Monterrey, Mexico.* We use coherence-gated dynamic light scattering (CG-DLS) to measure the particle size distribution of aerosols from e-cigarettes at native concentrations, without sample processing, revealing burning power-dependent size spanning from 350 to 550 nm.

FW7D.5 • 18:30
Background-free Interferometric Scattering from Dynamic Complex Fluids, Erick Zora-Guzmán[1], Josue A. Perales-Hernandez[1], Vicente Reyes-Alejo[1], Omar A. Arrieta Guerrero[1], Roberto A. Alvarez-Aguirre[1], Jose Guzman-Sepulveda[1]; [1]*CINVESTAV Unidad Monterrey, Mexico.* We present a novel all-optical-fiber architecture that enables the measurement of interferometric dynamic light scattering in a background-free manner. We demonstrate particle sizing colloidal suspensions at ultra-low volume fractions, as low as $1x10^{-7}$.

FW7D.6 • 18:45
Optical Characterization of Noble Gas Clathrate Hydrates at Room Temperature, Omar A. Arrieta Guerrero[1], Jose Guzman-Sepulveda[1], Jesus C. Ruiz-Suarez[1]; [1]*CINVESTAV Unidad Monterrey, Mexico.* The nucleation of noble gas clathrate hydrates is studied by means of Fresnel reflectometry and dynamic light scattering, using a fiber-optic common-path interferometer in reflection, at room temperature and high pressures up to 600 atm.

17:30 -- 18:15
Room 1D
FW7E • Frequency Combs, High-Harmonic Generation, and Attoscience
Presider: Patrice Genevet; Colorado School of Mines, USA

FW7E.1 • 17:30 (Invited)
Femtosecond Fieldoscopy, Hanieh Fattahi[1]; [1]*Max-Planck-Inst Physik des Lichts, Germany.* This talk explores Femtosecond Fieldoscopy, a novel technique that delivers exceptional detection sensitivity, bandwidth, and dynamic range—enabling attosecond temporal precision and sub-diffraction spatial resolution for advanced ultrafast optical measurements.

FW7E.2 • 18:00
Molecular Fingerprinting of *f*-Block Molecules using a Soft X-ray, HHG Light Source, Siyang Wang[1], cassandra gates[1], maksim kulichenko[1], valerio pinchetti[1], Patrick J. Skrodzki[1], Thomas Hoffman[1], Harshad Gajapathy[1], sang-eun lee[1], samuel greer[1], matthew carpenter[1], sergei tretiak[1], benjamin stein[1], pamela bowlan[1]; [1]*Los Alamos National Laboratory, USA.* Soft x-ray absorption spectroscopy is a powerful technique for investigating electronic structure and molecular fingerprinting. Here, we present a broadband, tabletop soft x-ray light source capable of detailed characterization *f*-block molecular systems through multiple electronic transitions.

FW7E.4 • 18:15
High-Harmonic Generation from Resonant Dielectric Metasurfaces, Pavel Tonkaev[1], Felix Richter[2], Ivan Toftul[1], Maria Antonietta Vincenti[3], Ivan Sinev[2], Michael Scalora[4], Hatice Altug[2], Yuri Kivshar[1]; *[1]Australian National Univ., Australia; [2]Ecole Polytechnique Federale de Lausanne (EPFL), Switzerland; [3]Univ. of Brescia, Italy; [4]U.S. Army Combat Capabilities Development Command, USA.* We study high-harmonic generation in silicon metasurfaces with quasi-bound states in the continuum, experimentally demonstrating enhanced emission and unconventional power scaling compared to unpatterned membranes using a free-standing platform.

FW7E.4 • 18:15 (Invited)
Chiral Nanophotonics: Towards Single Molecule Chiroptical Measurements, Malcolm Kadodwala[1]; *[1]Univ. of Glasgow, UK.* Abstract not available.

17:30 -- 19:00
Room 1E
LW7F • Quantum Science with NV Centers, Neutral Atoms, and Trapped Ions
Presider: Alex Burgers; Univ. of Michigan, USA

LW7F.1 • 17:30
Ytterbium Atom Arrays and Nanophotonics for Quantum Science, Leela K. Chari[1], Jacob Barnhart[1], Alex P. Burgers[1]; *[1]Univ. of Michigan, USA.* We present photonic crystal cavities that enable strong atom-photon coupling at telecom wavelengths, providing a scalable interface for distributed quantum technologies. Additionally, we present progress on metasurfaces for generating *in situ* optical tweezer arrays.

LW7F.2 • 17:45
Loading, cooling and imaging of atom arrays via electromagnetically-induced transparency, Shai Tsesses[1], Tamara Sumarac[2,1], Emily Qiu[1], Peiran Niu[1], Adrian Menssen[1], Mikhail Lukin[2], Vladan Vuletić[1]; *[1]Massachusetts Inst. of Technology, USA; [2]Harvard Univ., USA.* We present a novel method for enhanced single-atom loading, fast cooling and non-destructive imaging of alkali atom arrays, which operates under the magnetic fields required for continuous operation of neutral atom quantum processors.

LW7F.3 • 18:00 (Invited)
Integrated Focusing Optics for Scalable Trapped-Ion Quantum Computing, Sara L. Mouradian[1]; *[1]Univ. of Washington, USA.* Engineered trapped-ion technologies promsie quantum-enhanced sensing and computation but will require precise optical control over a cm-scale device. In this talk I will show how integrated focusing optics can provide enhanced readout and control.

LW7F.4 • 18:30 (Invited)
Spin Squeezing in an Ensemble of Nitrogen-Vacancy Centers in Diamond, Emily J. Davis[1], Weijie Wu[2], Lillian Hughes[3], Bingtian Ye[2], Zilin Wang[2], Dominik Kufel[2], Tasuku Ono[2], Simon Meynell[4], Maxwell Block[2], Che Liu[2], Haopu Yang[2], Ania Bleszynski Jayich[4], Norman Yao[2]; *[1]New*

York Univ., USA; [2]Physics, Harvard Univ., USA; [3]Materials, Univ. of California, Santa Barbara, USA; [4]Physics, Univ. of California, Santa Barbara, USA. We present the first experimental demonstration of spin squeezing in a solid-state spin system. Our experiments are performed on a strongly-interacting ensemble of nitrogen-vacancy (NV) color centers in diamond at room temperature and squeezing (-0.5 pm 0.1 dB) is generated by the native magnetic dipole-dipole interaction between NVs. Our results open the door to entanglement-enhanced metrology using macroscopic ensembles of optically-active spins in solids.

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Session Guide

Disclaimer: this guide is limited to technical program with abstracts and author blocks as of 22 October. For updated and complete information with special events, reference the online schedule or mobile app.

Thursday, 30 October

08:00 -- 09:00
Room 2A
FTh1A • Space Optics Theme: Space-Based Optical Remote Sensing
Presider: Kristian Damkjer; NUVIEW, Inc., USA

FTh1A.1 • 08:00 (Invited)
Small Orbital Debris Detection Using Lasers, Andrew Nicholas[1], Charles M. Brown[1], Joshua M. Wolf[1], Kenneth D. Marr[1], Theodore T. Finne[1], Vanessa M. Kooi[1]; [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. Launch on StpSat-7 expected in February 2026.

FTh1A.2 • 08:30 (Invited)
Optical Space Situational Payload developments for Space Domain Awareness, Edgar Madril[1]; [1]*Honeywell Aerospace, USA.* Low Swap, low cost, high coverage, rapid-to-market, small debris detection of Space Situational Awareness sensors to address detection, avoidance and warning in the orbital space sector, extending from LEO to Cislunar space.

08:00 -- 09:00
Room 1A
FTh1B • Free Space and Quantum Optical Communication
Presider: Giovanni Milione; NEC Laboratories America Inc., USA

FTh1B.1 • 08:00 (Invited)
Optical Communications for Artemis II Crewed Moon Mission, Farzana I. Khatri[1]; [1]*Massachusetts Inst. of Technology, USA.* An overview and status of NASA's Orion Artemis II Optical Communications (O2O) demonstration will be presented. O2O provides up to 250 Mbps optical downlink and 20 Mbps uplink for mission data transfer and real-time video.

FTh1B.2 • 08:30
Two-Pumps-Based Degenerate Entanglement Assisted Communication with SLM-Based Beam Pointing, Ivan B. Djordjevic[2], Ignacio A. Rojas[1]; [1]*Univ. of Arizona, USA;* [2]*Florida State Univ., USA.* We successfully demonstrate two-pumps-based degenerate entanglement assisted free-space optical communication system at 1 Gb/s operating in L-band with SLM-based beam pointing by employing type-0 PPLN waveguide to generate signal and idler photons at 1570 nm.

FTh1B.3 • 08:45
Physical Layer Encryption for Secure Optical Communication, Abhinand Venugopalan[1], Karanveer Singh[1], Janosch Meier[1], Thomas Schneider[1]; [1]*Technische Universität Braunschweig, Germany.* Signal encryption is achieved by orthogonal signal processing, allowing transmission

at low signal-to-noise ratio, and the protection of the raw bit streams at the physical layer.

08:00 -- 09:00
Room 1B
FTh1C • Quantum Correlations
Presider: Frederic Bouchard; National Research Council Canada, Canada

FTh1C.1 • 08:00 (Invited)
Quantum Frequency Conversion Controlled by Structured Light, Rafael F. Barros[1,2], André L. Santos Junior[3], Antonio Z. Khoury[3], Robert Fickler[1]; *[1]Tampereen Yliopisto, Finland; [2]Instituto de Física, Universidade de São Paulo, Brazil; [3]Instituto de Física, Universidade Federal Fluminense, Brazil.* We show that structured light can be leveraged to convert an entangled photon to another frequency, thereby changing its quantum state from polarization to a spatial mode encoding while also controlling the degree of entanglement.

FTh1C.2 • 08:30
Measuring High-Dimensional Unitary Transformations with Undetected Photons, Salini Rajeev[1], Mayukh Lahiri[1]; *[1]Oklahoma State Univ., USA.* We present a novel, quantum interferometric method of measuring high-dimensional unitary transformations. In contrast to existing methods, the proposed method does not require detecting the qudit on which the unitary transformation is performed.

FTh1C.3 • 08:45
Encoding quantum information on near-field photons using total angular momentum, Shai Tsesses[1,2], Amit Kam[2], Yigal Ilin[2], Kobi Cohen[2], Yaakov Lumer[2], Lior Fridman[2], Amir Sivan[2], Stav Lotan[2], Anatoly Patsyk[2], Liat Nemirovsky-Levy[2], Larisa Popilevsky[2], Meir Orenstein[2], Mordechai Segev[2], Guy Bartal[2]; *[1]Massachusetts Inst. of Technology, USA; [2]Technion - Israel Inst. of Technology, Israel.* We encode quantum information on photons confined to surface using a new degree-of-freedom unique to the near-field regime – Total angular momentum. We observe photon-pair non-classical correlations on-chip, as well as single-photon polarization-mode entanglement in free-space.

08:00 -- 09:00
Room 1C
FTh1D • Optoelectronic Sensor Systems
Presider: Tzu-Yung Huang; Nokia Bell Labs, USA

FTh1D.1 • 08:00 (Invited)
Hermetic Fused Silica Packaging for Implantable Optoelectronic Systems, Lin Du[1]; *[1]The Ohio State Univ., USA.* We present a fused silica-based hermetic packaging platform for implantable optoelectronic systems, enabling biocompatibility, long-term stability, and CMOS compatibility through wafer-level microfabrication and laser-assisted bonding and dicing techniques.

FTh1D.2 • 08:30

Nonlinear Symmetry Breaking to Enhance the Sagnac Effect in a Microresonator Gyroscope, Thariq Shanavas[1], Gregory R. Krueper[1], Jiangang Zhu[2], Wounjhang Park[1], Juliet Gopinath[1]; *[1]Univ. of Colorado Boulder, USA; [2]DeepSight Technologies, USA.* We present a new technique to enhance the Sagnac effect in an optical gyroscope. We demonstrate the smallest (200 μm) optical gyroscope to date, with area-normalized performance matching or exceeding the best reported values.

FTh1D.3 • 08:45
High-Resolution Multispecies Analysis Using Mid-IR Dual-Comb Spectroscopy *via* Difference Frequency Generation, Syed T. Ahmad[1], Zhenhai Wang[1], Ali khazraji[1], Luca Moretti[2], Mathieu Walsh[3], Daivde Gatti[2], Jerome Genest[3], Marco Marangoni[2], Aamir Farooq[1]; *[1]Physical Science Engineering, King Abdullah Univ. of Science and technology, Saudi Arabia; [2]Dipartimento di Fisica, Politecnico di Milano, Italy; [3]3Centre d'optique, photonique et laser, Université Laval, Canada.* We demonstrate a broadband Mid-IR dual-comb spectrometer for high-resolution detection of greenhouse gases (CH_4, N_2O, C_2H_4) across 8 – 10 μm. Spectral matching with HITRAN parameters enables precise monitoring, offering strong potential for environmental and industrial applications

08:00 -- 09:00
Room 1D
FTh1E • Structured Light I
Presider: Presider to be Announced

FTh1E.1 • 08:00
Spatio-temporal Optical Vortices: Mode-entanglement and Fractional Transverse OAM, Hsiao-Chih Huang[1], Kefu Mu[1], Hui M. Leung[1], Chen-Ting Liao[1]; *[1]IU Bloomington, USA.* We introduce and present results on a new family of structured light in spatio-temporal optical vortices that have non-separable, mode-entangled transverse orbital angular momentum (t-OAM) and polarization. Additionally, we present experimental methodologies and results on the arithmetic of integer and fractional t-OAM.

FTh1E.2 • 08:15
Orbitalization properties of optical beams, Glenn Ochsner[1,2], Sushil Pokharel[1], Jyrki Laatikainen[1], Olga Korotkova[1]; *[1]Univ. of Miami, USA; [2]Miami Univ., USA.* A recently introduced orbitalization ellipse characterizing geometrical features of superpositions of several orbital angular momentum states is extended to electromagnetic and partially coherent beams.

FTh1E.3 • 08:30
Optical vortex wavefront sensor, Aleksandra K. Korzeniewska[2], Magdalena Lukowicz[2], Kamil Kalinowski[2], Rosario Porras-Aguilar[1], Mateusz Szatkowski[2]; *[1]The Univ. of North Carolina at Charlotte, USA; [2]Department of Optics and Photonics, Wroclaw Univ. of Sci and Tech, Poland.* We present a wavefront sensor based on Shack-Hartmann principles, in which we introduce phase singularities to improve the spot localization algorithm, especially in noisy environments.

FTh1E.4 • 08:45

Engineering correlations with a spatially structured quantum eraser, Bereneice C. Sephton[1], Carlo Schiano[1], Lorenzo Marrucci[1], Corrado de Lisio[1], Vincenzo D'Ambrosio[1]; *[1]Univ degli Studi di Napoli Federico II, Italy.* Quantum interference is a resource for many quantum tasks, from computation to communication. We show that spatially structuring overlapping photons and exploiting which-way information can create a quantum eraser which sculpts correlations between the outputs.

08:00 -- 09:00
Room 1E
LTh1F • Strong Fields and High-order Harmonic Generations
Presider: Shambhu Ghimire; SLAC National Accelerator Laboratory, USA

LTh1F.1 • 08:00 (Invited)
Quantum Interference in Ultrafast Photoelectron Holography and Strong-Field Nonsequential Double Ionization, Carla Figueira de Morisson Faria[1]; *[1]Univ. College London, UK.* We study quantum interference in attosecond photoelectron holography and nonsequential double ionization, tracing holographic structures to quantum pathways, and identifying interference building blocks in arbitrary fields. NSDI interference is robust and controllable via field shaping.

LTh1F.2 • 08:30
Few-cycle visible source for efficient high-order harmonic generation near 100 eV, Tran-Chau Truong[1], Aria Christensen[1], Chelsea Kincaid[1], Merlin Hart[1], Christian Zupan[1], Alexandra Landsman[1], Michael Chini[1]; *[1]Ohio State Univ., USA.* We demonstrate a few-cycle laser source centered at 515 nm for generating efficient high-order harmonics near 100 eV. The source is achieved by frequency-doubling a high-repetition-rate Yb-based laser, followed by spectral broadening and chirped-mirror compression.

LTh1F.3 • 08:45
Electric-Field-Induced Enhancement of Excitonic Third Harmonic Generation, Ruixin Zuo[1], Matthias Reichelt[1], Cong Ngo[1], Xiaohong Song[2], Torsten Meier[1]; *[1]Universität Paderborn, Germany; [2]Hainan Univ., China.* Static electric fields lead to Stark shifts and ionization of excitons. For a bilayer of MoS_2 we demonstrate that electric fields of intermediate strength can significantly increase excitonic third harmonic generation before ionization dominates.

09:15 -- 10:00
Room 2A
FTh2A • FiO Visionary Session IV: Space Optics
Presider: Zachary Lapin, USA

FTh2A.1 • 09:15 (Visionary)
Beyond the Horizon: Cutting-Edge Innovations in Space-Based Optics and Optical Systems, Becky Borrelli[1]; *[1]L3Harris Technologies, USA.* This talk explores advancements in optical systems for space applications, covering topics such as additive manufacturing of metals and glass, composite optics, mirror replication, and cutting-edge on-orbit wavefront sensing and control for assured system performance.

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09:15 -- 10:00
Room 3B
LTh2B • Laser Science Visionary III
Presider: Yuki Kobayashi; Univ. of Michigan, USA

LTh2B.1 • 09:15 (Visionary)
High Harmonic Generation as a Probe of Condensed Phase Systems: From Solids to Liquids, Mette B. Gaarde[1]; [1]*Louisiana State Univ., USA.* High-harmonic generation (HHG) can be an exquisite spectroscopic probe of both structure and dynamics in condensed-phase systems, with a sub-femtosecond time-resolution matching the natural time scale of electrons. I will discuss recent progress in HHG spectroscopy in crystalline solids, and provide an outlook on its sensitivity to local structure and dynamics in liquids.

10:30 -- 11:30
Room 2A
FTh3A • Space Optics Theme: Advanced Space Optics
Presider: Kristian Damkjer; NUVIEW, Inc., USA

FTh3A.1 • 10:30 (Invited)
Design of Next-Gen Optics for Space & Defense Missions, Katherine T. Fountaine[1]; [1]*Northrop Grumman Corp, USA.* This talk covers several research projects in the field of next-generation optics for space applications, including imaging, communications and emissivity engineering. Unique challenges for space-specific applications will be discussed including c-SWAP and space qualification.

FTh3A.2 • 11:00 (Invited)
Advancing Photonic Resilience and Precision Navigation for Space, Yves Deiss[1]; [1]*Exail, USA.* Exail presents radiation-resistant fibers, spatialized electro-optic modulators, and micro-optic assemblies, alongside the qualification of a compact 3-axis fiber optic gyroscope enabling robust, high-performance photonic systems for space.

10:30 -- 12:30
Room 1A
FTh3B • Measurement Techniques and Micro and Nano Technology
Presider: Kate Medicus; Ruda Optical Inc., USA

FTh3B.1 • 10:30 (Invited)
Computational 3D Sensing and Imaging through Scattering Media with Synthetic Waves, Florian Willomitzer[1]; [1]*Coll of Opt Sciences, Univ. of Arizona, USA.* This talk introduces novel techniques that leverage synthetic waves—beat waves generated by optical fields at closely spaced wavelengths—for computational imaging. Specifically, these methods enable

precise 3D measurement on optically rough surfaces, imaging through scattering media such as biological tissue, and visualization of light-in-flight pulses propagating through a scene at light speed,

FTh3B.2 • 11:00
Membrane Motion in an Interferometer for Precise Measurement of Material Parameters, David W. Alexander[1], Christopher M. Lacny[1], Kevin J. Webb[1]; *[1]Purdue Univ., USA.* Material characterization based on relative motion within an interferometer's structured field is demonstrated, with precise extraction of the refractive index and thickness of a thin membrane from experimental data, presenting opportunities beyond conventional ellipsometry.

FTh3B.3 • 11:15
Holographic VOC Sensors Enabled by MOF Nanoparticles Functionalization, Aleksandra Hernik[1,2], Masaya Sugihara[2,1], Ajay Padunnappattu[3], Liam Tubridy[1], Norbert Stock[3], Rob Ameloot[2], Izabela Naydenova[1]; *[1]Centre for Industrial & Engineering Optics, Technological Univ. Dublin, Ireland; [2]Centre for Membrane Separations, Adsorption, Catalysis, and Spectroscopy, KU Leuven, Belgium; [3]Inst. of Inorganic Chemistry, Kiel Univ., Germany.* We investigated various fabrication strategies to integrate porous metal–organic framework nanoparticles into holographic diffraction gratings. The resulting optical sensors achieved sub-ppm sensitivity to toxic organic vapors via adsorption-induced refractive index changes.

FTh3B.4 • 11:30
Ultrafast High-Resolution QPI LiDAR Using Dissipative Soliton Mode-Locked Laser, Qingyang Zhu[1], Yi Hao[1], Xuanyi Liu[1], Shichen Zheng[1], Annan Xia[1], Hong Ye[1], Qian Li[2], H. Y. Fu[1]; *[1]Tsinghua Univ., China; [2]Peking Univ., China.* A quantitative phase imaging LiDAR is proposed using a custom-built fiber laser. Spatial information is encoded into the spectrum by spectral scanning and time-stretching technology, achieving a 30.72-MHz line-scan rate and a <125-µm lateral resolution.

FTh3B.5 • 11:45
Effect of Different Detection Planes in Time-Averaging Interferometric Vibrometry Considering the Object Surface Properties, Florian Dötzer[1], Marie Mannagottera[1], Stefan Sinzinger[1]; *[1]Technische Universität Ilmenau, Germany.* For demanding interferometric measurements such as time-averaging vibrometry in the picometer-regime, the detector should be illuminated as homogeneously as possible. We discuss detection in the image- and Fourier-plane considering properties of the object surface.

FTh3B.6 • 12:00
Design Exploration Tools for Metasurface Categorization, Comparison, Simulation, and Evaluation, Matthew M. Ferguson[1], Ao Sun[1], Daniel K. Nikolov[1], Nick Vamivakas[1], Jannick P. Rolland[1]; *[1]Univ. of Rochester, USA.* Metasurfaces have a high entry barrier due to their complex physical mechanisms. We present simulation and categorization tools that lower this barrier, enabling the exploration and control of metasurface behavior for tailored optical performance.

FTh3B.7 • 12:15
Fabrication and Characterization of Individually Addressable Electrowetting Microprism Arrays, Mahima Rana[1], Samuel D. Gilinsky[2], Eduardo J. Miscles[1], Darwin Quiroz[3], Mo Zohrabi[2],

Alexander Hedrick[1], Kaushik Jayaram[1], Sanjeev J. Koppal[4], Juliet Gopinath[2,3], Victor M. Bright[1]; *[1]Department of Mechanical Engineering, Univ. of Colorado Boulder, USA; [2]Department of Electrical, Computer and Energy Engineering, Univ. of Colorado Boulder, USA; [3]Department of Physics, Univ. of Colorado Boulder, USA; [4]Department of Electrical and Computer Engineering, Univ. of Florida, USA.* We demonstrate a sub-millimeter-scale electrowetting prism array with individually addressable conical cavities fabricated using standard 2D lithography. The device achieves symmetric ~ ±8° beam steering through voltage-induced meniscus tilt in a compact transmissive platform.

10:30 -- 12:30
Room 1B
FTh3C • Ultrafast Photonics
Presider: Bienvenu Ndagano; INRS-Energie Mat & Tele Site Varennes, Canada

FTh3C.1 • 10:30 (Invited)
Programmable Photonic Quantum Crcuits with Ultrafast Time-bin Encoding, Frederic Bouchard[1]; *[1]National Research Council Canada, Canada.* We experimentally investigate the feasibility of time-bin states of light at the picosecond timescale, known as ultrafast time-bin encoding, for applications in quantum information processing.

FTh3C.2 • 11:00
Demonstration of THz-bandwidth all-optical quantum teleportation towards ultra-fast optical quantum computation, Takumi Suzuki[1], Takaya Hoshi[1], Akito Kawasaki[1,2], Shotaro Oki[1], Konhi Ichii[1], Hironari Nagayoshi[1], Kazuma Takahashi[1], Takahiro Kashiwazaki[3], Taichi Yamashima[3], Asuka Inoue[3], Takeshi Umeki[3], Tatsuki Sonoyama[1,2], Kan Takase[1,2], Warit Asavanant[1,2], Mamoru Endo[1,2], Akira Furusawa[1,2]; *[1]Univ. of Tokyo, Japan; [2]OptQC Corp., Japan; [3]NTT Device Technology labs, Japan.* We demonstrated all-optical quantum teleportation over 2 THz bandwidth using waveguide optical parametric amplifiers, achieving a fidelity of F=0.80--- a result beyond the classical limit. This 10 000-fold bandwidth improvement is a major step toward THz-clock optical quantum computers.

FTh3C.3 • 11:15
High-speed High-efficiency All-optical Switching in Rubidium Vapour, Georgia Booton[1], Cameron McGarry[2], Tabijah Wasawo[1], William Davis[3], Kristina Rusimova[1], Alex Davis[1], Josh Nunn[4], Peter Mosley[1]; *[1]Univ. of Bath, UK; [2]Univ. of Sydney, Australia; [3]Macquarie Univ., Australia; [4]ORCA computing, UK.* Scalable photonic quantum platforms require a fast, low-loss switch to re-route photons whilst preserving their quantum state. We show light-matter interactions can deliver all-optical high-bandwidth switching with minimal loss in warm rubidium vapour.

FTh3C.4 • 11:30
Generation of One-Dimensional Cluster States enabling 25-GHz-Clock Quantum Computation, Takaya Hoshi[1], Konhi Ichii[1], Dohoon Lim[1], Takumi Suzuki[1], Akito Kawasaki[1,3], Ryuhoh Ide[1], Atsushi Sakaguchi[2], Shota Yokoyama[2], Takahiro Kashiwazaki[4], Taichi Yamashima[4], Asuka Inoue[4], Takeshi Umeki[4], Warit Asavanant[1,3], Mamoru Endo[1,2], Akira Furusawa[1,3]; *[1]The Univ. of Tokyo, Japan; [2]RIKEN Center for Quantum Computing, Japan; [3]OptQC Corp., Japan; [4]NTT Device Technology Labs, Japan.* We generate one-

dimensional cluster states with temporal-mode durations of 40 ps across over one million qumodes, which enables high-speed and large-scale optical quantum computation.

FTh3C.5 • 11:45
Automated Quantification of Error Sources in Quantum State Tomography of Time-bin Entangled Photons, Junpei Oba[1], Hsin-Pin Lo[2], Yasuhiro Yamada[2], Takayuki Matsui[1], Takuya Ikuta[2], Yuya Yonezu[2], Toshimori Honjo[2], Seiji Kajita[1], Hiroki Takesue[2]; *[1]Toyota Central R&D Labs., Inc., Japan; [2]NTT Basic Research Laboratories, NTT Corporation, Japan.* We present a model-based framework that quantifies error sources by optimizing model parameters to reproduce an experimental density matrix, successfully attributing 87% errors in the experiment of the time-bin entangled photon-pair generation.

FTh3C.6 • 12:00
Long-Range Transmission of Cluster States over 25 km of Optical Single-Mode Fiber via Multi-Level Time-Bin Encoding, Robert Johanning[1,2], Philip Rübeling[1], Jan Heine[1], Oleksandr V. Marchukov[1], Michael Kues[1,2]; *[1]Inst. of Photonics, Germany; [2]Cluster of Excellence PhoenixD, Germany.* We demonstrate the transmission of a cluster state over 25 km fiber using multi-level time-bin encoding and chirped pulse modulation. Our work paves the way to multipartite entangled long-distance quantum networking and distributed photonic computing.

FTh3C.7 • 12:15
Comparative Study on Evolution of Gaussian, Super-Gaussian, and Sech Optical Pulses in Nonlinear Fibers, Abhisek Roy[1], PARTHA ROY CHAUDHURI[1]; *[1]Indian Inst. of Technology Kharagpur, India.* This study investigates the nonlinear propagation of Gaussian, super-Gaussian, and hyperbolic secant pulses in optical fibers using the generalized Nonlinear Schrödinger Equation, revealing pulse-shape-dependent dispersion, distortion, and soliton suitability for advanced photonic applications.

10:30 -- 12:30
Room 1C
FTh3D • Image Acquisition, Optical Processing and Displays
Presider: Prathan Buranasiri; King Mongkut's Inst. of Tech. Ladkrabang, Thailand

FTh3D.1 • 10:30 (Invited)
Parallel Recording Technique for Quantitative Phase Imaging of Dynamic Object, Yasuhiro Awatsuji[1], Sudheesh K. Rajput[1], Tomoyoshi Inoue[1], Kenzo Nishio[1], Hou Natsu[2], Manoj Kumar[3], Osamu Matoba[4]; *[1]Kyoto Inst. of Technology, Japan; [2]National Inst. of Advanced Industrial Science and Technology, Japan; [3]Amity Univ. Punjab, India; [4]Kobe Univ., Japan.* The authors review two parallel techniques for recording complex amplitude images of objects: parallel phase-shifting digital holography and parallel transport of intensity equation. High-speed quantitative phase-imaging is demonstrated by each technique.

FTh3D.2 • 11:00
Motion-Based Subwavelength Field Imaging Through a Heavily Scattering Random Medium, Rohan E. Sheridan[1], Christopher M. Lacny[1], Kevin J. Webb[1]; *[1]Purdue Univ., USA.* A method for subwavelength imaging through a heavily scattering random medium based on relative motion is presented, along with a theory and supporting simulations, and the achievable

resolution is determined.

FTh3D.3 • 11:15
Universal 3D PSF Engineering with Diffractive Optical Processors, Md Sadman Sakib Rahman[1], Aydogan Ozcan[1]; [1]*Univ. of California Los Angeles, USA.* We demonstrate universal 3D point spread function engineering using diffractive optical processors, enabling snapshot multispectral 3D imaging without mechanical scanning, spectral filtering, or digital postprocessing.

FTh3D.4 • 11:30 (Invited)
Enhanced Imaging by Using Light Polarization, Tigran Galstian[1]; [1]*PATQER, Canada.* Abstract not available.

FTh3D.5 • 12:00
High Speed Biaxial Piezoelectric MEMS Micromirror with Varifocal Tunability, Hunter S. Shillingburg[1], Daniel Lopez[1,2]; [1]*Electrical Engineering and Computer Science, Pennsylvania State Univ., USA;* [2]*Microsystems and Nanotechnology Division, National Inst. of Standards and Technology, USA.* As demand surges for miniaturized optical systems capable of three-dimensional imaging, MEMS laser scanners have started gaining momentum. We demonstrate a single, high-speed micromirror scanner capable of changing its focal point within 15µs.

FTh3D.6 • 12:15
Assessment of Phase Reconstruction of Point Cloud-based Computer-generated Holograms via Transport of Intensity, Feiyang Luo[1], Saleha Qissi[2], Partha P. Banerjee[1]; [1]*Univ. of Dayton, USA;* [2]*Department of Physics, Univ. of Bisha, Saudi Arabia.* We discuss a regularized transport of intensity method applicable to fast and accurate reconstruction of point-cloud and layer-based computer-generated holograms for augmented reality applications.

10:30 -- 12:30
Room 1D
FTh3E • Structured Light II
Presider: Bienvenu Ndagano; INRS-Energie Mat & Tele Site Varennes, Canada

FTh3E.1 • 10:30 (Invited)
Structured Light in Waveguide-based Hamiltonian Simulators, Christina I. Jörg[1], Max Weber[1], Julian Schulz[1], Ian Heil[1], Georg von Freymann[1]; [1]*RPTU Kaiserslautern-Landau, Germany.* We explore 3D micro-printed waveguide arrays for quantum simulation using higher modes and orbital angular momentum. This approach enables switchable artificial gauge fields and more accurate modeling of complex condensed matter phenomena beyond single-mode systems.

FTh3E.2 • 11:00 (Invited)
Efficient Bi-Photon State Characterisation and Its Applications in Quantum Technologies, Ebrahim Karimi[1]; [1]*Univ. of Ottawa, Canada.* High-dimensional photonic entangled states are key resources for advancing quantum imaging, quantum sensing, secure communication, and quantum computation. The most common method for generating such states is spontaneous parametric down-conversion (SPDC), in which a pump photon splits into

two daughter photons that share correlations across multiple photonic degrees of freedom. Characterising these high-dimensional states, however, is highly challenging, as it scales quadratically with the state dimensionality and usually requires large sets of projective measurements within the framework of positive operator-valued measures (POVMs).

FTh3E.3 • 11:30
Turbulence- and Scattering-Resilient Polarization-Based Underwater Ranging Using Stokes Polarimetry and Different Longitudinal Wavenumbers, Yingning Wang[1], Cade R. Peters[2], Heng Wu[1], Yuxiang Duan[1], Huibin Zhou[1], Zixun Zhao[1], Yue Zuo[1], Zile Jiang[1], Robert Bock[4], Moshe Tur[3], Andrew Forbes[2], Alan Willner[1]; *[1]Univ. of Southern California, USA; [2]School of Physics, Univ. of the Witwatersrand, South Africa; [3]School of Electrical Engineering, Tel Aviv Univ., Israel; [4]R DEX Systems, Inc., USA.* We experimentally demonstrate scattering and turbulence resilient optical ranging by leveraging structured light and polarization, achieving < 20-mm average ranging errors over 0.4-meters in scattering and turbulent water (γ = 1.6 m^{-1} and D/r_0 = 2.6).

FTh3E.4 • 11:45
Accurate Underwater Optical Ranging with Simultaneous Coarse and Fine Techniques that Utilize Two Counter-Rotating Spatial Petals, Heng Wu[1], Yingning Wang[1], Cade R. Peters[2], Yuxiang Duan[1], Huibin Zhou[1], Zile Jiang[1], Zixun Zhao[1], Yue Zuo[1], Hongkun Lian[1], Ruoyu Zeng[1], Robert Bock[3], Andrew Forbes[2], Moshe Tur[4], Alan Willner[1]; *[1]Univ. of Southern California, USA; [2]Univ. of the Witwatersrand, South Africa; [3]R-DEX Systems, Inc, USA; [4]Tel Aviv Univ., Israel.* We demonstrate simultaneous coarse and fine underwater optical ranging over 0-0.4 m, with a structured beam combining two counter-rotating petal sets. Average errors of 4.5 mm and 7.1 mm are achieved in clear water and scattering water ($\gamma \sim 6\ m^{-1}$), respectively.

FTh3E.5 • 12:00
Four-dimensional topological charge vectors in quasi-lattices of light, Shai Tsesses[1,2], Pascal Dreher[3], David Janoschka[3], Alexander Neuhaus[3], Kobi Cohen[2], Tim Meiler[4,5], Tomer Bucher[2], Shay Sapir[2,6], Bettina Frank[4], Timothy J. Davis[3,4], Frank Meyer zu Heringdorf[3], Harald Giessen[4], Guy Bartal[2]; *[1]Massachusetts Inst. of Technology, USA; [2]Technion - Israel Inst. of Technology, Israel; [3]Univ. of Duisburg-Essen, Germany; [4]Univ. of Stuttgart, Germany; [5]Nanyang Technical Univ., Singapore; [6]Weizmann Inst., Israel.* We demonstrate four-dimensional conserved topological charges in pentagonal plasmonic quasi-lattices. Consolidating phase-resolved SNOM and ultrafast 2PPE-PEEM measurements, we reveal connections between the time dynamics of the quasi-lattices to the free energy of quasicrystals.

FTh3E.6 • 12:15
Structured Randomness: rotating speckles through propagation, Pau Riera Rodriguez[1], Rafael Piestun[1]; *[1]Univ. of Colorado Boulder, USA.* We propose a method to engineer speckle patterns with propagation order via a tailored superposition of Laguerre-Gaussian (LG) modes with random complex coefficients. The tailored speckle patterns exhibit rotating and self-imaging properties.

10:30 -- 12:30
Room 1E

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Session Guide

Disclaimer: this guide is limited to technical program with abstracts and author blocks as of 22 October. For updated and complete information with special events, reference the online schedule or mobile app.

LTh3F • Ultrafast Science and Technology

Presider: Yuki Kobayashi; Univ. of Michigan, USA

LTh3F.1 • 10:30 (Invited)
Advanced Ultrafast Probes of Quantum Materials – from THz to X-rays, Robert A. Kaindl[1]; [1]*Arizona State Univ., USA.* Recent advancements in ultrashort THz, electron, and X-ray sources enable new perspectives on non-equilibrium physics. I will discuss the development of advanced ultrafast probes and their application to capturing transient symmetry-broken phases in quantum materials.

LTh3F.2 • 11:00
Photoinjector Drive Laser System for LCLS-II, Hao Zhang[1,2], Sasha Gilevich[2], Alan Miahnahri[2], Shawn Alverson[2], Axel Brachmann[2], Joseph Duris[2], Paris Franz[2], Alan Fry[2], Jack Hirschman[2], Kirk A. Larsen[2], Randy Lemons[2], Siqi Li[2], Brittany Lu[1], Agostino Marinelli[2], Mikael Martinez[2], Justin May[2], Erel Milshtein[2], Krishna Murari[2], Nicole Neveu[2], Joseph Robinson[2], John Schmerge[2], Theodore Vecchione[2], Chengcheng Xu[2], Feng Zhou[2], Sergio Carbajo[1,2]; [1]*Univ. of California, Los Angeles, USA;* [2]*SLAC National Accelerator Laboratory, USA.* We provide a detailed account of the design and implementation of the LCLS-II photoinjector laser system, highlighting its major subsystems and innovations that enable the generation of high-energy, high-quality X-ray pulses on the attosecond timescale, crucial for advancing X-ray Free Electron Laser (XFEL) research.

LTh3F.3 • 11:15
Characterizing few-cycle ultraviolet resonant dispersive waves through direct field sampling, Kirk A. Larsen[1], Christopher Lantigua[2], Chelsea Kincaid[3], Felix Allum[1], Mathew Britton[1], José Godínez Castellanos[4], Brian Kaufman[1], Marcel Neuhaus[1], François Sylla[5], Kyung Taec Kim[6], Stephen Bradforth[4], Matthias Kling[1], Joseph Robinson[1], Christian Brahms[7], John Travers[7], Michael Chini[3], Matthew Bain[1], Ruaridh Forbes[8]; [1]*SLAC National Accelerator Laboratory, USA;* [2]*Univ. of Central Florida, USA;* [3]*The Ohio State Univ., USA;* [4]*Univ. of Southern California, USA;* [5]*SourceLAB, France;* [6]*Gwangju Inst. of Science and Technology, Korea (the Republic of);* [7]*Heriot-Watt Univ., UK;* [8]*Univ. of California, Davis, USA.* We demonstrate compression of few-cycle ultraviolet resonant dispersive waves to 6.9 fs at 390 nm generated in a cascaded hollow capillary fiber system. Temporal characterization is performed using both direct optical field sampling and self-diffraction FROG.

LTh3F.4 • 11:30 (Invited)
Petahertz Switching of Currents in Nanoscale Materials, Matthias F. Kling[1,2]; [1]*Stanford PULSE Inst., Stanford Univ., USA;* [2]*LCLS, SLAC National Accelerator Laboratory, USA.* Advancements in petahertz electronics are facilitated by the manipulation of solid-state responses to intense light fields. I will highlight recent results on controlled currents in nanoscale materials, and the implementation of a lightwave-driven Haldane model in two-dimensional materials. Additionally, I will discuss how relevant dynamics in quantum and topological materials can be probed with X-ray free electron lasers.

LTh3F.5 • 12:00
Passive Coherent Combining for Energy-Scaled Pulse Compression in Multipass Cells, Nayla E. Jimenez De la vega[1,2], Marcus Seidel[1,2], Victor Hariton[1], Henrik Tünnermann[1], Ingmar Hartl[1], Hüseyin Çankaya[1]; [1]*Deutsches Elektronen Synchrotron, Germany;* [2]*Helmholtz-*

Institut Jena, Germany. A proof-of-concept demonstration of divided pulse spectral broadening in a multipass cell with common-path Mach-Zehnder-interferometers is reported. The used virtually dispersion-free, flexible delay lines offer unique peak power scaling potential in nonlinear pulse compression.

LTh3F.6 • 12:15
Quantum Trajectory Selector: Clocking Attosecond Dynamics Within Recollision Physics, Ann-Kathrin Raab[1], Allison Lucas[1], Yaguo Tang[1], Andrew Piper[1], Qiaoyi Liu[1], Abraham Camacho Garibay[1], Dietrich Kiesewetter[1], Vyacheslav Leshchenko[1], Jens Bækhøj[2], Pierre Agostini[1], Kenneth Schafer[2], Louis DiMauro[1]; *[1]Department of Physics, The Ohio State Univ., USA; [2]Department of Physics & Astronomy, Louisiana State Univ., USA.* To investigate re-collision dynamics we launch an electron along a specific quantum trajectory by combining an attosecond extreme ultraviolet pulse with a phase-locked, strong infrared field.

09:00 -- 10:30
JD1A • Virtual Poster Session

JD1A.1
Label-Free Analysis of Epithelial Cells Using a Custom-built Digital Holographic Microscope and Convolutional Neural Networks, Juan M. Llaguno[1], Rémi Liaigre[2], Miguel Arocena[1], Federico Lecumberry[1], Julia R. Alonso[1]; *[1]Universidad de la Republica, Uruguay; [2]Ecole Nationale Supérieure d'Ingénieurs du Mans, France.* We present a custom-built, 3D-printed digital holographic microscope for label-free phase imaging of epithelial cells. Using an off-the-shelf CNN-based segmentation pipeline, we are able to quantify morphological and biophysical parameters of the cells.

JD1A.2
1D Barcode Recognition Using ToF Camera and YOLOv8, Nazish Imam[1], Dongzhao Yang[1], Jianhao Li[1], Jiaonan Zhang[1], Zhongqi Pan[2], Yang Yue[1]; *[1]Xi'an Jiaotong Univ., China; [2]Department of Electrical & Computer Engineering, Univ. of Louisiana at Lafayette, Lafayette, LA 70504, USA, USA.* A ToF-camera-based 1D barcode recognition method is proposed, incorporating YOLOv8 and adaptive infrared image enhancement module. It achieves an average decoding accuracy of 93.15%, and significantly outperforms traditional computer vision methods under low-light conditions..

JD1A.3
Label-Free RI-based Early Detection of Chikungunya Virus Using SPR Sensor, Kamini Kumari[1], palak NA[1], Rajeev Kumar[1], Lokendra Singh[1]; *[1]Graphic Era (Deemed to be Univ.), India.* SPR sensors can provide label-free and early detection of Chikungunya virus. The silver, Yttrium Lithium Fluoride, and Zirconium nitride-coated CsF prism sensor yields a sensitivity of 360.61 °/RIU at the R_{min} value

JD1A.4
Optimized Surface Plasmon Resonance Biosensor utilizing 2D Material for Enhanced Malaria Detection, Md Al Amin I. Utshob[1], Maymona B. Juwel[1], Rawfarin Sabiha[1], Khandakar

Mohammad Ishtiak[1]; *[1]Ahsanullah Univ. of Science & Tech, Bangladesh.* We propose a highly sensitive surface plasmon resonance (SPR)-based biosensor utilizing 2D materials for malaria detection and benchmark its performance against existing studies.

JD1A.5
Design and Performance Analysis of a Highly Sensitive SPR Biosensor for Water Pollution Detection, Mohammed A. Alavee[1], Kazi T. Tanzid[1], Md. Asibur R. Bappy[1], Riyaj A. Siyam[1], Khandakar Mohammad Ishtiak[1]; *[1]Ahsanullah Univ. of Science & Tech, Bangladesh.* The proposed surface plasmon resonance biosensor is highly sensitive and exhibits lower reflectance in detecting different types of water pollution caused by chemicals, wastes, or any other impurities, enabling accurate evaluation of water quality.

JD1A.6
Surface Hardness of WC/NiCrBSiC Clad Layer using Laser-Induced Breakdown Spectroscopy, Samar R. AlSayed Ali[1], Doaa Youssef[1]; *[1]Laser Inst. (NILES) Cairo Univ., Egypt.* This study investigated surface hardness as a principal factor in determining the mechanical properties of Ti64 titanium alloys using Laser-Induced Breakdown Spectroscopy, providing a rapid, non-destructive alternative to conventional hardness measurement methods.

JD1A.7
VQ-VAE Encoding of Complex Holograms, Shima Rafiei[1]; *[1]McMaster Univ., Canada.* We show that VQ-VAE2 effectively encodes complex-valued holograms. Trained on the diverse \textit{InterfereI} dataset, it enables high-fidelity encoding and compression for efficient storage, supporting immersive AR/VR display applications.

JD1A.8
Micro-Expression Recognition Using Active 3D Time-of-Flight Imaging, Jiaonan Zhang[1], Xinyue Wang[1], Yiwen Zhang[2], Tianxu Xu[5], ZhiLin Zhang[1], Qiang Wang[3], Zhongqi Pan[4], Yang Yue[1]; *[1]Xi'an Jiaotong Univ., China; [2]Drilling & Production Technology Research Inst., Chuanqing Drilling Engineering Company Limited, China; [3]Angle AI (Tianjin) Technology co. LTD, China; [4]Department of Electrical & Computer Engineering, Univ. of Louisiana at Lafayette, USA; [5]Zhengzhou Univ., School of Electrical and Information Engineering, National Center for International Joint Research of Electronic Materials and Systems, China.* An end-to-end spatio-temporal joint model is proposed, combined with TBME dataset collected by an active 3D Time-of-Flight (ToF) camera. This method offers enhanced robustness to illumination variations and can effectively handle complex emotional dynamics.

JD1A.9
Tile-Based HER2+ Breast Cancer Classification Using Feature-Enriched Ensemble Learning, Adarsh P. Nayak[2], Kausalya N. Makkithaya[1], Gagan Raju[1], Nirmal Mazumder[1]; *[1]Department of Biophysics, Manipal School of Life Sciences, Manipal Academy of Higher Education, India; [2]School of Computer Engineering, Manipal Inst. of Technology, India.* Feature-based classification of HER2 status in breast cancer is explored using histopathology tiles. The proposed pipeline utilizes ensemble learning on extracted features, offering an interpretable alternative to deep learning in computational pathology workflows.

JD1A.10

Low-Cost Smartphone-Based Optical Imaging Device with Electroluminescence Illumination for Advancing Tele-Pathology, Vyasraj G. Bhat[1], MANIKANTH KARNATI[1], Vibha Kamath[1], Soumyabrata Banik[2], Nirmal Mazumder[1]; *[1]Manipal Academy of Higher Education, India; [2]School of Physics and Astronomy, Univ. of St Andrews, UK.* High-resolution imaging is vital for diagnostics, but traditional methods are costly and limited in low-resource areas. Smartphone advancements offer a portable, affordable solution, enabling point-of-care diagnostics and improving global healthcare access.

JD1A.11
Quantitative texture analysis and classification of two-photon microscopy images of prostate cancer tissue, Kausalya N. Makkithaya[1], Gagan Raju[1], Guan-Yu Zhuo[2], Nirmal Mazumder[1]; *[1]Department of Biophysics, Manipal School of Life Sciences, Manipal Academy of Higher Education, India; [2]Inst. of Biophotonics, National Yang Ming Chiao Tung Univ., Taiwan.* This study employs two-photon microscopy to investigate subtle differences between healthy and cancerous prostate tissue. Analysis of textural features from two-photon microscopy images demonstrates a robust, method to enhance the accuracy of prostate cancer diagnosis.

JD1A.12
Biophysical Evaluation of Anthocyanin-Based Bioplastics in Wound Healing *via* In Vivo Imaging, Shreya Shahapur[1], MANIKANTH KARNATI[1], Gagan Raju[1], Nirmal Mazumder[1]; *[1]Manipal Academy of Higher Education, India.* Anthocyanin-infused starch bioplastics from red cabbage showed strong antioxidant, pH-responsive, and wound-healing properties, with enhanced tissue regeneration, biodegradability, and real-time monitoring potential, offering a sustainable solution for advanced wound care.

JD1A.13
Characterization of selected Millet cultivars using Raman Spectroscopy, Sanjana Gupta[1], Hemanth Noothalapati[2], Sarwar Hossain[2], Nirmal Mazumder[1]; *[1]Department of Biophysics, Manipal School of Life Sciences, Manipal Academy of Higher Education, Manipal, Karnataka 576104, India, India; [2]Faculty of Life and Environmental Sciences, Shimane Univ., Matsue 690-8504, Japan, Japan.* Raman spectroscopy evaluated millet rice flour and millet starch with 785 nm and 532 nm excitations. Results showed that millet starch had higher crystallinity and purity, highlighting the utility of Raman spectroscopy in food analysis.

JD1A.14
An Autofluorescence -Based Biosensor for Non-Invasive and Cost-Effective Bilirubin Detection in Neonates, Maryam A. Ajees[1], Pawas Kumar[1], Vyasraj G. Bhat[1], Vibha Kamath[1], Gagan Raju[1], Nirmal Mazumder[1]; *[1]Department of Biophysics, India.* Autofluorescence-based detection of bilirubin plays a significant role in non-invasive neonatal diagnostics. In the current study, an optical biosensor is being developed and calibrated for bilirubin quantification using blue-light excitation and fluorescence intensity analysis

JD1A.15
Spectrophotometric Evaluation of Edible Mustard Oil for Photooxidation Analysis., Edwin Pious[1], Shravan Kumar[1], Gagan Raju[1], Manikanth Karnati[1], Nirmal Mazumder[1]; *[1]Department of Biophysics, Manipal School of Life Scienes, Manipal Academy of HIgher Education, India.* This study employs fluorescence and UV-Vis spectroscopy to monitor early photooxidative changes in mustard oils under light and dark circumstances, revealing oxidation-related spectrum

changes and the methods' sensitivity for early detection.

JD1A.16
Polarized Second Harmonic Generation (P-SHG) Imaging of Starch Samples from different Botanical Origins, Bhoomika R. Hande[1], Nandana B[1], Gagan Raju[1], Guan-Yu Zhuo[2], Nirmal Mazumder[1]; *[1]Department of Biophysics, Manipal Academy of Higher Education, India; [2]Inst. of Biophotonics, National Yang Ming Chaio Tung Univ., Taiwan.* We used polarization-resolved second-harmonic microscopy to study starch from different sources-potato, rice, and millet. The images revealed considerable differences in the granule shape, size, and molecular arrangement of crystalline-amorphous region based on botanical origin.

JD1A.17
Characterization of Citric Acid Crosslinked Starch Elastomers Reinforced with Silicon Dioxide Using Raman Spectroscopy, Marnin R. Vas[1], Pooja N[1], Hemanth Noothalapati[2], Sarwar Hossain[2], Nirmal Mazumder[1]; *[1]Department of Biophysics, Manipal School of Life Sciences, Manipal Academy of Higher Education, India; [2]Faculty of Life and Environmental Sciences, Shimane Univ., Japan.* Raman spectroscopy was used to characterize potato starch films crosslinked with citric acid and Silicon Dioxide. An excitation laser of 532nm was used, and the spectra displayed that the films were successfully modified.

JD1A.18
Non-Invasive Spectroscopic Techniques for the Photopigmentation Study in *Coleus scutellarioides*, Gargi M. Joshi[1], Swechha Mahapatra[1], Manikanth Karnati[1], Nirmal Mazumder[1]; *[1]Department of Biophysics, Manipal School of Life Sciences, Manipal Academy of Higher Education, India. Coleus scutellarioides* is a variegated plant whose leaves contain multiple, diverse photopigments. Non invasive optical spectroscopic techniques, particularly UV-Vis and fluorescence spectroscopy have been used to understand more about the composition and dynamics of these photopigments.

JD1A.19
Impact of Heat-Moisture Treatment on Millet Starch: A Spectroscopic and Microscopic Characterization, Anusha Thomas[1], Bhoomika R. Hande[1], Nandana B[1], MANIKANTH KARNATI[1], Nirmal Mazumder[1]; *[1]Department of Biophysics, Manipal Academy of Higher Education, India.* This study explores the effect of heat-moisture treatment (15–35% moisture) on millet starch, highlighting changes in molecular order and morphology using FTIR and SEM to assess structural reorganization across different treatment conditions.

JD1A.20
Polarization-Resolved SHG Microscopy-Based Structural Elucidation of Native Potato Starch Varieties, Nandana B[1], Gagan Raju[1], Bhoomika R. Hande[1], Nirmal Mazumder[1], Guan-Yu Zhuo[2]; *[1]Department of Biophysics, Manipal School of Life Sciences, India; [2]National Yang Ming Chaio Tung Univ., Inst. of Biophotonics, China.* We applied polarization-resolved second-harmonic microscopy to native potato starch. Some varieties showed strongly aligned, crystalline starch (high SHG intensity and polarization), while others were more disordered. These insights can guide starch use in food and material science.

JD1A.21

Spectroscopic Characterization of Activated Carbon Infused Composite Films: Redefining Cosmetic Facial Sheet Masks, Siya N. Jain[1], Shreya Shahapur[1], Pooja N[1], Madhusree J E[2], Sib Sankar Mal[2], Nirmal Mazumder[1]; *[1]Manipal Academy of Higher Education, India; [2]Chemistry, NITK, India.* This study presents a biodegradable facial mask using starch infused with activated carbon. The films prepared were evaluated for physicochemical and mechanical properties, biodegradability, and biocompatibility. Results highlighting its potential for sustainable skincare.

JD1A.22
GLCM-Based Texture Feature Analysis for Differentiating Perineural Invasion in Oral Squamous Cell Carcinoma Histopathology Slides, Shravya A. Prabhu[2], Kausalya N. Makkithaya[1], Gagan Raju[1], Nirmal Mazumder[1]; *[1]Department of Biophysics, Manipal School of Life Sciences, Manipal Academy of Higher Education, India; [2]Information Science and Engineering, Nitte Mahalinga Adyanthaya Memorial Inst. of Technology, India.* Identifying subtle nerve invasion (PNI) in oral cancer tissue is difficult but crucial for prognosis. Using image textural analysis, clear differences between PNI and non-PNI samples was found. This could help build automated detection tools.

JD1A.23
Biophysical Characterization of Commercial Tablets using FTIR Spectroscopy, Vibha Kamath[1], Vyasraj G. Bhat[1], Pooja N[1], Gagan Raju[1], Nirmal Mazumder[1]; *[1]Manipal School of Life Sciences, India.* The study showed Fourier Transform Infrared (FTIR) Spectroscopy can identify pharmaceuticals and characterize a molecular structure in solid dosage forms. FTIR spectroscopy was used to analyse and differentiate pharmaceutical tablet formulations according to their functional group contents.

JD1A.24
Spectroscopic and Microscopic Analysis of Horsegram Starch, Neha Jay J A[1], Nandana B[1], Bhoomika R Hande[1], Manikanth Karnati[1], Nirmal Mazumder[1]; *[1]Manipal Academy of Higher Education, India.* The aim of the current study was the isolation and characterization of horsegram starch and determining its amylose and resistant starch content. Physicochemical analysis was performed using optical microscopy, DSC, FTIR, SEM, and XRD.

JD1A.25
Multimodal Characterization of Rice Starch for Structural and Physicochemical Profiling, Prerana R. Chowdhury[3], Bhoomika R. Hande[3], Nandana B[3], Sampath U. Gunathilake[1], Hemanth Noothalapati[2], Sarwar Hossain[2], Nirmal Mazumder[3]; *[1]Department of Polymer Science, Faculty of Applied Science, Univ. of Sri Jayewardenepura, Sri Lanka; [2]Faculty of Life and Environmental Sciences, Shimane Univ., Japan; [3]Department of Biophysics, Manipal Academy of Higher Education, India.* Rice starch granules from traditional cultivars were characterized using optical microscopy, SEM, FTIR, XRD, and Raman spectroscopy to reveal morphological, crystalline, and molecular features, demonstrating the effectiveness of multimodal microanalytical approaches.

JD1A.26
Enhanced Harmonic Pulse Generation in a Hybrid Mode-Locked Fiber Laser with Microfiber Knot Resonator, qian zhang[1], Junchi Jiang[1], Yixin Zhu[1], Huizheng Li[2], Xinxin Jin[2]; *[1]Suzhou City Univ., China; [2]Beihang Univ., Beijing, China.* A hybrid NPR and BP-SA mode-

locked fiber laser integrated with a microfiber knot resonator ring achieves low-threshold self-starting pulses and stable 8th–24th-order harmonic mode-locking with repetition rates up to 207.46 MHz.

JD1A.27
Stable frequency transmission using single-wavelength, bidirectional optical carrier with phase compensation., Yunrui Zhang[1], Hao Gao[1], Jie Zhang[1], Bin Luo[1], Song Yu[1]; [1]*Beijing Univ. of Posts and Telecommunications, China.* We propose a novel frequency transmission scheme utilizing the single-wavelength optical carrier for both forward and backward transmission over an 80 km fiber link. Experimental results show a frequency instability of 3.9 × 10−17@10000s.

JD1A.28
Weak frequency signal detection based on optical local oscillator enhancement, Yunrui Zhang[1], Hao Gao[1], Jie Zhang[1], Bin Luo[1], Song Yu[1]; [1]*Beijing Univ. of Posts and Telecommunications, China.* A weak frequency signal detection scheme based on optical local oscillator enhancement is proposed which uses homogeneous laser and increases the sensitivity of the receiver by 10dB compared to the Intensity Modulation/Direct Detection (IMDD).

JD1A.29
Refractive Index Sensitivity Analysis in Few-Mode FBGs, Ajay Kumar[1]; [1]*Indian Inst. of Technology Delhi, India.* We have studied the refractive index sensitivity of LP01 and LP11 modes of the FM-FBG sensor by enhancing field interaction to the surrounding medium by etching the cladding and some part of the core.

JD1A.30
Elliptical Airy Beam Dynamics Through Turbulent Atmosphere, Sagar Ailawadhi[1], Deependra Singh Gaur[1], Akhilesh Kumar Mishra[1]; [1]*Indian Inst. of Technology Roorkee, India.* We study the elliptical Airy beam (EAB) dynamics under strong atmospheric turbulence. Reduced beam wandering and scintillation show relatively better energy confinement ability of EAB. These results find potential applications in free-space optical communication.

JD1A.31
Where do the spin and wave-particle duality of photons and electrons come from?, Sennian Chen[1]; [1]*Huaqiao Univ., China.* We proved: electrons and photons have double helix structures to make them quantized and fixed-value spin; have wave-particle hybrid structure to make them wave-particle duality; probability distribution of electrons around the proton is causal.

JD1A.32
Coupling of Polarized Single Photons into an On-Chip Hybrid Photonic Plasmonic Cavity, SUBRAT SAHU[1], COLIN JACOB[1], ABHISHEK KUMAR[2], RAJAN JHA[1]; [1]*PHYSICS, IIT BHUBANESWAR, India;* [2]*School ofAdvanced Materials (SAMaT), JNCASR, India.* An on-chip hybrid photonic-plasmonic cavity is proposed for channeling plasmon-enhanced polarized single photons into guided modes. We show that the device leads to a high Purcell factor ~ 6000, and a degree of polarization ~99%.

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Disclaimer: this guide is limited to technical program with abstracts and author blocks as of 22 October. For updated and complete information with special events, reference the online schedule or mobile app.

JD1A.33
Design and Optimization of Multi-analyte Based Biosensors Through RNN-LSTM Layers, Kawsar Ahmed[1], Md Mamun Ali[1], Md Bellal Hossain[2], Francis M. Bui[1]; [1]*Univ. of Saskatchewan, Canada;* [2]*School of Electrical and Information Engineering,, The Univ. of Sydney, Australia.* In the history of multi-analyte biosensors, we proposed, for the first time, a deep learning (DL) model to predict loss profile, enabling the design and optimization of SPR-based multi-analyte biosensors for the simultaneous detection of multiple analytes.

JD1A.34
Digital Holography Technique for exposing Defect on Photovoltaic Cell, Abdullahi Bako[1], Bunyarit Voochaiyaphum[1], Prathan Buranasiri[1]; [1]*King Mongkut's Inst. of Tech. Ladkrabang, Thailand.* We employed digital holography techniques to detect surface anomalies from photovoltaic cell. the approach allowed for precise spatial mapping of micro-crack features without requiring physical contact or electrical biasing compared to conventional methods.

JD1A.35 Extended Contributed (Poster Only)
Optical Trapping of Microparticles in Various Dispersion Media under CW and Pulsed Modes, Deepak Kumar[1], Ajitesh Singh[1], Krishna Kant Singh[1], Debabrata Goswami[1]; [1]*Indian Inst. of Technology Kanpur, India.* The trapping stability of the microparticles, expressed in terms of their corner frequency values, varies inversely with the refractive index of the dispersion medium. Femtosecond laser is more efficient in trapping compared to the CW mode.

JD1A.36
Experimental Demonstration of Retroreflecting Modulation-Based Bidirectional UWOC with Time-Division Coherent Detection, Tiankuo Wei[1,2], Xinke Tang[1], Weijie Dai[2], Hui Chen[1], Yuhan Dong[1,2]; [1]*Pengcheng Laboratory, China;* [2]*Shenzhen International Graduate School, Tsinghua Univ., China.* A retroreflecting modulation-based bidirectional UWOC system is proposed and experimentally verified, enabling 1-Gbps downlink transmission with amplitude modulator and SiPM, and 1-Mbps uplink transmission with MEMS grating modulator and time-division coherent detection.

JD1A.37
High-Efficiency Optical Coupling in Si/SiO2 Microring Resonators, Mehrdad Ghasemi[1]; [1]*electical, amirkabir, Iran (the Islamic Republic of).* This paper presents a numerical investigation of light coupling and field confinement in a silicon/silicon dioxide (Si/SiO2) microring resonator using FDTD simulations. By optimizing the waveguide-ring coupling geometry, efficient light confinement at 1550 nm was achieved, with coupling efficiencies exceeding 92%.

JD1A.38
Improving the optical properties of $CuWO_4$ using Ti_3C_2 MXene, Amirali Mostafavi Mousavi[1], Ali A. Sabbagh Alvani[1], Reza Salimi[1]; [1]*Amirkabir Univ. of Technology, Iran (the Islamic Republic of).* The $CuWO_4/Ti_3C_2$ heterostructure was prepared hydrothermally. The introduction of Ti_3C_2 resulted in a significant enhancement of the optical properties of $CuWO_4$, addressing its limitations regarding charge carrier mobility due to the electron-hole recombination.

JD1A.39

Underwater Acoustic Detection Using Distributed Acoustic Sensing in a Controlled Wave Flume, Kishore S. Kumar[1], Balaji Srinivasan[1]; [1]*Indian Inst. of Technology Madras, India.* We demonstrate the feasibility of using DAS to detect underwater acoustic signals in a controlled wave flume. We successfully detected both low and high-frequency underwater acoustic signals with an acoustic SNR of ~20 dB generated using a speaker and an acoustic projector, and validated them against FBG sensors.

JD1A.40
Synergistic Control of Surface Roughness in Sol-Gel TiO_2 Coatings to Optimize Anti-Reflective Performance, Pouya Jafari[1], Ali A. Sabbagh Alvani[1], Hassan Sameie[1]; [1]*Amirkabir Univ. of Technology, Iran (the Islamic Republic of).* Sol-gel TiO_2 coatings on glass achieved controlled surface roughness via Pluronic F127 concentration and HF etching. This roughness optimization enhanced anti-reflective properties by reducing visible light reflectance through improved light trapping.

JD1A.41
Graded-Index Non-Zero Dispersion-Shifted Fiber with Triple-Concentric Rings for OAM Modes, Yuxiang Huang[1], Xulang Chen[1], Wenqian Zhao[1], Yuetian Wang[1], Zhongqi Pan[2], Yang Yue[1]; [1]*Xi'an Jiaotong Univ., China;* [2]*Univ. of Louisiana at Lafayette, USA.* A graded-index non-zero dispersion-shifted fiber with triple-concentric rings for orbital angular momentum (OAM) modes is proposed, which can support 78 OAM modes. The impact of shape factor and trench on fiber performance is also analyzed.

JD1A.42
Generation of 2-Octave Supercontinuum for $OAM_{4,1}$ Mode in Graded-Index ZBLAN Ring Fiber, Xiaoke Wu[1], Haoyang Ren[1], Wenpu Geng[2], Zhongqi Pan[3], Yang Yue[1]; [1]*Xi'an Jiaotong Univ., China;* [2]*Nankai Univ., China;* [3]*Univ. of Louisiana at Lafayette, USA.* A ZBLAN ring core fiber is proposed for broadband orbital angular momentum supercontinuum generation. It is capable of generating a supercontinuum spanning 2-octave bands within a 2-cm fiber, covering wavelengths from 1750 to 7000 nm.

JD1A.43
Simulating a Dynamical Schr\"odinger Cat State with a Focusing Beam, Pawan Khatiwada[1], Allison Guo[1,2], Edward Yu[1], Xiao-Feng Qian[1]; [1]*Stevens Inst. of Technology, USA;* [2]*Summit High School, USA.* We explore the equivalence between paraxial optical beam propagation and the dynamics of a 2D quantum harmonic oscillator. We demonstrate simulation of time evolution for coherent, squeezed, and Schr\"odinger cat states with superposed Hermite-Gaussian modes.

JD1A.44
Portable Raman Spectrometer with SVM-based Machine Learning for Quick and Non-Invasive Biofluid Screening, Umesh C. Garnaik[1], Shilpi Agarwal[1]; [1]*Jawaharlal Nehru Univ., India.* Raman spectroscopy provides a quick and non-destructive way to analyze biofluids for disease diagnosis. A portable Raman spectrometer is developed and optimized for the characterization and classification of CSF and saliva, using SVM classification.

JD1A.45

Autoencoder-based Equalizer for ICI Mitigation in Gridless Nyquist-WDM Systems, David Morón[1], Carlos Ordoñez[1], Kevin Martinez[1], Jhon J. Granada Torres[1]; *[1]Universidad de Antioquia, Colombia.* We propose an autoencoder-based equalizer to minimize the effects of inter-channel interference in a gridless 3x16-Gbaud 16-QAM Nyquist-WDM system. Gains of up to 1.4 dB were obtained compared to conventional demodulation.

JD1A.46
Laser Treatment of Austempered Ductile Iron (ADI): Improvement in Surface Hardness and Microstructure Characteristics, Samar R. AlSayed Ali[1], Adel Nofal[2]; *[1]Laser Inst. (NILES) Cairo Univ., Egypt; [2]Central Metallurgical Research and Development Inst. (CMRDI), Egypt.* This research investigates the potential of varying laser powers in laser treatment to modify the surface microstructure and microhardness of austempered ductile iron. The application of low, medium, and high laser powers was studied.

JD1A.47
Preliminary Study of Diffraction Gratings in Nonlinear Films., Michel O. Chacón Carrero[1], Sandra M. Martinez Loide[1], Miguel Á. Vázquez Guevara[2], Jose A. Andrade Lucio[1], Edgar Alvarado Méndez[1]; *[1]División de Ingenierías, Campus Irapuato-Salamanca, Universidad de Guanajuato, Mexico; [2]División de Ciencias Naturales y Exactas, DCNE, Universidad de Guanajuato, Mexico.* The nonlinear absorption and refractive index of *moringa olifera* gelatin films were measured via CW-Ar^+ Z-scan at 528 nm, revealing efficient low-power diffraction gratings, consistent with a thermal-lens model.

JD1A.48
High-Purity OAM Modes with Broadband Negative Dispersion in Tapered Graded-Index Dual Ring-Core Fiber, Yuetian Wang[1], Wenpu Geng[2], Zhongqi Pan[3], Yang Yue[1]; *[1]Xi'an Jiaotong Univ., China; [2]Nankai Univ., China; [3]Univ. of Louisiana at Lafayette, USA.* A tapered graded-index dual ring-core fiber is proposed for OAM transmission. It supports $OAM_{1,1}$ mode at > 98.25% purity and achieves −435.75 ps/(nm●km) dispersion from 1344–1563 nm with < 0.32 ps/(nm●km) fluctuation.

JD1A.49
Performance Investigation of FSO-WDM-PON for B5G Connectivity in Coastal Regions, Ridhi Gupta[1], Yugnanda Malhotra[1], Jolly Parikh[1], Rajneesh Talwar[2]; *[1]Bharati Vidyapeeth's College of Engineering, India; [2]Chitkara Univ., India.* Free Space Optics connectivity largely depends on geographic and atmospheric conditions. The performance of FSO-WDM PON in Port Blair's (Andaman and Nicobar Island) coastal region is evaluated under scenarios of rain, humidity, and visibility.

JD1A.50
Self-healing of Spatial Quantum Correlations in Bright Structured Twin Beams, Jerin A. Thachil[1], Chirang R. Patel[1], Ashok Kumar[1]; *[1]IIST Trivandrum, India.* We investigate the healing of transverse spatial quantum correlations in truncated bright structured twin beams generated via four-wave mixing in atomic vapor, highlighting their potential for high-dimensional quantum imaging and quantum information processing.

JD1A.51

CdSe-derived DBR layers for improved THz performance in Photoconductive Antenna, Abhijit Sethi[1], Nisha Flora Boby[2], Naga Vamsi Krishna Reddy[1], Shyamal Mondal[1]; *[1]Defence Inst. of Advanced Technology, India; [2]ECE, Sathyabama Inst. of Science and Technology, India.* This paper reports, the performance of CdSe-quantum-dot-based PCA with CdSe/ZnTe DBR layers have been studied. This hybrid PCA shows maximum photocurrent of 71 mA, electric field of 0.4×10^{7} V/m having a bandwidth of 9.8 THz.

JD1A.52
Hybrid Neural Network Modeling for Temperature Prediction Using MZI–FBG Sensor System, Muhammad Fajar Faliasthiunus Pradipta[1], Lina Marlina[1], BRIAN PAMUKTI[1], Shien Kuei Liaw[1]; *[1]National Taiwan Univ of Science & Tech, Taiwan.* We present a hybrid CNN–DNN model using MZI–FBG sensors for multiclass temperature classification ranging 50°C-110°C. The model achieves over 99% accuracy across seven classes, offering a fast, scalable, and cost-effective sensing solution.

JD1A.53
Regeneration of truncated Airy pulses under alternating third- and fourth-order chromatic dispersions, Lucien Mandeng Mandeng[1,2], Clément Tchawoua[3]; *[1]NATIONAL ADVANCED SCHOOL OF ENGINEERING, Cameroon; [2]NASEY OPTICA CHAPTER, NATIONAL ADVANCED SCHOOL OF ENGINEERING OF YAOUNDE, Cameroon; [3]Laboratory of Mechanics, Materials and Structures, Department of Physics, Faculty of Science, Univ. of Yaoundé I, Yaoundé, Cameroon, Cameroon.* We demonstrate that Airy pulse regeneration can be achieved under the effect of quartic dispersion, mediated by asymmetric inversion driven by positive third-order dispersion. The resulting focusing regions exhibit alternating hysteresis-like patterns.

JD1A.54
Impact of Free-Space Optics (FSO) Switching in Quantum Datacentre Environments, Victor Virag[1], Alfonso Ruocco[1], Alejandra Beghelli[1,2]; *[1]Univ. College London, UK; [2]BT Group, UK.* We evaluate FSO switches' impact on the entanglement fidelity of a 9-node tree datacentre-like topology. Simulations show that each switch layer reduces fidelity by 8.9%, only partially mitigated by EPL distillation's improvement of 5.61%

JD1A.55
Defect measurement by full-Stokes imaging, Yukitoshi Otani[1], Yuto Nomura[1], Nathan Hagen[1]; *[1]Utsunomiya Univ., Japan.* Defects can be detected by imaging scattered light from objects as Stokes parameters. By detecting polarized light in the dark field, defects could be detected down to 1μm with a wider measurement range than with conventional methods.

JD1A.56
Tunable Scattering from Chiral Cylinders via Multi-Brewster Angle Control, Rajab Y. Ataai[2], Esmail Abuhdima[1], Salaheddeen Bugoffa[3], Abdulmajid Mrebit[4], Issa Elbelazi[5], Carlisa Wright[6], Kyle Rolle[7]; *[1]EET, ECPI Univ., USA; [2]Computer Science, Physics and Engineering, Benedict College, USA; [3]Engineering Technology Department, Norfolk State Univ., USA; [5]Electrical and Electronic Engineering, Faculty of Technical Science, Libya.* This work explores how tuning the chirality coefficient in chiral materials induces multiple Brewster angles, enabling reflection control, and examines the resulting impact on electromagnetic wave scattering from a translating chiral cylindrical structure.

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JD1A.57
Stationary spatiotemporal beam inside a nonlinear GRIN fiber, SONALI MAITY[1], Anuj P. Lara[1], Samudra Roy[1]; [1]*Indian Inst. of Technology Kharagpur, India.* Dynamics of the spatiotemporal beam inside a GRIN fiber is investigated exploiting variational method. The results lead to the specific input condition to achieve stationary beam propagation. The catastrophic SPM-induced beam-collapse is investigated.

JD1A.58
High-dimensional OAM Recognition using Multimode Fiber, Purnesh S. Badavath[1], Vijay Kumar[1]; [1]*NIT Warangal, India.* We demonstrate high-dimensional OAM mode recognition over a 1 km length of 62.5���� multimode fiber using a 1D temporal speckle sequence captured via a fast-photodiode. A custom-designed 1D CNN achieves 97% classification accuracy across seventeen ����$_{,}$ modes

JD1A.59
c-GAN for Resolving Ill-Posed Spectral Reconstruction in Liquid Crystal Metasurface Spectrometers, TAO CHEN[1], Jiewen Nie[1], Jiajun Li[1], Haining Yang[1]; [1]*Southeast Univ., China.* We proposed a conditional GAN for computational spectral reconstruction for liquid crystal metasurface spectrometers, which resolved 0.5nm FWHM peaks under a 20dB signal-to-noise ratio, 30dB below the minimum requirement of conventional deep learning methods.

JD1A.60
Inverse Design of Multilayer thin film Using Surrogate Modeling and Multi-Objective Optimization, Sani Mukhtar[1], Emad Alkhazraji[2], Haitham Khaled[2], Jaime Viegas[1]; [1]*Khalifa Univ. of Science and Techno, United Arab Emirates;* [2]*Abu Dhabi Polytechnic, United Arab Emirates.* We present an AI-driven framework for designing multilayer optical thin film structures, combining a neural network surrogate, interpretability tools, and multi-objective optimization to achieve high-efficiency thin-film designs with enhanced physical insights and performance for advanced photonic applications including filters and mirrors.

JD1A.61
Comparison of Self-reconstruction Properties of Bright and Dark Generic Poincaré Beams, Rahul Joshi[1], P. Senthilkumaran[1], Sunil Kumar[1]; [1]*Indian Inst. of Technology Delhi, India.* A comparative study analyzing the self-reconstruction of dark and bright generic Poincaré beams. Bright beams, comprising generic stable constituent beams, self reconstruct more efficiently after asymmetric obstruction, making them suitable for robust optical communications and imaging.

JD1A.62
Accurate Modelling of Liquid Crystal Metasurfaces for Spectrum Modulation, Pengyao Niu[1], Sen Wang[1], Jirong Bao[1], TAO CHEN[2], Jiewen Nie[2], Haining Yang[2]; [1]*Chien-Shiung Wu College, Southeast Univ., China;* [2]*School of Electronic Science & Engineering, Southeast Univ., China.* We established a simulation model for liquid crystal metasurfaces, incorporating substrate optics, liquid crystal molecules, and their interaction, which agrees well with experiments and supports the design of tunable, high-performance metasurface devices.

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JD1A.63
Twist-Induced Chirality in Fiber Bragg Gratings for Tunable Multi-Band Reflectivity, Neha Ahlawat[1], Garima Bawa[2], Saurabh Mani Tripathi[1]; [1]*Indian Inst. of Technology Delhi, India;* [2]*CREOL, The College of Optics and Photonics, Univ. of Central Florida, USA, USA.* We study twist-induced chirality in fiber Bragg gratings and demonstrate how increasing twist rate alters reflection spectra, enabling controllable multi-band reflectivity for applications in tunable filters, polarization devices, and broadband sensors.

JD1A.64
Robustness Analysis of Integrated Photonics-Based Quantum Gates Using Monte Carlo Simulations, Thomas J. Mikhail[1], Farah A. Abdulrazek[1], Mohamed A. Swillam[1]; [1]*The American Univ. in Cairo, Egypt.* This study performs a comparative analysis of photonic quantum gate designs by introducing real-world fabrication errors via Monte-Carlo simulations. By analyzing the resulting means/standard deviations, we provide insight into each design's fidelity and probability of success.

JD1A.65
Integrated Reflective Interferometers for Enhanced Sensing and Modulation, Thomas J. Mikhail[1], Seif M. Swillam[1], Mohamed A. Swillam[1]; [1]*The American Univ. in Cairo, Egypt.* We present a class of integrated photonic structures inspired by Michelson interferometers, using circular Bragg gratings and directional couplers. The design is enhanced with subwavelength gratings to improve sensing performance and enable better phase control.

JD1A.66
Dielectric Loss Effects on Transverse Modes in Chiral Magnetic Slab Resonators, Nagi A. Buaossa[1], Rajab Y. Ataai[2], Nagi A. Buaossa[1]; [1]*Univ. of Dayton, USA;* [2]*2Computer Science, Physics and Engineering Department, Benedict College, USA Minor Outlying Islands.* Lossy magnetic chiral slab resonators are introduced to characterize their spectral characteristics for transverse modes. A novel tri-layer configuration is proposed, adapted to the standard slab structure, explicitly incorporating chiral magnetic resonator with dielectric loss.

JD1A.67
Temperature-Insensitive Robust Source of High-Quality Polarization-Entanglement, Nilesh Tiwari[1], Om shankar[1], Vivek Venkataraman[1], Joyee Ghosh[1]; [1]*Indian Inst. of Technology Delhi, India.* We demonstrate a temperature-robust Sagnac-interferometer based source of polarization-entangled photons using 20-mm long ppKTP, maintaining stable operation with >92% fidelity, over > 1.2°C change.