Frontiers in Optics + Laser Science Session Guide

Disclaimer: this guide is limited to technical program with abstracts and author blocks as of 6 September. For updated and complete information with special events, reference the online schedule or mobile app.

Monday, 23 September

08:00 -- 09:00
Room: 3A
FM1A • Quantum Technologies Theme: Quantum Sensors
Presider: Brian Smith; Univ. of Oregon, USA

FM1A.1 • 08:00 (Invited)
Compact Platforms for Cold-Atom Clocks, Erling Riis[1], Paul Griffin[1], Aidan Arnold[1], James McGilligan[1]; [1]*Univ. of Strathclyde, UK.* We examine solutions for miniaturizing atomic clocks for performance at the 10^{-15} level. Microwave and optical interrogation of a rubidium microwave clock are highlighted. MEMS and additively manufactured vacuum and spectroscopy cells will be presented.

FM1A.2 • 08:30 (Invited)
Withdrawn

FM1A.3 • 08:30 (Invited)
Chip-Scale Atomic Devices with Atomic Vapor Cells, John Kitching1; *1National Inst of Standards & Technology, USA.* Abstract not available.

08:00 -- 09:00
Room: 3B
FM1B • Computational Optics for Biological Applications
Presider: Partha Banerjee; Univ. of Dayton, USA

FM1B.1 • 08:00 (Invited)
Computational Microscopy for Pathology Analysis, Changhuei Yang[1]; [1]*California Inst. of Technology, USA.* In this talk, I will discuss some of our recent computational microscopy and deep learning work, that showcase some of these shifts in the context of pathology. I will talk about APIC – an improved computational microscopy method to collect and process image data, which brings significant workflow advantages to pathology. I will also talking about the use of Deep Learning in image analysis, and point out some of the surprising and impactful ways Deep Learning can improve pathology.

FM1B.2 • 08:30 (Invited)
Unlocking Tissue Secrets: Live Histology Without Labels Through Microstructured Imaging Windows, Mario Marini[1], Margaux Bouzin[1], Laura Sironi[1], Luca Presotto[1], Jennifer Riccio[1], Davide Panzeri[1], Donato Inverso[2], Maddalena Collini[1], Laura D'alfonso[1], Giuseppe Chirico[1]; [1]*Universita degli studi di Milano-Bicocca, Italy;* [2]*Division of Immunology, Transplantation and Infectious Diseases, Universita Vita Salute San Raffaele, Italy.* Ex-vivo tissue section histology serves as the pathologists' primary method, yet it is time-consuming, subjective, and invasive. Here, we explore how techniques such as non-linear excitation, structured illumination, and physically inspired image reconstruction pave the way for in-vivo tissue histology.

08:00 -- 09:00
Room: 3C
FM1C • State-Of-The-Art High-Speed Optical Interconnects for Data Centers
Presider: Stanley Cheung; Hewlett Packard Labs, USA

FM1C.1 • 08:00
Polymer Slot Modulators for Next Generation Data Interconnects, Jasper Drisko[1], Hadi Rabbani Haghighi[1], Felipe Della Lucia[1], Amir Hosseinnia[1], Miroslaw Florjanczyk[1], Mateo Powell Serrano[1], Bryan Berggren[1], Andres Damian[1], Patrick Riedel[1], Gannon Kehe[1], Brenden Basica[1], Andrew Wylde[1], Brian Shaw[1], Cody Soule[1], Mehedhi Hasan[1], Zhiming Liu[1], Xiaoyue Huang[1], Baoquan Chen[1], Barry Johnson[1], Ginelle Ramann[1], John Zyskind[1]; *[1]Lightwave Logic, Inc, USA.* In this paper, we present the design of a Polymer Slot Modulator and use it to demonstrate eye diagrams up to 100 Gbaud PAM4/200 Gbps data rates with sub-1-Volt electrical drive amplitudes.

FM1C.2 • 08:15
Long Term Reliability Methodology of Next Gen Pluggable Optical Modules for PAM4 Applications in Hyperscale Datacenters, Viral Pradeep Lowalekar[1], Abhijit Chakravarty[1]; *[1]Meta Platforms Inc., USA.* Meta is deploying high-speed interconnects in datacenters due to increased bandwidth push in AI domain. This paper revolves around long-term reliability strategy developed in-house at Meta as a path to evaluate supplier performance in DC environment.

FM1C.3 • 08:30 (Invited)
Highly Integrated Light Engines for Data Center Optical Interconnects, Radhakrishnan Nagarajan[1]; *[1]Marvell Semiconductor Inc., USA.* Abstract not available.

08:00 -- 09:00
Room: 3D
FM1D • Advanced Optics in Vision and Biology
Presider: Susana Marcos; Univ. of Rochester, USA

FM1D.1 • 08:00 (Invited)
Anterior Eye Optical Imaging and Correction, Susana Marcos[1]; *[1]Univ. of Rochester, USA.* Future eye corrections will focus on customizing treatments based on patient-specific optomechanical eye models derived from 3D Quantitative Anterior Segment Optical Coherence and Elastography. This approach enhances understanding and optimization of treatments for myopia, presbyopia, and keratoconus.

FM1D.2 • 08:30
Space Division Multiplexing Optical Coherence Tomography for Wide-field Angiographic Imaging of the Human Retina, Aaron J. Adkins[1], Senyue Hao[1], Chao Ren[1], Andrew Song[1], Chao Zhou[1]; *[1]Washington Univ. in St. Louis, USA.* We have constructed a parallelized 4-channel multi-beam optical coherence tomography system capable of achieving high speed and wide field of view angiographic imaging of the retina.

FM1D.3 • 08:45
Real-time Wide-field Broadband Coherent Anti-Stokes Raman Scattering Microscopy, Chiara Ceconello[2], Andrea Rabolini[2], Federico Vernuccio[2], Arianna Bresci[2], Francesco Manetti[2], Salvatore Sorrentino[2], Marco Ventura[1], Renzo Vanna[1], Giulio Cerullo[2,1], Dario Polli[2,1]; *[1]Istituto di Fotonica e Nanotecnologie Consiglio Nazionale delle Ricerche, Italy; [2]Physics, Politecnico di Milano, Italy.* We present a novel wide-field broadband coherent anti-Stokes Raman scattering microscope, based on supercontinuum generation in a bulk crystal. It features rapid high-resolution chemical imaging over wide field of views, up to the video rate.

08:00 -- 09:00
Room: 3E
FM1E • Frequency Combs, High-Harmonic Generation, and Attoscience I
Presider: To be Announced

FM1E.1 • 08:00
Quantum Walk Optical Frequency Comb Laser in the Near Infrared, Alex Dikopoltsev[1], Bahareh Marzban[1], Lucius Miller[1], Mathieu Bertrand[1], Giacomo Scalari[1], Jerome Faist[1]; *[1]ETH Zurich, Switzerland.* Leveraging insights from a mid-infrared quantum walk comb laser, we experimentally demonstrate its highly controllable near-infrared counterpart. We show a 1.050 THz flat-top bandwidth centered at 1604.5 nm and the ballistic expansion of its bandwidth.

FM1E.2 • 08:15
3 µm Driven High Harmonic Generation in an Anti-Resonant Hollow Core Fiber, Will Hettel[1], Drew Morrill[1], Daniel Carlson[1], Jeremy Thurston[1], Clay Klein[1], Grzegorz Golba[1], Rachel Larsen[1], Henry Kapteyn[1,2], Margaret Murnane[1], Michaël Hemmer[1]; *[1]Physics, Univ. of Colorado Boulder, USA; [2]Kapteyn-Murnane Laboratories Inc, USA.* We report the generation of high harmonics in an anti-resonant hollow-core fiber driven by an ultrastable ~0.3% RMS, kHz laser at 3 µm wavelength. This geometry enables lower-loss guiding of mid-IR lasers.

FM1E.3 • 08:30
Integrated Multi Cavity-Soliton Phase Locking via Kerr-Induced Synchronization for Microcomb Metrology Applications, Shao-Chien Ou[1], Pradyoth Shandilya[2], Curtis Menyuk[2], Kartik Srinivasan[1,3], Gregory Moille[1,3]; *[1]Joint Quantum Inst., USA; [2]Univ. of Maryland Baltimore, USA; [3]National Inst. of Standards and Technology, USA.* We show that in Kerr-induced synchronization, multi-soliton integrated frequency comb states show the same metrological performance as single soliton states, thanks to common phase-locking trapping by the reference pump laser.

FM1E.4 • 08:45
Absolute Absorption Cross Section Measurement of Formaldehyde Using Near-ultraviolet Dual-comb Spectroscopy, Lukas Fürst[1], Alexander Eber[1], Adrian Kirchner[1], Emily Hruska[1], Mithun Pal[1], Birgitta Bernhardt[1]; *[1]Graz Univ. of Technology, Austria.* The first broadband ultraviolet dual-comb spectroscopy system is used to analyze the absolute absorption cross section of formaldehyde with high spectral resolution. This enables the determination of the transition strength and fundamental rotational constants.

08:00 -- 10:00
Room: 3F
LM1F • Anderson Dissertation Award Presentations
Presider: Brian Washburn; National Inst of Standards & Technology, USA

LM1F.1 • 08:00 (Invited)
A Laser Phase Plate for Transmission Electron Microscopy, Jeremy Axelrod[1]; *[1]Univ. of California Berkeley, USA.* A near-concentric Fabry-Perot optical cavity supporting a continuous-wave focal intensity of 590 GW/cm2 phase shifts a throughgoing electron beam via the ponderomotive potential and is used to increase image contrast in transmission electron microscopy.

LM1F.2 • 08:30 (Invited)
Room-Temperature Quantum Optomechanics and Free-Electron Quantum Optics, Guanhao Huang[1]; *[1]École Polytechnique Fédérale de Lausanne, Switzerland.* We discuss experimental observation of quantum optical effects in two experiments: the first demonstrations of room-temperature quantum optomechanics with a macroscopic solid-state mechanical object, and free electron-photon non-classical correlation mediated by photonic integrated circuits.

LM1F.3 • 09:00 (Invited)
Enabling Precision Astronomical Spectroscopy with Laser Frequency Combs, Connor Fredrick[1]; *[1]Univ. of Colorado at Boulder, USA.* We describe the design and long-term performance of the 30 GHz optical frequency comb used as the primary calibration source of the Habitable Zone Planet Finder (HPF) spectrograph, a system used for one of the most demanding spectroscopic applications in astronomy, the detection of planets beyond our solar system through Doppler spectroscopy.

LM1F.4 • 09:30 (Invited)
Photon Pair Generation from Quantum Optical Metasurfaces, Jose Tomas Santiago-Cruz[1]; *[1]Friedrich-Alexander Universitat Erlangen-Nurnberg Fachbereich Theologie, Germany.* In this talk I will review the first-ever experiments on photon pair generation via spontaneous parametric down-conversion in nanoscale sources, namely thin films and metasurfaces.

09:15 -- 10:00
Room: 3A
FM2A • FiO Quantum Technologies Visionary Session I
Presider: Mehdi Namazi; Qunnect Inc., USA

FM2A.1 • 09:15 (Visionary)
Building the Entanglement Fabric to Scale Quantum Computing, Carmen Palacios-Berraquero[1]; *[1]nu Quantum, UK.* We present the advantages of constructing a large-scale and flexible entanglement topology - an Entanglement Fabric - via high-performance networking of modular quantum processing units, as a solution to architect Fault Tolerant Quantum Computers. We also present the latest results on Nu Quantum’s launch of a world-first Quantum Networking Unit and Qubit-Photon Interface, the quantum networking hardware systems underpinning the creating of a useful Entanglement Fabric.

10:30 -- 12:30
Room: 3A
FM3A • Quantum Technologies Theme: Quantum Computing Hardware
Presider: Christopher Myatt; Vescent, USA

FM3A.1 • 10:30 (Invited)
From Utility Scale Quantum to Quantum-Centric Supercomputing, Jerry M. Chow[1]; *[1]IBM TJ Watson Research Center, USA.* Abstract not available.

FM3A.2 • 11:00 (Invited)
Quantum Theme Invited Speaker: Title to be Announced, Jason Petta[1]; *[1]Univ. of California Los Angeles, USA.* Abstract not available.

FM3A.3 • 11:30 (Invited)
Quantum Theme Invited Speaker: Title to be Announced, Alexander Keesling[1]; *[1]QuEra Computing Inc., USA.* Abstract not available.

FM3A.4 • 12:00 (Invited)
Quantum Theme Invited Speaker: Title to be Announced, David Hayes[1]; *[1]Quantinuum, USA.* Abstract not available.

10:30 -- 12:30
Room: 3B
FM3B • Holographic Acquisition and Imaging, and Optical Processing
Presider: Giuseppe Chirico; Universita degli studi di Milano-Bicocca, Italy and Abbie Watnik; US Naval Research Laboratory, USA

FM3B.1 • 10:30 (Invited)
Recent Advances in High-Speed Imaging with Parallel Phase-Shifting Digital Holography, Yasuhiro Awatsuji[1], Sudheesh K. Rajput[1], Tomoyoshi Inoue[2], Kenzo Nishio[1], Hou Natsu[3], Osamu Matoba[4]; *[1]Kyoto Inst. of Technology, Japan; [2]Hiroshima Univ., Japan; [3]National Inst. of Advanced Industrial Science and Technology, Japan; [4]Kobe Univ., Japan.* The authors review recent advances in high-speed imaging of dynamic object with parallel phase-shifting digital holography. 3-D imaging of temperature of the air surrounding a heated object was demonstrated as an example of the advances.

FM3B.2 • 11:00
Optical information transfer through random unknown diffusers using a diffractive decoder with electronic encoding, Yuhang Li[1], Tianyi Gan[1], Bijie Bai[1], Cagatay Isil[1], Mona Jarrahi[1], Aydogan Ozcan[1]; *[1]ECE, Univ. of California Los Angeles, USA.* We present an optical diffractive decoder with an electronic encoder network to accurately transmit optical information of interest through unknown random phase diffusers that are present in the optical path.

FM3B.3 • 11:15
Aberration analysis using the CMA-ES Algorithm, Hyukjin Yang[1], Minsu Yeo[1], Byungho Kim[1], Hansol Kim[1], Yoonchan Jeong[1]; *[1]Seoul National Univ., Korea (the Republic of).* We

investigate the CMA-ES algorithm as a novel derivative-free optimization tool for aberration analysis, which shows excellent performance with an RMS error of 0.07% even under the 10-dB SNR condition.

FM3B.4 • 11:30 (Invited)
Differentiable Holography and its Development, Ni Chen[1], David J. Brady[1]; [1]*Univ. of Arizona, USA.* We show that differentiable holography allows for inline single-shot complex field imaging, high-performance pixel super-resolution lensless imaging, and denser volumetric particle velocimetry in a single shot.

FM3B.5 • 12:00 (Invited)
Optical Clone: A Holographic 3D Video Display, Hongyue Gao[1]; [1]*Shanghai Univ., China.* Abstract not available.

10:30 -- 12:30
Room: 3C
FM3C • Advances in Free Space Optical Communications and Quantum Networking
Presider: Giovanni Milione; NEC Laboratories America Inc., USA

FM3C.1 • 10:30 (Invited)
Advances in Mode-Multiplexed Free-Space Optical Communications, Alan E. Willner[1]; [1]*Univ. of Southern California, USA.* Mode-division-multiplexing (MDM) holds the promise of increased data capacity for free-space optical communication systems. This talk will highlight various advances in MDM performance, mitigation of atmospheric turbulence, and applicability to different system frequency ranges.

FM3C.2 • 11:00
Plasmonic Modulators for Future High-Capacity Space Communication, Laurenz Kulmer[1], Yannik Horst[1], Tobias Blatter[1], Marcel Destraz[2], Benedikt Bauerle[2], Juerg Leuthold[1]; [1]*ETH Zurich, Switzerland;* [2]*Polariton Technologies AG, Switzerland.* Over a 53km turbulent free-space optical link we have shown data transmission up to 424Gbit/s. These results were enabled by plasmonic modulators offering bandwidths above 100GHz and were extended up to 774Gbit/s in fiber experiments.

FM3C.3 • 11:15
WiFoO - Practical Low-cost Free Space Optical Communication With Consumer Hardware, Mikaeel Dindar[1], Philip Ginster[1], Mitchell Cox[1]; [1]*School of Electrical and Information Engineering, Univ. of the Witwatersrand Johannesburg, South Africa.* Free Space Optical (FSO) communication could provide low-cost rural connectivity but cost and complexity make traditional FSO unsuitable. Instead we present WiFoO, a novel IEEE 802.11 based FSO solution with low hardware and installation costs.

FM3C.4 • 11:30
Driverless On-Chip Sub-THz Plasmonic Modulator Antenna Receiver, Hande Ibili[1], Tobias Blatter[1], Laurenz Kulmer[1], Michael Baumann[1], Salim Turki[1], Yannik Horst[1], Boris Vukovic[1], Stefan M. Koepfli[1], Jasmin Smajic[1], Juerg Leuthold[1]; [1]*ETH Zurich, Switzerland.* We present an amplifier-free on-chip antenna-integrated plasmonic modulator receiver in sub-THz regime. A

framework for designing plasmonic antennas and transmission of up to 80Gbit/s in a wireless sub-THz link starring these receivers are shown.

FM3C.5 • 11:45
Tunable and Reconfigurable 10-Gbaud Optical Data Format Aggregation of Two Independent Channels with Constellation Biasing by using Nonlinear Wave Mixing, Wing Ko[1], Abdulrahman Alhaddad[1], Amir Minoofar[1], Narek Karapetyan[1], Huibin Zhou[1], Muralekrishnan Ramakrishnan[1], Zile Jiang[1], Xinzhou Su[1], Moshe Tur[2], Jonathan Habif[1], Alan E. Willner[1]; *[1]Univ. of Southern California, USA; [2]Tel Aviv Univ., Israel.* We experimentally demonstrate the optical format aggregation of two independent channels using nonlinear wave mixing. Using the same system, we show multiple format aggregation (2 BPSK-to-QPSK, 2 QPSK-to-16QAM, and 2 OOK-to-QPSK) at different baud rates (5/10 Gbaud).

FM3C.6 • 12:00
Quantum Wrapper Networking: Investigating the Noise Impact of Classical Headers on the Quantum Payload, Gamze Gul[1], Mehmet B. On[3], Shannon G. Tan[1], Roberto Proietti[2], Gregory S. Kanter[1], S. J. Ben Yoo[3], Prem Kumar[1]; *[1]Northwestern Univ., USA; [2]Politecnico di Torino, Italy; [3]Univ. of California Davis, USA.* We study in time and frequency domains the impact of classical headers on quantum payload in quantum wrapper networking. We identify and characterize in-fiber scattering processes that produce noise photons to degrade the quantum payload.

FM3C.7 • 12:15
Faithful Polarization Entanglement Distribution in SeQUeNCe Quantum Network Simulator, Ansh Singal[3,2], Allen Zang[4], Anirudh Ramesh[1,2], Alexander Kolar[4], Joaquin Chung[2], Rajkumar Kettimuthu[2], Prem Kumar[3]; *[1]Northwestern Univ., USA; [2]Data Science and Learning Division, Argonne National Laboratory, USA; [3]Electrical and Computer Engineering, Northwestern Univ., USA; [4]Univ. of Chicago Division of the Physical Sciences, USA.* We simulate polarization entanglement distribution with the Fock state representation in the open-sourced quantum network simulator SeQUeNCe. Simulations are validated by comparing with experimental entanglement distribution results and unknown experimental parameters are estimated.

10:30 -- 12:30
Room: 3D
FM3D • Advanced Optics in Label-Free Imaging
Presider: Ruikang Wang; Univ. of Washington, USA

FM3D.1 • 10:30 (Invited)
Virtual Staining of Label-free Tissue, Aydogan Ozcan[1]; *[1]Univ. of California Los Angeles, USA.* We will cover deep learning-based virtual staining techniques that can generate different types of histological stains from label-free microscopic images of unstained samples by using, e.g., autofluorescence microscopy, quantitative phase imaging and reflectance confocal microscopy.

FM3D.2 • 11:00

Multifunctional Imaging for Monitoring Vaginal Health with Fractional Pixel CO_2 Treatment, Wenqi He[3,2], Saijun Qiu[3,2], Karla Lorente[1], Afiba Arthur[1], Yuchen Jiang[2,3], Yona Tadir[3], Felicia Lane[1], Zhongping Chen[3,2]; *[1]Department of Obstetrics and Gynecology, Univ. of California Irvine Medical Center, USA; [2]Biomedical Engineering, Univ. of California Irvine, USA; [3]Beckman Laser Inst., Univ. of California Irvine, USA.* Monitoring the vaginal health changes is crucial in evaluating the treatment effectiveness for patients with genitourinary syndrome of menopause (GSM). Here we developed a multifunctional OCT/OCTA/OCE system to offer comprehensive analysis of vaginal tissue.

FM3D.3 • 11:15
Experimental Comparison of Parametric Attenuation Models in Optical Coherence Tomography of Highly Scattering Media, Gavrielle Untracht[1], Morgane Zimmer[1], Lars Lindvold[1], Dominik Marti[1], Peter Andersen[1]; *[1]Danmarks Tekniske Universitet, Denmark.* We investigate the accuracy of several models for extracting optical properties of tissue from optical coherence tomography images and assess their suitability for use in highly scattering media.

FM3D.4 • 11:30
Pneumatic optical coherence tomography for robotic imaging in tortuous and large luminal organs, Tinghua Zhang[1], Chao Xu[1], Sishen Yuan[1], Peng Liu[1], Hongliang Ren[1], Wu Yuan[1]; *[1]The Univ. of Hong Kong, Hong Kong.* Endoscopic optical coherence tomography (OCT) faces significant challenges when used in tortuous and large luminal organs because of the lack of steerability. Here, we report a robotic OCT endoscopy based on pneumatic soft actuator.

FM3D.5 • 11:45 (Invited)
Dental OCT Prototype for Imaging Microstructure and Microcirculations in Oral Cavity, Ruikang K. Wang[1]; *[1]Univ. of Washington, USA.* We present innovative solutions of adaptive contour tracking and scanning to address the challenges of wide field of view, high speed and electrical dispersion in OCT imaging of oral cavity, aimed for clinical translations.

FM3D.6 • 12:15
Aberration-corrected High-resolution OCT Microprobe Using Liquid-shaped Freeform Microlens, Chao Xu[1], Tinghua Zhang[1], Peng Liu[1], Wu Yuan[1]; *[1]The Chinese Univ. of Hong Kong, Hong Kong.* This study introduces a novel liquid shaping technique, thereby facilitating scalable fabrication of disposable high-resolution OCT microprobes. This method allows for customization of distal freeform microlenses, which effectively corrects chromatic aberration and astigmatism, ultimately enabling high-performance imaging.

10:30 -- 12:30
Room: 3E
FM3E • Integrated Devices and Systems for Nonlinear Optics
Presider: Aseema Mohanty; Tufts Univ., USA

FM3E.1 • 10:30
SiN-based Kerr Optical Frequency Division for Stable mmWave Generation, Shuman Sun[1], Mark Harrington[2], Fatemehsadat Tabatabaei[1], Samin Hanifi[1], Beichen Wang[1], Zijiao Yang[1,3], Kaikai Liu[2], Jiawei Wang[2], Ruxuan Liu[1], Jesse Morgan[1], Steven Bowers[1], Paul Morton[4], Karl Nelson[5], Andreas Beling[1], Daniel Blumenthal[2], Xu Yi[1,3]; *[1]Department of Electrical and Computer*

Engineering, Univ. of Virginia, USA; [2]Department of Electrical and Computer Engineering, Univ. of California Santa Barbara, USA; [3]Department of Physics, Univ. of Virginia, USA; [4]Morton Photonics, USA; [5]Honeywell Aerospace Technologies, USA. Kerr optical frequency division is demonstrated with SiN-based reference and microcomb for stable mmWave generation. The phase noise is record-low for integrated photonic mmWave oscillators (-121 dBc/Hz at 10 kHz offset with 110 GHz carrier).

FM3E.2 • 10:45
Resonant non-reciprocal electro-optic frequency shifter in lithium niobate, Gwan In Kim[1], Violet Workman[2], Oğulcan E. Örsel[1], Jieun Yim[3], Seho Kim[1], Gaurav Bahl[3]; *[1]Electrical and Computer Engineering, Univ. of Illinois Urbana-Champaign, USA; [2]Physics, Univ. of Illinois Urbana-Champaign, USA; [3]Mechanical Science and Engineering, Univ. of Illinois Urbana-Champaign, USA.* We experimentally demonstrate a resonant non-reciprocal electro-optic frequency shifter in a LNOI photonic integrated circuit, reaching ~12 dB contrast for single sideband conversion in opposing directions.

FM3E.3 • 11:00
Exploring ultralow-loss cladding and packaging for integrated nonlinear nanophotonics, Atasi Dan[1,2], Jizhao Zang[1,2], Zachary L. Newman[1,3], David R. Carlson[1,3], Scott B. Papp[1,2]; *[1]Time and Frequency Division, National Inst. of Standards and Technology, USA; [2]Department of Physics, Univ. of Colorado Boulder, USA; [3]Octave Photonics, USA.* We explore silicon-dioxide cladding deposition of nonlinear nanophotonics devices, which are designed to generate soliton microcombs. We demonstrate ultralow-loss claddings that facilitate complex nonlinear phenomena, packaged device prototypes, and heterogeneous integration.

FM3E.4 • 11:15
Amorphous Metal-Oxide Mixtures for Integrated Nonlinear Photonics, Alexa R. Carollo[1,2], Jizhao Zang[1,2], Atasi Dan[1,2], Grant M. Brodnik[1,2], Haixin Liu[1,2], David R. Carlson[3], Jennifer A. Black[1], Scott B. Papp[1,2]; *[1]NIST Boulder, USA; [2]Physics, Univ. of Colorado Boulder, USA; [3]Octave Photonics, USA.* We explore integrated nonlinear photonics with amorphous metal-oxide mixtures of titania and tantala (TiO_2-Ta_2O_5). Our experiments demonstrate that designing titania-tantala material composition leads to increased microresonator quality factor and improved photonics layer properties.

FM3E.5 • 11:30
Monolithic 3D Integration of Tantala and Lithium Niobate on Silicon for $\chi^{(3)}$-$\chi^{(2)}$ Nonlinear Photonics, Grant M. Brodnik[1,2], Grisha Spektor[3], Lindell M. Williams[2,1], Jizhao Zang[1,2], Alexa R. Carollo[1,2], Atasi Dan[1,2], Jennifer A. Black[1], David R. Carlson[3], Scott B. Papp[1,2]; *[1]Time and Frequency Division, NIST Boulder Laboratories, USA; [2]Physics, Univ. of Colorado Boulder, USA; [3]Octave Photonics, USA.* We present 3D-integrated thin-film lithium niobate and tantala on a common silicon wafer for diverse, high-performance nonlinear optics. We demonstrate $\chi^{(2)}$ second-harmonic generation in periodically poled waveguides and $\chi^{(3)}$ soliton microcomb formation in high-Q tantala microresonators.

FM3E.6 • 11:45
Nonlinear Properties of Hybrid ZnTe-on-SiN Waveguides, Katherine Stoll[1], Harish Bhandari[2], Oleg Maksimov[2], Katherine Hansen[2], Lionel Kimerling[1], Anuradha Agarwal[1,4], Samuel Serna[3,1]; *[1]MIT, USA; [2]Radiation Monitoring Devices Inc, USA; [3]Bridgewater State Univ.,*

USA; [4]Materials Research Laboratory, Massachusetts Inst. of Technology, USA. A novel ZnTe-on-SiN waveguide system is presented and demonstrates a negligible TPA coefficient with a comparable nonlinear Kerr refractive index to conventional pure silicon to enable efficient nonlinear devices with minimal absorption loss.

FM3E.7 • 12:00 (Invited)
UV to MIR Frequency Combs with Thin-film Lithium Niobate Waveguides, Tsung-Han Wu[1]; *[1]Univ. of Colorado at Boulder, USA.* We investigate thin-film lithium niobate waveguides with chirped poling periods to achieve efficient supercontinuum generation through χ(2) and χ(3) nonlinearities. Utilizing these nonlinearities, we produce frequency combs that span from the blue to the mid-infrared range. Additionally, we apply this broadband frequency comb to various applications.

10:30 -- 12:30
Room: 3F
LM3F • Nanoscale Excitations and Dynamics
Presider: Matt Graham; Oregon State, USA

LM3F.1 • 10:30 (Invited)
Ultrafast Nano-Imaging: Probing Quantum Dynamics in Space and Time, Markus B. Raschke[1]; *[1]Univ. of Colorado at Boulder, USA.* We developed ultrafast nano-imaging in coherent and far-from equilibrium pump-probe modalities. In corresponding ultrafast movies we resolve the space-time evolution of fundamental quantum dynamics from the few-femtosecond coherent to the thermal transport regime.

LM3F.2 • 11:00 (Invited)
Spontaneous Polarization Induced Ultrafast Photovoltaic Effect and Non-volatile Optical Switch in Rhombohedral-Stacked MoS_2, Ziliang Ye[1]; *[1]Univ. of British Columbia, Canada.* Rhombohedrally stacked bilayer MoS_2 has a spontaneous electric polarization due to an asymmetric interlayer coupling, which can bring an efficient photovoltaic effect with a picosecond response time and a fast non-volatile switching behaviour for light.

LM3F.3 • 11:30
New quasiparticles in semiconductor moiré superlattices, Xiaoqin Li[1]; *[1]Univ. of Texas at Austin, USA.* We identify novel excited states in transition metal dichalcogenides (TMD) homobilayers. Optical resonances in $MoSe_2$ bilayers change with variations in twist angle and doping. "Charge-transfer" trions emerge in those bilayers with gradual atomic alignment variations.

LM3F.4 • 11:45
Characterizing the nanoscale transport properties of nanostructured semiconductors using extreme ultraviolet high harmonic beams, Emma Nelson[1], Brendan McBennett[1], Albert Beardo[1], Theodore Culman[1], Henry Kapteyn[1,2], Margaret Murnane[1], Joshua Knobloch[1]; *[1]JILA, USA; [2]KM Labs Inc., USA.* We use ultrafast, extreme ultraviolet high harmonic beams to fully characterize a silicon metalattice, a novel nanostructured semiconductor material. We then develop a general, predictive model for the highly-confined heat flow behavior in nanostructured materials.

LM3F.5 • 12:00 (Invited)
Driving Floquet Physics with Excitons in 2D Materials, Felipe Jornada[1]; [1]*Stanford Univ., USA.* Using first-principles time-dependent adiabatic GW calculations, we show that excitons can drive strong changes in the electronic properties of materials through an exciton-driven Floquet effect.

14:00 -- 15:30
Room: 3A
FM4A • Quantum Technologies Theme: Quantum Computing Applications
Presider: Karan Mehta; Cornell Univ., USA

FM4A.1 • 14:00 (Invited)
Advancing Toward Scientific Quantum Advantage, Krysta Svore[1]; [1]*Microsoft Corp, USA.* We've entered the era of reliable quantum computing. Hear more about the most reliable logical qubits on record, and the path to scientific quantum advantage through the collective advancement of AI, supercomputing, and quantum.

FM4A.2 • 14:30 (Invited)
Quantum Theme Invited Speaker: Title to be Announced, Nathan Wiebe[1]; [1]*Univ. of Toronto, Canada.* Abstract not available.

FM4A.3 • 15:00 (Invited)
Quantum Chaos and Dual Unitary Systems: Pushing the Boundaries of Science with Quantum Computers, Sabrina Maniscalco[1]; [1]*Univ. of Helsinki, Finland.* In this talk, I will present our pioneering work, obtained in collaboration with IBM and Trinity College Dublin, leveraging state-of-the-art error mitigation techniques to simulate the decay of auto-correlation functions in quantum chaotic many-body systems, a key challenge for near-term quantum computers. These functions are vital for understanding transport properties, such as conductivity and diffusion, and for addressing fundamental questions in non-equilibrium quantum dynamics.

14:00 -- 15:30
Room: 3B
FM4B • Optical Encoding, Diffractive Processors and Neural Networks
Presider: Kaoru Minoshima; Univ. of Electro-Communications, Japan and Florian Willomitzer

FM4B.1 • 14:00 (Invited)
Nonlinear Optical Encoding With Multiple Linear Scattering, Hui Cao[1]; [1]*Yale Univ., USA.* We exploit the passive nonlinear mapping inside a multiple-scattering cavity for rapid optical information processing. High-order structural nonlinearity fosters the generation of low-dimensional latent feature space and facilitates strong data compression to enhance computing performance.

FM4B.2 • 14:30
Concealment of secret messages into ordinary images using diffractive processors, Yuhang Li[1], Bijie Bai[1], Ryan Lee[1], Tianyi Gan[1], Yuntian Wang[1], Mona Jarrahi[1], Aydogan

Ozcan[1]; *[1]Univ. of California Los Angeles, USA.* We present an information-hiding camera that conceals secret messages and information into ordinary images, deceiving human perception. These images are securely decoded by a jointly optimized neural network to retrieve the original message.

FM4B.3 • 14:45
Physics-informed neural networks for classical and quantum communication with multimode fibers, Qian Zhang[1], Jiali Sun[1], Stefan Rothe[2], Juergen W. Czarske[1,3]; *[1]Chair of Measurement and Sensor System Technique, Technische Universitat Dresden, Germany; [2]Department of Applied Physics, Yale Univ., USA; [3]Inst. of Applied Physics, Technische Universitat Dresden, Germany.* Physics-informed neural networks provide mode decomposition based on intensity-only images in high-dimensional quantum communication using multimode fibers.

FM4B.4 • 15:00
Neural Network-Based Orbital Angular Momentum Multiplexing via a Camera-in-the-Loop Approach, Nima Asoudegi[1], Mo Mojahedi[1]; *[1]Univ. of Toronto, Canada.* We employ a gradient descent method and a neural network, along with a learned propagation model, to design orbital angular momentum multiplexed holograms. This approach significantly enhances information capacity and image fidelity.

FM4B.5 • 15:15
Stress-Programmable Out-of-plane Interposers for 3-D Photonic Integration & Control, Yanan H. Wen[1], Andrew Greenspon[1], Alex Witte[1], Andrew Leenheer[2], Gerald Gilbert[1], Matt Eichenfield[2,3], Dirk Englund[4]; *[1]MITRE Corp, USA; [2]Sandia National Laboratories, USA; [3]The Univ. of Arizona James C Wyant College of Optical Sciences, USA; [4]Massachusetts Inst. of Technology, USA.* We demonstrate a method for programmable 3D deflection of MEMS cantilevers using directional stress-engineering of the cantilever film stack as a potential solution for 2.5- and 3-D opto-electronic packaging, integration and control.

14:00 -- 15:30
Room: 3C
FM4C • Utilizing Optical Fiber Networks for Sensing and Time Transfer
Presider: Giovanni Milione; NEC Laboratories America Inc., USA

FM4C.1 • 14:00 (Invited)
Ultrastable Optical Signal Transfer Over Deployed Multi-Core Fiber, Nazanin Hoghooghi[1]; *[1]NIST Boulder, USA.* Abstract not available.

FM4C.2 • 14:30
Towards Free-Space Time and Frequency Transfer With Optically-Derived Millimeter Waves, Dylan Meyer[1], Alexander Lind[1,2], Igor Kudelin[1,2], William Groman[2,3], Jeff Sherman[2], Franklyn Quinlan[1,2], Scott Diddams[1,2]; *[1]Electrical, Computer, and Energy Engineering, Univ. of Colorado Boulder, USA; [2]Time and Frequency Division, National Inst. of Standards and Technology, USA; [3]Physics, Univ. of Colorado Boulder, USA.* Optically derived 90 GHz carriers are generated via electro-optic frequency combs. The carrier noise characteristics are analyzed to evaluate effects of free-space transmission on stability and phase noise.

FM4C.3 • 14:45 (Invited)
Machine Learning and Distributed Acoustic Sensing over Optical Fiber Networks to Monitor Critical Infrastructure, Tingfeng Li[1]; [1]*NEC Labs America, USA.* Abstract not available.

14:00 -- 15:30
Room: 3D
FM4D • Advanced Neuro-Optics and Optical Fabrication
Presider: Rongguang Liang; Univ of Arizona, Coll of Opt Sciences, USA

FM4D.1 • 14:00
Estimation and Comparison of Brainstem Fiber Orientation Via Diffusion MRI Tractography and Polarization Sensitive Optical Coherence Tomography, Isabella Aguilera[1], Elizabeth Hutchinson[1], Travis Sawyer[1]; [1]*The Univ. of Arizona, USA.* dMRI-based tractography methods reconstruct neural pathways but often lack detailed microstructural information. This study compares fiber orientation distributions in the human brainstem obtained through Constrained Spherical Deconvolution tractography and Polarization Sensitive Optical Coherence Tomography.

FM4D.2 • 14:15 (Invited)
3D-Printed Glass Micro-Optics for Biomedical Imaging Applications, Rongguang Liang[1]; [1]*Univ of Arizona, Coll of Opt Sciences, USA.* This presentation will highlight advances in 3D-printed glass optics, showcasing their impact on biomedical imaging technologies like microscopes and endoscopes, while addressing challenges and future developments in 3D printing optics.

FM4D.3 • 14:45
3D Printed Freeform Silica Microlens for Ultrathin High-performance OCT Endoscopy, Chao Xu[1], Zhihan Hong[2], Rongguang Liang[2], Wu Yuan[1]; [1]*Department of Biomedical Engineering, The Chinese Univ. of Hong Kong, Hong Kong;* [2]*College of Optical Sciences, Univ. of Arizona, USA.* Traditional fabrication techniques for miniature optical coherence tomography (OCT) endoscopes face difficulties, including compromised imaging quality and restricted design flexibility. To overcome these challenges, we have developed an ultrathin OCT endoscope with high imaging performance by leveraging 3D printed freeform silica microlenses.

14:00 -- 15:30
Room: 3E
FM4E • Frequency Combs, High-Harmonic Generation, and Attoscience II
Presider: Frank Wise; Cornell University, United States

FM4E.1 • 14:00 (Invited)
Structuring Light Pulses on the Attosecond Scale, Carlos Hernández-García[1]; [1]*Universidad de Salamanca, Spain.* Attosecond light pulses structured in their spatial intensity, phase and polarization profiles can be designed thanks to high-order harmonic generation. We report the latest advances including generation of attosecond vortex pulses with controlled angular momenta

FM4E.2 • 14:30

A Dual-Branch Frequency Comb for Molecular Vibrational Spectroscopy, Sichong Ma[2,1], Peter Chang[2,1], Tsung-Han Wu[2,3], Sida Xing[4], Zhimin Liu[1,3], Dietrich Leibfried[1,3], Chin-wen Chou[1,3], Scott Diddams[2,1]; *[1]Department of Physics, Univ. of Colorado Boulder, USA; [2]Department of Electrical, Computer and Energy Engineering, Univ. of Colorado Boulder, USA; [3]Time and Frequency Division, National Inst. of Standards and Technology, USA; [4]Shanghai Inst. of Optics and Fine Mechanics Chinese Academy of Sciences, China.* We present a dual-branch frequency comb producing light at 1550 nm and 1920 nm for precision vibrational Raman spectroscopy of a single CaH^+ molecular ion.

FM4E.3 • 14:45

Using Open-Path Dual-Comb Spectroscopy to Monitor Methane Mitigation by Altering Cattle Diet, Chinthaka Weerasekara[2], Nathan Malarich[1], Kevin Cossel[1], Stephen Welch[2], Brett DePaola[3], Cosmin Blaga[3], Ian Coddington[1], Jaymelynn Farney[4], Sarah Sexton-Bowser[2,5], James Drouillard[4], Eduardo Santos[2], Brian R. Washburn[1]; *[1]National Inst. of Standards & Technology, USA; [2]Agronomy, Kansas State Univ., USA; [3]physics, Kansas State Univ., USA; [4]Animal Science and Industry, Kansas State Univ., USA; [5]Center for Sorghum Improvement, Kansas State Univ., USA.* A sorghum diet may reduce cattle methane emission with an unknown change in ammonia production. Dual comb spectroscopy is used to monitor methane and ammonia emissions over months from two cattle groups with different diets.

FM4E.4 • 15:00 (Invited)

Atomic-Scale Imaging of Valence Electron Dynamics in Space and Time, David A. Reis[1]; *[1]Stanford Univ., USA.* We report measurements of local symmetry breaking of interstitial electrons in silicon via nonlinear x-ray-optical mixing and other recent progress towards imaging valence electron motion on the atomic-scale in space and time.

14:00 -- 15:30
Room: 3F
LM4F • Attosecond and X-ray Light Sources
Presider: Michael Zuerch; Univ. of California at Berkeley, USA

LM4F.1 • 14:00

Development, Characterization, and Applications of Laser-driven X-ray Sources at ELI Beamlines, Jaroslav Nejdl[1]; *[1]ELI Beamlines, Czechia.* The ELI Beamlines facility advances laser-driven sources of high-flux, coherent XUV and X-ray pulses. Key developments include precisely tunable high-order harmonics and advanced sources based on relativistic laser-matter interaction, employing both under-critical and over-dense plasmas.

LM4F.2 • 14:15

Full Polarization Characterization of a Broadband High-harmonic Source, Lenard Gulyas Oldal[1], Barnabas Gilicze[1], Tamas Bartyik[1], Daniel Kiss[1], Fabio Frassetto[3], Gabriele Zeni[3], Luca Poletto[3], Tamas Csizmadia[1], Balazs Major[1,2]; *[1]ELI-HU Nonprofit Kft, Hungary; [2]Department of Optics and Quantum Electronics, Szegedi Tudomanyegyetem, Hungary; [3]Consiglio Nazionale delle Ricerche, Italy.* We present full characterization and demonstrate impurities in the polarization state of a high-harmonic source using a double-stage extreme-ultraviolet

polarimeter and an in-situ method based on photoelectron momentum distributions recorded by a Reaction Microscope.

LM4F.3 • 14:30 (Invited)
Isolated Attosecond Pulse Generation and Field-Resolved Spectroscopy with Turn-Key Lasers, Michael Chini[1]; [1]*The Ohio State Univ., USA.* Attosecond pulses can provide access to electron dynamics in atoms, molecules and solids, but the required lasers remain inaccessible to many laboratories. Here, we describe progress in generating isolated attosecond pulses from turn-key lasers.

LM4F.4 • 15:00 (Invited)
Attosecond X-ray Free-Electron Lasers, Agostino Marinelli[1]; [1]*SLAC National Accelerator Laboratory, USA.* In my talk I will discuss the development of attosecond x-ray free-electron lasers and their application to ultrafast science at the LCLS: from the early demonstration of attosecond pulses the recent demonstration of pump/probe spectroscopy.

16:00 -- 18:00
Room: 3A
FM5A • Quantum Technologies Theme: Quantum Networking and Photonic Integrated Circuits
Presider: David Hayes; Quantinuum, USA

FM5A.1 • 16:00 (Invited)
Scalable Diamond and Silicon Carbide Quantum Systems, Souvik Biswas[1], Jelena Vuckovic[1]; [1]*Ginzton Laboratory, Stanford Univ., USA.* We demonstrate a scalable integrated platform for quantum technologies based on photonically interfaced spin qubits in diamond and silicon carbide, and show all-to-all interactions of up to 10 color centers strongly coupled to a resonator.

FM5A.2 • 16:30 (Invited)
Towards a Practical Quantum Repeater, Mehdi Namazi[1]; [1]*Qunnect Inc., USA.* Abstract not available.

FM5A.3 • 17:00 (Invited)
Single Photon Detectors for Communication and Sensing, Val Zwiller[1]; [1]*Kungliga Tekniska Hogskolan Kista, Sweden.* We develop superconducting single photon detectors with the highest time resolution and detection efficiency. A wide range of applications are enabled by our single pixel and arrays of detectors.

FM5A.4 • 17:30 (Invited)
Integrated Quantum Photonics in Thin Film Lithium Niobate, Laura Padberg[1]; [1]*Universitat Paderborn, Germany.* We show our development on devices in thin film lithium niobate that enable the realization of quantum optical applications on chip. We present the design, fabrication and characterization of these devices.

16:00 -- 18:00
Room: 3B
FM5B • Wavefront Techniques, and Intelligent Optics
Presider: Prathan Buranasiri; KMITL, Thailand and Hiroshi Yoshikawa; Nihon Univ., Japan

FM5B.1 • 16:00 (Invited)
Wavefront Reconstruction from Propagation Through Turbulence, Abbie T. Watnik[1]; *[1]US Naval Research Laboratory, USA.* This presentation will discuss novel methods in wavefront reconstruction including plenoptic wavefront sensing, digital holography and machine-learning-based techniques for beam correction and correct through atmospheric turbulence.

FM5B.2 • 16:30 (Invited)
Optical Design for Quantum-Limited Wavefront Cameras, David J. Brady[1]; *[1]Univ. of Arizona, USA.* Quantum fluctuations limit the accuracy of wavefront characterization in unprepared states to one photon per mode. Here we describe the optical design and system performance of wavefront sensors that approach this limit.

FM5B.3 • 17:00
Withdrawn

FM5B.4 • 17:15
Optical SIMD logic gate utilizing parallelism, Ryosuke Mashiko[1], Makoto Naruse[1], Ryoichi Horisaki[1]; *[1]The Univ. of Tokyo, Japan.* We propose a novel optical SIMD logic gate termed diffraction casting (DC) by utilizing spatial parallelism of light. Numerical demonstration showcased the versatile virtue of DC including high scalability and the realization in end-to-end optical computing.

FM5B.5 • 17:30
Fourier ptychographic microscopy and its applications in whole slide imaging system via feature-domain computational framework, An Pan[1], Shuhe Zhang[2], Aiye Wang[1]; *[1]XIOPM, China; [2]Department of Precision Instruments, Tsinghua Univ., China.* A feature-domain framework is reported for Fourier ptychographic microscopy, termed FD-FPM, to realize full-FOV reconstruction and reduce the accuracy requirement, achieving data acquisition of 4s/slide at 336nm spatial resolution with the FOV of 4.7mm diameter.

FM5B.6 • 17:45
Intelligent Prediction and Discovery of Nonlinear Optics Using Fourier Domain Physics Informed Neural Networks, Jonathan Musgrave[1], ShuWei Huang[1]; *[1]Univ. of Colorado Boulder, USA.* We present a novel physics informed machine learning method which incorporates temporal and frequency domain physics to discover and predict ultrafast nonlinear optical systems with sparse and noisy data.

16:00 -- 18:00
Room: 3C
FM5C • Photonic and Atomic Quantum Technologies
Presider: Giovanni Milione; NEC Laboratories America Inc., USA

FM5C.1 • 16:00 (Invited)
Direct Electro-Optic Transduction for High Bandwidth Entanglement Distribution, Chris Axline[1], Phoebe Tengdin[1], Stephan Gamper[1], Aleksandr Tusnin[1], Moritz Businger[1], Guilhem Alma[1], Daniel Brau[1]; [1]*Miraex SA, Switzerland.* Quantum interconnects will be key to scale quantum computers and deploy quantum networks. I discuss what is required to realize practical, high-bandwidth quantum interconnects using microwave-to-optical transducers based on integrated photonics.

FM5C.2 • 16:30
Efficient and Deterministic InAs/GaAs Quantum Dot Single-Photon Source Emitting Directly in the Original Telecommunications Band (O-band), Marcus Albrechtsen[1], Matéo Vernet[1], Yu Meng[1], Nikolai Spitzer[2], Mikkel Thorbjørn Mikkelsen[1], Rodrigo Adriano Thomas[1], Andreas Wieck[2], Peter Lodahl[1], Arne Ludwig[2], Leonardo Midolo[1]; [1]*Univ. of Copenhagen, Denmark;* [2]*Lehrstuhl für Angewandte Festköperphysik, Ruhr-Universität Bochum, Germany.* We demonstrate efficient, pure and on-demand InAs quantum dots in GaAs membranes that emit directly in the telecom O-band (~1310 nm) with > 1 MHz count rates, compatible with existing quantum communication infrastructure.

FM5C.3 • 16:45
Two Photon Tripartite Entanglement Transfer via Time-Multiplexed Quantum Walks, Jonas Lammers[1], Federico Pegoraro[1], Philip Held[1], Benjamin Brecht[1], Christine Silberhorn[1]; [1]*Paderborn Univ., Integrated Quantum Optics, Inst. for Photonic Quantum Systems (PhoQS), Germany.* We experimentally study the transfer of multiparticle qubit entanglement towards qubit-qudit entanglement via modal entanglement in a time-multiplexed discrete-time quantum walk. We verified this transfer via the von Neumann entropy and performing steering-like experiments.

FM5C.4 • 17:00
Compressive Tomography of Unstructured High-Dimensional Photonic Entanglement, Will McCutcheon[1], Suraj Goel[1], Natalia Herrera Valencia[1], Saroch Leedumrongwatthanakan[1], Mehul Malik[1]; [1]*Heriot-Watt Univ., UK.* Entanglement-based quantum networks require characterising resources shared between distant nodes. We distribute high-dimensional (d=131x131 >2^14) entangled states through multi-mode fibres, characterise them using compressive sensing (compression ratios <0.00103) and certify reconstruction fidelity (F> 0.9441).

FM5C.5 • 17:15
Programable High-dimensional Quantum Gates via MPLC, Daniel Dahl[1], Martin Plöschner[1], Nicolas Fontaine[2], Jacqui Romero[1], Joel Carpenter[1]; [1]*The Univ. of Queensland, Australia;* [2]*Nokia Bell Labs, USA.* We use multi-plane light conversion (MPLC) to implement a programmable high-dimensional quantum gate device for 17-dimensional qudits using Laguerre-Gaussian modes. Verified gates include X-gate, Z-gate, and Discrete Fourier Transform (DFT)-gate, enhancing quantum communication and computing.

FM5C.6 • 17:30
Co-transmission of Quantum and Coherent Signals on a Single Frequency Channel via the Serrodyne Technique, Philip Rübeling[1], Jan Heine[1], Robert Johanning[1], Michael Kues[1]; [1]*Leibniz Universität Hannover, Germany.* Co-transmission of coherent signals and frequency-

entangled photons over a single frequency channel is experimentally demonstrated via the serrodyne technique. Our approach preserves entanglement and paves the way towards scalable and efficient hybrid quantum coherent networks.

FM5C.7 • 17:45
Quantum-Enhanced Rotation Sensing and Interferometer Stabilization Using Wavefront Photonic Gears, Guy Tshuva[1], Ofir Yesharim[1], Ady Arie[1]; *[1]Tel Aviv Univ., Israel.* We present a compact, efficient rotation sensor using structured light and bright N00N states. It employs opposite spiral phase plates to convert mechanical rotation into wavefront phase shifts, stabilized by quantum PID control.

16:00 -- 18:00
Room: 3D
FM5D • Advanced Optics in Microscopy and Sensing
Presider: Maciej Trusiak; Politechnika Warszawska, Poland

FM5D.1 • 16:00
Diffraction minima resolve point scatterers at tiny fractions (1/80) of the wavelength, Thomas A. Hensel[1], Jan O. Wirth[2], Stefan W. Hell[1,2]; *[1]MPI NAT, Germany; [2]Nanoscopy, Max Planck Inst. for Medical Research, Germany.* Diffraction usually limits the discernment of close point scatterers. We show that a diffraction minimum instead of a maximum allows to resolve multiple indistinguishable point scatterers at tiny fractions (1/80) of the employed wavelength.

FM5D.2 • 16:15
Near-isotropic Super-resolved Imaging with Reflection-engineered Speckle Illumination, Hajun Yoo[1], Kwanhwi Ko[1], Sukhyeon Ka[1], Gwiyeong Moon[1], Hyunwoong Lee[1], Seongmin Im[1], Donghyun Kim[1]; *[1]School of Electrical and Electronic Engineering, Yonsei Univ., Korea (the Republic of).* We enhanced 3D wide-field fluorescence microscopy using reflection-engineered speckle illumination. Experiments with fluorescent beads and U87-MG cell membranes demonstrated that this method provides near-isotropic resolution enhancement, achieving close to 100 nm super-resolution in all directions.

FM5D.3 • 16:30
SpiralVortex Superresolution Localization With a Stable Excitation Beam, Samantha G. Reynolds[1], Patrick Fowler[1], Andrew A. Voitiv[1], Deigo Restrepo[2], Emily Gibson[3], Juliet Gopinath[4,5], Mark Siemens[1]; *[1]Univ. of Denver, USA; [2]Department of Cell and Developmental Biology, Univ. of Colorado Anschutz Medical Campus, USA; [3]Department of Bioengineering, Univ. of Colorado Anschutz Medical Campus, USA; [4]Department of Electrical, Computer, and Energy Engineering, Univ. of Colorado Boulder, USA; [5]Department of Physics, Univ. of Colorado Boulder, USA.* We propose and demonstrate SpiralVortex superresolution localization, in which fluorescence is measured while a dark spot spirals out from the center of a stationary excitation beam. The stable beam offers potential for superresolution at depth.

FM5D.4 • 16:45
Enhancing Passive Upconversion Imaging in the Near-Infrared Using Nanostructures, Rabeeya Hamid[3], Demeng Feng[3], Emma Belliveau[1], Manchen Hu[1], Justin Edwards[3], Minjeong Kim[3], Pournima Narayanan[1], Chenghao Wan[1], David Czaplewski[2], Daniel Congreve[1], Mikhail

Kats[3]; [1]*Stanford Univ., USA;* [2]*Argonne National Laboratory, USA;* [3]*Univ. of Wisconsin-Madison, USA.* We demonstrate high-resolution upconversion imaging without any external power input at near-infrared intensities approaching nightglow levels. This is achieved through a combination of materials engineering combined with nanostructures that enhance the absorption of incident near-infrared light and collection of emitted visible light.

FM5D.5 • 17:00 (Invited)
Ultra-sensitive Label-free Plasmonic Biosensing based on Detection of Goos-Hänchen (GH) Shifts, Ho-Pui Ho[1]; [1]*The Chinese Univ. of Hong Kong, Hong Kong.* We report the possibility of achieving label-free sensing of biomolecules in the femto molar regime by the detecting the Goos-Hänchen (GH) shift (lateral displacement of the p-polarisation) near the plasmonic absorption dip. Compared to the conventional phase-sensitive scheme, which is well-known for offering high detection sensitivity due to the steep phase jump across the resonance dip, the reported GH scheme has much less complex optical setup because of the absence of an interferometer.

FM5D.6 • 17:30 (Invited)
Lensless Digital Holographic Microscopy - a Cost-Effective and Easy Way for High-Throughput Label-Free Bio-Examination, Piotr Arcab[1], Maciej Trusiak[1]; [1]*Warsaw Univ. of Technology, Poland.* Abstract not available.

16:00 -- 18:00
Room: 3E
FM5E • Silicon Photonics and Heterogeneous Integration
Presider: Robert Devlin; Metalenz Inc., USA

FM5E.1 • 16:00 (Invited)
Heterogeneously Integrated Silicon Photonics, Duanni Huang[1]; [1]*Intel Corporation, USA.* We review the latest advancements in Intel's 300mm silicon photonics platform for emerging applications such as high bandwidth density optical compute interconnects.

FM5E.2 • 16:30
Heterogeneous integration of single-frequency lasers at 980 nm, Nima Nader[1], Eric J. Stanton[1,2], Grant M. Brodnik[2,3], Nusrat Jahan[1,2], Skyler C. Weight[1,2], Ali E. Dorche[1,2], Lindell M. Williams[2,3], Kevin L. Silverman[1], Sae Woo Nam[1], Scott B. Papp[3], Richard P. Mirin[1]; [1]*Applied Physics Division, National Inst. of Standards and Technology, USA;* [2]*Univ. of Colorado Boulder, USA;* [3]*Time and Frequency Division, National Inst. of Standards and Technology, USA.* We present distributed feedback (DFB) diode lasers heterogeneously integrated with tantalum pentoxide (Ta_2O_5/tantala) waveguides. DFB gratings etched in tantala waveguides provide the necessary feedback for single mode lasing with 43 dB side mode suppression ratio.

FM5E.3 • 16:45
Heterogeneously Integrated Near-Infrared Fabry-Perot Diode Laser on Tantalum Pentoxide, Nima Nader[2], Nusrat Jahan[1,2], Skyler C. Weight[1,2], Eric J. Stanton[4,1], Ali E. Dorche[3,1], Kevin L. Silverman[2], Richard P. Mirin[2]; [1]*Physics, Univ. of Colorado Boulder, USA;* [2]*Applied Physics Division, National Inst. of Standards and Technology, USA;* [3]*Nexus Photonics, USA;* [4]*EMode Photonix, USA.* We present a Fabry-Perot diode laser heterogeneously integrated

with tantalum pentoxide (Ta_2O_5/tantala) waveguides on a silicon substrate. Devices with etched facet and tantala loop mirrors, and of varying lengths and widths, are characterized.

FM5E.4 • 17:00 (Invited)

Enhancing Telecommunication and Data Communication with Silicon Integrated Photonics, Winnie N. Ye[1]; [1]*Carleton Univ., Canada.* This paper presents our advancements in silicon integrated photonics for telecommunication and data communication. Key innovations include integrated subwavelength gratings, with promising improvements in device performance and fabrication tolerance.

FM5E.5 • 17:30

Mid-Infrared QCL Core Arrayed Waveguide Gratings, Tushar Sanjay Karnik[1], Laurent Diehl[2], Qingyang Du[1], Christian Pfluegl[2], Daryoosh Vakhshoori[2], Juejun Hu[1]; [1]*Massachusetts Inst. of Technology, USA;* [2]*Pendar Technologies LLC, USA.* We report the fabrication of arrayed waveguide gratings on a quantum cascade laser (QCL) wafer. The waveguides employ a strained InGaAs/InAlAs gain medium as the core material grown on an InP substrate.

FM5E.6 • 17:45

Chip-scale high-performance photonic microwave oscillator, Yang He[1], Long Cheng[1], Heming Wang[1], Yu Zhang[2], Roy Meade[2], Kerry Vahala[3], Mian Zhang[2], Jiang Li[1]; [1]*hQphotonics Inc, USA;* [2]*HyperLight Corporation, USA;* [3]*California Inst. of Technology, USA.* We report a chip-scale high performance photonic microwave oscillator based on integrated electro-optical frequency division, which achieves a phase noise level of -141 dBc/Hz at 10 kHz offset for scaled 10 GHz carrier output.

16:00 -- 18:00
Room: 3F
LM5F • Strong-Field Driven Quantum Phenomena in Materials and Gases
Presider: Shambhu Ghimire; SLAC National Accelerator Laboratory, USA

LM5F.1 • 16:00 (Invited)

High-Harmonic Generation in Strongly Correlated Insulators, Yuta Murakami[5], Kento Uchida[3], Shintaro Takayoshi[1], Akihisa Koga[2], Koichiro Tanaka[3], Philipp Werner[4]; [1]*Konan Daigaku Rikogakubu, Japan;* [2]*Tokyo Kogyo Daigaku, Japan;* [3]*Kyoto Daigaku, Japan;* [4]*Universite de Fribourg, Switzerland;* [5]*Rikagaku Kenkyujo, Japan.* We discuss the physics of high-harmonic generation in the Mott insulator, a standard strongly correlated state. We reveal the important role of many-body elemental excitations as well as correlations between charge and spin.

LM5F.2 • 16:30 (Invited)

From Ultrafast Electron Emission with Non-Classical Light to Valley Currents from Quantum Materials Based on Light-Dressing, Peter Hommelhoff[1], Jonas Heimerl[1], Daniel Lesko[1], Stefan Meier[1], Tobias Weitz[1], Weihze Li[1]; [1]*Friedrich-Alexander-Universität, Germany.* Electron emission from sharp needle tips with ultrashort pulses of bright squeezed vacuum light is investigated experimentally. Further, strong two-color driving of graphene results in valley currents and light-dressed Floquet-Bloch states.

LM5F.3 • 17:00 (Invited)

Photon Bunching in High-Harmonic Emission Controlled by Quantum Light, Giulio Vampa[1], Samuel Lemieux[1], Sohail Jalil[1], David Purschke[1], Neda Boroumand[1], David Villeneuve[1], Andrei Naumov[1], Thomas Brabec[1]; *[1]Joint Attosecond Science Laboratory, National Research Council of Canada and Univ. of Ottawa, Canada.* Perturbing high-harmonic emission from a semiconductor with a bright squeezed vacuum field results in the emission of sidebands of the high-harmonics that exhibit super-Poissonian statistics, indicating that the emitted photons are *bunched*. Our results suggest that perturbing strong-field dynamics with quantum-optical states is a viable way to coherently control the generation of these states at short wavelengths.

LM5F.4 • 17:30

Quantum-Optical Characterization of High Harmonic Emission from Non-Centrosymmetric Solid-State Media, Julita Poborska[1], Igor Tyulnev[1], Viktoriia Shiriaeva[1], Oscar Beltrán[1], Lenard Vamos[1], Jens Biegert[1,2]; *[1]Institut de Ciencies Fotoniques, Spain; [2]Institucio Catalana de Recerca i Estudis Avancats, Spain.* We characterize the quantum nature of high harmonic radiation from the non-centrosymmetric solid-state systems by measuring the intensity auto- and cross-correlation of selected even and odd harmonic orders and evaluating the Cauchy-Schwartz inequality.

LM5F.5 • 17:45

Generation of High-order Harmonic Spatiotemporal and Spatiospectral Optical Vortices, Rodrigo Martín Hernández[1,3], Guan Gui[2], Luis Plaja[1,3], Henry Kapteyn[2], Margaret Murnane[2], Miguel A. Porras[4], Chen-Ting Liao[2,5], Carlos Hernández-García[1,3]; *[1]Grupo de Investigación en Aplicaciones del Laser y Fotonica, Universidad de Salamanca, Spain; [2]JILA and Department of Physics, Univ. of Colorado Boulder, USA; [3]Unidad de Excelencia en Luz y Materia Estructuradas (LUMES), Universidad de Salamanca, Spain; [4]Grupo de Sistemas Complejos, ETSIME, Universidad Politecnica de Madrid, Spain; [5]Department of Physics, Indiana Univ., USA.* Spatiotemporal (STOV) and spatiospectral (SSOV) optical vortices are unique structured light tools for exploring ultrafast laser-matter interactions. We theoretically and experimentally study the high-topological charge extreme-ultraviolet/attosecond regime STOV and SSOV generation through high-order harmonic generation.

Tuesday, 24 September

08:00 -- 09:00
Room: 3A
FTu1A • Virtual Reality and Augmented Vision Theme: Perception
Presider: Praneeth Chakravarthula; UNC-Chapel Hill, USA

FTu1A.1 • 08:00 (Invited)
Perceptually-Guided Multi-Color Holograms Unlock Brighter Images in Holographic Displays, Kaan Aksit[1]; [1]*Univ. College London, UK.* This talk introduces an emerging hologram type known as Multi-color holograms. These holograms can provide brighter scenes and improve refresh rates in standard holographic displays without requiring any major hardware modifications in these displays.

FTu1A.2 • 08:30 (Invited)
Toward Human-Centered XR: Bridging Cognition and Computation, Qi Sun[1]; [1]*New York Univ., USA.* Virtual and Augmented Reality enables unprecedented possibilities for displaying virtual content and sensing physical surroundings. We will discuss some of our research on leveraging eye/muscular sensing and learning to model our perception, reaction, and sensation in virtual environments.

08:00 -- 09:00
Room: 3B
FTu1B • Surface and Nanostructure Metrology
Presider: Guoqiang Li; Fudan Univ., USA

FTu1B.1 • 08:00 (Invited)
Vision Ray Metrology for the Metrology of Optical Freeform Surfaces, Konstantinos Falaggis[1], Ana Hiza R. Andrade[1]; [1]*Univ of North Carolina at Charlotte, USA.* Vision Ray Metrology is a novel technique for measuring freeform optics in transmission. This work examines converting geometric wavefronts into height measurements, emphasizing the impact of sample back surface flatness and telecentricity on accuracy.

FTu1B.2 • 08:30
Extreme Ultraviolet Scatterometry for Characterizing Nanometer Scale Features in a Damascene Sample, Clay Klein[1], Nicholas W. Jenkins[1], Yunzhe Shao[1], Yunhao Li[1], Seungbeom Park[2], Wookrae Kim[3], Henry Kapteyn[1,4], Margaret Murnane[1]; [1]*Physics, JILA & STROBE NSF Science & Technology Center, Univ. of Colorado & NIST, USA;* [2]*Core Technology R&D Team, Mechatronics Research, Samsung Electronics Co., Ltd., Korea (the Republic of);* [3]*Advanced Process Development Team, Samsung Electronics Co., Ltd, Korea (the Republic of);* [4]*Kapteyn-Murnane Laboratories Inc, USA.* We characterize nanoscale out-of-plane features on an industrially relevant semiconductor sample using a coherent extreme ultraviolet high harmonic generation source at 29nm. The advantages of using 13.5nm light are also shown.

FTu1B.3 • 08:45

Multi-Modal Extreme-Ultraviolet Reflectometer: Solving Inverse Problems in Nanostructure Metrology, Yunzhe Shao[3], Nicholas W. Jenkins[3], Clay Klein[3], Yunhao Li[3], Yuka Esashi[3], Michael Tanksalvala[3,2], Margaret Murnane[3], Henry Kapteyn[3,1]; *[1]KMLabs Inc., USA; [2]National Inst. of Standards and Technology, USA; [3]Physics, Univ. of Colorado Boulder, USA.* We present a unique instrument, designed to characterize the composition, geometry, topography, and interface quality of 2D heterostructures. We demonstrate three modes of characterizations, including reflectometry, scatterometry, and coherent diffractive imaging reflectometry.

08:00 -- 09:00
Room: 3C
FTu1C • Nano-Devices and Applications
Presider: Chris Axline; Miraex SA, Switzerland

FTu1C.1 • 08:00 (Invited)
Nano-Mechanical Photonic Integrated Circuits with Quantum Dots, Leonardo Midolo[1]; *[1]Niels Bohr Inst., Kobenhavns Universitet, Denmark.* I will present recent advances in generating and routing single photons on-chip using quantum dots and reconfigurable photonic devices based on nano-mechanical motion and discuss the challenges in scaling up the technology further.

FTu1C.2 • 08:30
Multi-degree-of-freedom control of nonlinear optical two-dimensional quantum, Haoning Tang[2], Yiting Wang[2], Xueqi Ni[2], Kenji Watanabe[1], Takashi Taniguchi[1], Shanhui Fan[3], Eric Mazur[2], Amir Yacoby[2], Yuan Cao[4]; *[1]Busshitsu Zairyo Kenkyu Kiko, Japan; [2]Harvard Univ., USA; [3]Stanford Univ., USA; [4]Univ. of California Berkeley College of Engineering, USA.* We introduce the first on-chip, microelectromechanical system for the in situ tuning of twisted 2D materials, enabling tunable interfacial properties, synthetic topological singularities, and adjustable-polarization light sources for advanced quantum material manipulation in 2D-3D devices.

FTu1C.3 • 08:45
UV-visible dual-comb spectroscopy with thin-film lithium niobate nanophotonics, Kristina F. Chang[4], Carter Mashburn[1,4], Tsung-Han Wu[2,4], Luis Ledezma[3], Ryoto Sekine[3], Alireza Marandi[3], Scott Diddams[2,4]; *[1]Physics, Univ. of Colorado Boulder, USA; [2]Electrical, Computer and Energy Engineering, Univ. of Colorado Boulder, USA; [3]Electrical Engineering, California Inst. of Technology, USA; [4]National Inst. of Standards and Technology, USA.* A dual-comb spectrometer based on nonlinear UV-visible generation in thin film lithium niobate nanophotonics is presented. With this instrument, spectroscopy between 370 and 800 nm is performed with 100 GHz resolution.

08:00 -- 09:00
Room: 3D
FTu1D • Photonic Computing and Sensing on Integrated Platform
Presider: Duanni Huang; Intel Corporation, USA

FTu1D.1 • 08:00 (Invited)
Silicon Photonics-Powered Biosensing for Rapid Quantification of Blood Biomarkers, Kyle Preston[1], Guojun Chen[1], Cole Chapman[1], Sarat Gundavarapu[1], Ebrahim Aljohani[1], Armando Paredes Arroyo[1], Chi-Chen Lin[1], Alexander Vinitsky[1], Alana Gonzales[1], Ze Yin[1], Michael Dubrovsky[1], Diedrik Vermeulen[1]; *[1]SiPhox Health, USA.* We demonstrate the capabilities of the SiPhox Home silicon photonics platform, consisting of disposable biosensor cartridges and swept-source instrumentation, for rapid measurement of blood biomarker concentrations such as a high-sensitivity C-reactive protein (hsCRP) assay.

FTu1D.2 • 08:30 (Invited)
Non-reciprocal devices for in-memory photonic computing, Nathan Youngblood[1], Paolo Pintus[2,3], Mario Dumont[3], Vivswan Shah[1], Toshiya Murai[4], Yuya Shoji[5], Duanni Huang[3], John Bowers[3]; *[1]Univ. of Pittsburgh, USA; [2]Physics, Universita degli Studi di Cagliari, Italy; [3]ECE, Univ. of California Santa Barbara, USA; [4]Platform Photonics Research Center, National Inst. of Advanced Industrial Science and Technology (AIST), Japan; [5]Electrical and Electronic Engineering, Tokyo Inst. of Technology, Japan.* Non-reciprocal platforms can offer several key advantages for scalable and efficient photonic computing. In this talk, I will present our recent experimental work validating the use of non-reciprocal materials to implement high-endurance memory for photonic computing.

08:00 -- 09:00
Room: 3E
FTu1E • Laser-Plasma Based Acceleration, Light Sources, and Frequency Combs
Presider: R. Jason Jones; Univ of Arizona, Coll of Opt Sciences, USA

FTu1E.1 • 08:00
Withdrawn

FTu1E.2 • 08:15
Withdrawn

FTu1E.3 • 08:30
A Compact, Easily Tunable Extreme-ultraviolet Source: High-harmonic Generation in Strongly Overdriven Regime, Balazs Major[3,4], Katalin Kovacs[1], Evaldas Svirplys[2], Muhammad Anus[2], Omair Ghafur[2], Katalin Varju[3,4], Marc J. J. Vrakking[2], Valer Tosa[1], Bernd Schüttte[2]; *[1]Institutul National de Cercetare-Dezvoltare pentru Tehnologii Izotopice si Moleculare, Romania; [2]Max-Born-Institut fur Nichtlineare Optik und Kurzzeitspektroskopie im Forschungsverbund Berlin eV, Germany; [3]ELI-HU Nonprofit Kft, Hungary; [4]Department of Optics and Quantum*

Electronics, Szegedi Tudomanyegyetem, Hungary. We present a compact high-harmonic generation approach – termed as strongly overdriven regime – providing continuum radiation ranging from 18 to 140 eV albeit using long driving laser pulses, acting as a flexible and intense extreme-ultraviolet source.

FTu1E.4 • 08:45
Dual-comb Correlation Spectroscopy of Channelized Thermal Light, Jordan Wind[2], Eugene Tsao[2], Connor Fredrick[1], Alexander Lind[2], Scott Diddams[2]; [1]*Physics, Univ. of Colorado Boulder, USA;* [2]*Electrical, Computer & Energy Engineering, Univ. of Colorado Boulder, USA.* With optical heterodyne, we measure the spectrum of thermal light using two near-infrared combs with 5-GHz repetition rates. Spectral multiplexing across dense wavelength-division multiplexing channels enables high signal-to-noise ratio.

08:00 -- 09:00
Room: 3F
LTu1F • Ultrafast and Nonlinear Probes of Quantum Materials
Presider: Matt Graham; Oregon State, USA

LTu1F.1 • 08:00 (Invited)
Nonequilibrium Dynamics in Highly Correlated Phases of Matter, Michael Zuerch[1,2]; [1]*Univ. of California at Berkeley, USA;* [2]*(2) Lawrence Berkeley National Laboratory, USA.* 1*T*-$TiSe_2$, a charge-density-wave compound, exhibits excitonic condensation and anomalous light-induced states. We employ attosecond XUV absorption spectroscopy and ultrafast electron diffraction to explore its complex electron-phonon interactions and topological defect dynamics.

LTu1F.2 • 08:30 (Invited)
Revealing Two Subsequent Magnetic Phase Transitions in a Helimagnet, Liuyan Zhao[1]; [1]*Univ. of Michigan, USA.* Using polarization resolved second harmonic generation, we show our results of helimagnet Cr1/3NbS2: the interlock between structural chirality and magnetic helicity, the domain distribution of six helimagnetic states, and the two subsequent magnetic phases transitions.

09:15 -- 10:00
Room: 3A
FTu2A • FiO Virtual Reality and Augmented Vision Visionary Session
Presider: Sundeep Jolly; Apple

FTu2A.1 • 09:15 (Visionary)
The Transforming Landscape of Augmented Reality, Matthew Colburn[1]; [1]*Meta Tech - Reality Labs Research, USA.* To enable immersive experiences that are all-day wearable, advances in compute, battery, sensing, and display systems will require new architectures, materials, process technology, and metrology. In this talk, we will discuss the landscape of display technologies from low- to large immersive field-of-views.

09:15 -- 10:00
Room: 3F
LTu2B • Laser Science Visionary Session I

Presider: Susan Dexheimer; Washington State University, USA

LTu2B.1 • 09:15 (Visionary)

Application of X-ray Free Electron Lasers to Biological Research, Junko Yano[1]; [1]*Lawrence Berkeley National Laboratory, USA.* The advances in X-ray free-electron laser (XFEL)-based crystallography and spectroscopy have profoundly influenced our understanding of the mechanisms of biological machinery, by enabling the visualization of sequential events in real-time as the reactions proceed. The current status and opportunities in the field of X-ray science related to applications of XFELs in the chemical and biological sciences will be discussed.

10:30 -- 11:30
Room: Showcase Theater
JTu3A • Joint Plenary Session I

Presider: Andrew Forbes; Univ. of Witwatersrand, South Africa and Alexey Turukhin; Cisco Systems Inc., USA

JTu3A.1 • 10:30 (Plenary)

Using Light Absorption and Laser Speckle Dynamics to Measure Human Brain Function, David Boas[1]; [1]*Boston Univ., USA.* Light absorption by hemoglobin has been used to measure blood volume and oxygenation indications of human brain function for 30 years. More recently, laser speckle dynamics are being exploited to measure blood flow indications of brain function. Combined these methods provide a unique and robust measure of the functioning brain.

11:30 -- 13:00
Room: Bluebird Ballroom - Posters
JTu4A • Joint Poster Session I

JTu4A.1

Spatial Frequency Modulation Imaging for In-Line Monitoring of Laser Fabrication Processes, Daniel W. Scarbrough[1], Scott Hunter[1], Seth Cottrell[1], Jeff Squier[1]; [1]*Colorado School of Mines, USA.* Spatial frequency modulation imaging (SPIFI) is demonstrated with rapid acquisition, processing, and rendering used in conjunction with a fusing laser system for modifying metallic objects or performing laser powder bed fusion.

JTu4A.2

Low Thermal Noise TiO_2:GeO_2 and SiO_2 High Reflector Stacks for Gravitational Wave Detectors, Aaron J. Davenport[1], Gabriele Vajente[2], Nicholas Demos[3], GariLynn Billingsly[2], Ashot Markosyan[4], Riccardo Bassiri[4], Martin Fejer[4], Slawek Gras[3], Matthew Evans[3], Carmen Menoni[1]; [1]*Department of Electrical and Computer Engineering, Colorado State Univ., USA;* [2]*LIGO Laboratory, California Inst. of Technology, USA;* [3]*LIGO Laboratory, Massachusetts Inst. of Technology, USA;* [4]*E. L. Ginzton Laboratory, Stanford Univ., USA.* Multilayer TiO_2:GeO_2 alloy and SiO2 coating stacks with >99.999% reflectivity and reduced thermal noise with excellent optical properties are demonstrated. The effect of stepped annealing on the structural properties of the coatings is studied.

JTu4A.3
Isogyres in The Polarization of Light in Ferrofluids, Alberto Tufaile[1]; *[1]Univ. of São Paulo, Brazil.* We have examined the formation and development of isogyres in light polarization within ferrofluid films under magnetic fields through experiments, analyzing the data with Mueller matrices applied in Stokes vectors to model this system.

JTu4A.4
Seeing Virtually: An Exploration into Teaching E&M in Virtual Reality, Matthew Anderson[1], Janet Bowers[1], Dustin Thoman[1], Elizabeth Flynn[1], Adrian Larios[1], India Wishart[1], Molly Horner[1], Ryan Rios[1], Luke Anderson[2], Beau Green[2], Bharat Ahluwalia[2], Jamie Fleming[2]; *[1]San Diego State Univ., USA; [2]Altoura Inc., USA.* We are researching the use of augmented and virtual reality for teaching physics concepts in three dimensions: electric fields, magnetic fields, and electromagnetic waves. We will do a live demo and discuss our current findings.

JTu4A.5
Withdrawn

JTu4A.6
Understanding a Fabry-Pérot Etalon that Expands and Contracts at the Same Time, Molly Kate Kreider[1], Connor Fredrick[1], Ryan Terrien[2], Suvrath Mahadevan[3], Joe P. Ninan[4], Chad F. Bender[5], Daniel Mitchell[6], Jayadev Rajagopal[7], Arpita Roy[8], Christian Schwab[9], Jason T. Wright[3], Scott Diddams[1]; *[1]Univ. of Colorado Boulder, USA; [2]Carleton College, USA; [3]The Pennsylvania State Univ., USA; [4]Tata Inst. of Fundamental Research, India; [5]The Univ. of Arizona Department of Astronomy and Steward Observatory, USA; [6]LightMachinery Inc, Canada; [7]NOIRLab, USA; [8]Schmidt Sciences, USA; [9]Macquarie Univ., Australia.* We quantify the complicated chromatic drift of ~5,000 modes across ~500 nm of bandwidth of Fabry-Pérot etalons used for radial velocity measurements at the 10^{-10} level. We trace the behavior to the dielectric mirrors.

JTu4A.7
Bioplastic Diffraction Gratings Fabricated from Crab Shells: Performance at Varying Chitosan Concentrations, Efren Gumayan[1], Ian Ken Dimzon[1], Raphael Guerrero[1]; *[1]Ateneo de Manila Univ., Philippines.* We report the diffraction performance of bioplastic diffraction gratings fabricated from crab shell waste. Soft lithography is employed to fabricate grating replicas with different chitosan concentrations. First-order output from diffraction experiments confirms the fidelity of the replication process.

JTu4A.8
High Resolution and High Sensitivity Imaging Magnetometer with Magnetic Nanoparticle and Optical Heterodyne Detection, Jan Bartos[2], Taleb Ba Tis[1], Wounjhang Park[2,1], ShuWei Huang[2]; *[1]MSE, Univ. of Colorado Boulder, USA; [2]ECEE, Univ. of Colorado Boulder, USA.* We present progress towards an imaging magnetometer using a magneto-optical polymer nanocomposite thin film, experimentally demonstrating 29nT/√Hz sensitivity with <μm spatial resolution and the potential for 1pT/√Hz at the shot noise limit.

JTu4A.9
Lensless Tip and Tilt Measurement Using Defocused Speckle Imaging, Konstantinos Falaggis[1], Sevda Mamaghani[1]; [1]*Univ of North Carolina at Charlotte, USA.* This proceeding introduces a novel, cost-effective method for high-accuracy tip and tilt measurements using speckle imaging, achieving a few µrad uncertainty and sub-µrad repeatability, offering a wider angular range than traditional autocollimators

JTu4A.10
A Long-Range Fluorescence-Based Optical Detector for Oil Spills, Faith Poutoa[1], Matthew Anderson[1], David Pullman[1], Kayla Ryan[1], Valiant Smith[1], Arash Keyashian[1], Alex McLintock[1], Waleed Alany[1], Chris Turchiano[1], Steve Van Bibber[2], Christian Winther[2], Greg Laugle[2], Chris Chase[2]; [1]*San Diego State Univ., USA;* [2]*InterOcean Systems LLC, USA.* We report on the optical design, construction, and implementation of a UV-fluorescence based illumination and detection system capable of detecting crude and refined oils from a distance of 60 meters.

JTu4A.11
Sensing the Electric Field Produced by an Electron Beam Using Rydberg Atoms, Robert Behary[1], Nicolas DeStefano[1], Todd Averett[1,2], Saeed Pegahan[1], Kevin Su[1], Alexandre Camsonne[2], Shukui Zhang[2], Charlie Fancher[3], Neel Malvania[3], Eugeniy Mikhailov[1], Seth Aubin[1], Irina Novikova[1]; [1]*William & Mary, USA;* [2]*Thomas Jefferson National Accelerator Facility, USA;* [3]*The MITRE Corporation, USA.* We study the optical response of Rydberg atoms in the presence of an electron beam to perform a non-invasive beam characterization using a two-photon EIT resonance.

JTu4A.12
Refractive index measurement using common-path interferometer setup, Surya Gautam[1]; [1]*CSIR-National Physical Laboratory, India.* To measure the refractive index of a sample, we propose using a common-path interferometer setup. In this technique, the object and reference beams are generated within a common path to ensure consistent reconstruction.

JTu4A.13
Enhanced Sensor Characterization with Visible and NIR Spectrum-Simulation Light Sources, Xiaohua Ye[1]; [1]*Energetiq Technology Inc, USA.* A spectrum-simulating light source covering 380nm to 1100nm, powered by a laser driven light source, is proposed to facilitate sensor characterizations. Key features investigated include high color accuracy, linearity, and flexibility in the spectral output.

JTu4A.14
Formation of Multiple Stable Regions for Single Solitons in the Presence of an Avoided Crossing, Logan Courtright[1], Pradyoth Shandilya[1], Thomas F. Carruthers[1], Curtis Menyuk[1]; [1]*Univ. of Maryland, Baltimore County, USA.* Standard soliton theory for quadratic dispersion microresonators predicts an infinitely large region for soliton stability past $\alpha = \sqrt{3}$. In the presence of an avoided crossing, we show that multiple isolated regions of stability can form.

JTu4A.15
Behavior effect of 2D dopants Semiconductor on the efficiency of pn-photodiode based TMDC-MoS_2, Ahmed A. Khalil[3,1], Maram Abou Kana[3], Mohamed A. Swillam[2]; [1]*Physics*

department, The American Univ. in Cairo School of Sciences and Engineering, Egypt; [3]Cairo Univ., Egypt. SiC, GaN as 2D materials and MoS_2 as a TMDC semiconducting material was chosen, a pn-photodiode was fabricated, the resulted photodiode external and internal quantum efficiency was compared to that of MoS2 based photodiode.

JTu4A.16
Electron Beam Profiling Using Coherent Atomic Magnetometry, Nicolas DeStefano[1], Todd Averett[1], Shukui Zhang[2], Alexandre Camsonne[2], Aneesh Ramaswamy[3], Svetlana Malinovskaya[3], Irina Novikova[1], Eugeniy Mikhailov[1], Seth Aubin[1]; *[1]William & Mary, USA; [2]Thomas Jefferson National Accelerator Facility, USA; [3]Stevens Inst. of Technology, USA.* We image 2-D electron beam profiles through localized measurements of its magnetic field using nonlinear magneto-optical polarization rotation in hot Rb vapor.

JTu4A.17
Polarization-maintaining tellurite optical fiber for mid-infrared supercontinuum generation, Yasutake Ohishi[1]; *[1]Toyota Technological Inst., Japan.* To generate polarization-maintained mid-infrared supercontinuum, we have designed and fabricated tellurite oval-core optical fiber. Polarization-maintained supercontinuum light from 1660 to 2570 nm has been generated from the fabricated tellurite oval-core optical fiber.

JTu4A.18
Epsilon Near Zero (ENZ) Metasurfaces for Augmented Reality application, Iman Alhamdan[1]; *[1]school of physics and Astronomy, UK.* This study showcases multilayered metasurface designs that integrate Indium Tin Oxide (ITO) as an epsilon near zero material (ENZ). The simulation results demonstrate that this structure operates with high efficiency and tunability within the visible spectrum.

JTu4A.19
Ultraviolet Interference Coatings for Laser Fusion Drivers, Maxwell Weiss[1], Aaron J. Davenport[1], Samuel Castro-Lucas[1], Sarah Sadler[1], Carmen Menoni[1,2]; *[1]Colorado State Univ., USA; [2]XUV Lasers, USA.* Using a combination of HfO2, SiO2, and Al2O3 interference coatings for 355nm were fabricated by ion beam co-sputtering. The use of mixtures is effective for extending the UV cutoff to ~190 nm. The use of mixtures in the design of anti-reflective coatings improves their laser damage resistance.

JTu4A.20
LDLS Powered Broad-band TLS for the Application of Diamond Inspection, Xiaohua Ye[1]; *[1]Energetiq Technology Inc, USA.* Broad-band Tunable light source powered by LDLS® is proposed for the application of diamonds inspection. Experimental results of system performance and inspection for diamond samples, are presented.

JTu4A.21
Eliminating Sidewall Roughness in Microdisk Resonator using Focused Ion Beam Polishing, Lekshmi Eswaramoorthy[1,2], Brijesh Kumar[1], Parul Sharma[1], Anuj Kumar Singh[1], Abhay Anand[1], Sudha Mokkapati[2,3], Anshuman Kumar[1,3]; *[1]Indian Inst. of Technology Bombay, India; [2]Materials Science and Engineering, Monash Univ., Australia; [3]IITB Monash Research Academy, India.* Sidewall roughness significantly impacts the Quality (Q) factor of microdisks by

causing scattering losses. In this work, we report using Focused Ion Beam (FIB) polishing to achieve near-perfect smooth sidewalls, effectively enhancing the Q-factor.

JTu4A.22
Fabrication of Fluorescent Micro/Nanostructures via Two-Photon Lithography using Carbon-Based Photoinitiator, Akanksha Sharma[1], Sweta Rani[1], Tejas Suryawanshi[1], Arun Jaiswal[1], Sumit Saxena[1], Shobha Shukla[1]; *[1]Indian Inst. of Technology Bombay, India.* We report a two-photon lithography-based fabrication of fluorescent nanostructures using carbon quantum dots incorporated in a photosensitive resin. These fluorescent micro/nanostructures serve as a platform for various applications where optically emissive structures are required.

JTu4A.23
Stable dual-comb interferometry without locking of repetition frequencies, Riku Shibata[1], Shun Fujii[1], Shinichi Watanabe[1]; *[1]Keio Gijuku Daigaku Rikogakubu Daigakuin Rikogaku Kenkyuka, Japan.* We found that optimal mode number conditions in two frequency combs enable stable dual-comb interferometry without locking their repetition frequencies, facilitating measurements in fluctuating environments. The interferogram peak position remains stable regardless of repetition-frequency locking.

JTu4A.24
Ancilla-Assisted Process Tomography with Bipartite Separable Mixed States, Zhuoran Bao[1], Daniel F. James[1]; *[1]Univ. of Toronto, Canada.* We showed that the sinisterness of state, which quantifies the correlation between bipartite systems, can be used to estimate the best-case effectiveness of arbitrary separable mixed initial states in performing ancilla-assisted process tomography(AAPT).

JTu4A.25
For passive radiative cooling, we recommend broadband thermal emitters vs. narrowband ones, Yeonghoon Jin[1], Mikhail Kats[1]; *[1]Univ. of Wisconsin-Madison, USA.* We find that an experimentally realizable broadband emitter with high emissivity across 3–25 µm is usually more effective as a radiative cooler than a selective emitter with high emissivity only at 8–13 µm.

JTu4A.26
3D Soft X-ray Vector Ptychography of Topological Magnetic Skyrmions, Iona K. Binnie[1], Haocheng Fang[1], Benjamin Shearer[1], Chen-Ting Liao[1], Emma Cating-Subramanian[1], Sergio Montoya[2], Eric Fullerton[2], David Shapiro[3], Jianwei Miao[4], Henry Kapteyn[1], Margaret Murnane[1]; *[1]Univ. of Colorado at Boulder, USA; [2]Univ. of California San Diego, USA; [3]Advanced Light Source, USA; [4]Univ. of California Los Angeles, USA.* Soft x-ray coherent diffractive imaging is used to probe the fundamental scales of topological magnetic textures. 3D vector ptycho-tomography enables high resolution 3D static imaging of nanoscale spin textures in dipole-stabilized skyrmions.

JTu4A.27
A Wide-band Cellophane Based Polarization Converter for Efficient Generation of Beams of Polarization Order Number +1, Sandra A. Achieng[1,2], Geoffrey K. Rurimo[1,2], Ronald K. Rop[3]; *[1]Physics, Multimedia Univ. of Kenya, Kenya; [2]National Inst. for Optics and Lasers, Multimedia Univ. of Kenya, Kenya; [3]Physics, Univ. of Kabianga, Kenya.* This project fabricates

an eight-segment cellophane polarization mask that converts linearly polarized beams to order number +1 beams. It compares the outputs of a four-segment mask to those of the eight segment mask.

JTu4A.28
Numerical Aperture enhancement through curved holographic recording, Jorge Lasarte Sanz[1], Kevin Murphy[1], Izabela Naydenova[1], Jesús Atencia[2], Maria Victoria Collados[2], Suzanne Martin[1]; [1]*Technological Univ. Dublin, Ireland;* [2]*Engineering Research Inst. of Aragon (I3A), Universidad de Zaragoza, Spain.* We present a technique for enhancing the numerical aperture (NA) of Holographic Optical Lenses (HOLs) via curved-to-flat holographic recording and replaying, thus improving HOL performance with LED sources. Diffraction behavior of elements was modelled and tested.

JTu4A.29
New Interferometric Testing Utility (NITU) : A Python Package for Interferometric Data Analysis and Visualization, Meghdoot Biswas[1], Daewook Kim[1,2]; [1]*The Univ. of Arizona James C Wyant College of Optical Sciences, USA;* [2]*The Univ. of Arizona Department of Astronomy and Steward Observatory, USA.* New Interferometric Testing Utility (NITU) is a newly developed Python package for analyzing and visualizing interferometric data. It provides Zernike decomposition, interactive visualization, time series analysis, and additional features for optical manufacturing and testing.

JTu4A.30
Integrated freeform lens for Fourier transformation on SOI platform, Yang Gao[1], Zhiqiang Xia[1], Pan Wang[1], Kun Yin[1], Hui Yu[1]; [1]*Zhejiang Lab, China.* We experimentally demonstrated a novel on-chip integrated freeform lens for Fourier transform on a standard silicon-on-isolator (SOI) platform. The measured spatial spectrum is consistent with the numerical simulation and analysis results.

JTu4A.31
Implementation of a Fabry-Perot Fiber Optic Interferometer to Characterize Flexural Acoustic Waves, Yareli Navarro[1], Erika N. Hernández[1], Miguel Á. Bello-Jiménez[1], Rosa E. López[1,2]; [1]*Universidad Autonoma de San Luis Potosi Instituto de Investigacion en Comunicacion Optica, Mexico;* [2]*Consejo Nacional de Ciencia y Tecnologia, Mexico.* A Fabry-Perot interferometer and its application to characterize flexural acoustic waves along an optical fiber are presented. Parameters such as acoustic wavelength, attenuation coefficient and phase velocity are given around 2-MHz acoustic frequency range.

JTu4A.32
Surface Treatment for Improved Integration of FBGs, Alberto Rovera[1], Alessandro Aimasso[1], Alexandru Tancau[1], Devanarayanan Meena Narayana Menon[1], Davide Janner[1]; [1]*Politecnico di Torino, Italy.* Fiber Bragg sensors (FBG) temperature sensing for harsh environments was investigated with different bondings. Plasma treatment and laser texturing were employed to improve the integration for both adhesives and brazing alloys.

JTu4A.33
Phase only modulation of coherently coupled Orbital Angular Momentum beams for precise laser ranging, Evan Robertson[1], Tyler Cramer[1], Matthew Reid[1], Jaxon Wiley[1], J. Keith

Miller[1], Eric Johnson[1,2]; *[1]Clemson Univ., USA; [2]CREOL, Univ. of Central Florida, USA.* Phase only modulation of CCOAM beams provides a system with 15 mm resolution is achieved. This system's resolution is independent of beam size and propagation allowing precise measurement of a target over 8 m away.

JTu4A.34
Topographical Characterization System Using Fiber-based Interferometers' Combination, Arvind K. Maurya[1], Kalipada Chatterjee[1], Rajan jha[1]; *[1]Physics, Indian Inst. of Technology Bhubaneswar, India.* We present a topographical characterization system for surface analysis utilizing fiber-based cavity interferometers' systems. It provides a broad range of displacement sensing by achieving high-resolution and precise measurements, essential for material analysis and nanotechnology applications.

JTu4A.35
Forest Fire Detection and Audio Alarming System, Joana S. Vieira[2,1], Miguel Coelho[2,1], Luís Santiago[2,1], Rodolfo Oliveira[2,1], António Navarro[2,1], Rogério N. Nogueira[2,1], Ana M. Rocha[3,1]; *[1]Universidade de Aveiro, Portugal; [2]Instituto de Telecomunicacoes, Portugal; [3]Instituto de Nanoestruturas Nanomodelacao e Nanofabricacao, Portugal.* In this work, we present an optimized forest fires detection distributed temperature sensor that uses existing telecommunications fiber networks, integrated with an audio alert radio broadcasting system to warn car drivers near the fire zone.

JTu4A.36
Demonstration of a Single-pixel Imaging System for a Uniformly Moving Target with a Static Illumination, Wataru Yoshiki[1], Masaharu Imaki[1], Nobuki Kotake[1]; *[1]Mitsubishi Denki Kabushiki Kaisha Joho Gijutsu Sogo Kenkyujo, Japan.* We demonstrate a system for single-pixel imaging of a uniformly moving macroscopic target with a static illumination pattern. The system equips a static illumination pattern mask that is low-cost and applicable to wide wavelength.

JTu4A.37
U-Shape Lossy Mode Resonance Optical Fiber Sensor for Temperature Detection of Lithium-Ion Batteries, Keith M. Alcock[1], Keng Goh[2], Mustehsan Beg[2], Sonia Melendi-Espina[1], Miguel Hernaez[1]; *[1]School of Engineering, Univ. of East Anglia, UK; [2]School of Computing, Engineering and the Built Environment, Edinburgh Napier Univ., UK.* This study develops a Polyethylenimine/Graphene Oxide thin film-based Lossy Mode Resonance U-shaped optical fiber sensor for lithium-ion battery temperature measurement. The study encourages further development of this device further as it compares well to thermocouples.

JTu4A.38
Performance of the ptychography python module Tike on an HHG based tabletop EUV source, Taylor J. Buckway[1], Aaron Redd[1], Hyrum C. Taylor[1], Joshua Miller[1], Richard L. Sandberg[1]; *[1]Brigham Young Univ., USA.* Coherent tabletop extreme ultraviolet sources are becoming more prominent in laboratory scaled high resolution microscopy. We processed our ptychographic reconstructions with Tike, a high-performance ptychographic python module for diffraction based ptychography.

JTu4A.39

Signal processing for measuring the spatial resolution of an interference microscope, Zoulaiha Daouda[2], Peter J. de Groot[1], Xavier Colonna de Lega[1], Leslie Deck[1]; *[1]Zygo Corp, USA; [2]Electrical and computer engineering, Georgia Inst. of Technology, USA.* An algorithm for processing a stepped surface measurement to evaluate the instrument transfer function of an interference microscope using the topographical edge test is presented, showing agreement with a scalar diffraction-based calculation.

JTu4A.40

Biharmonic Inpainting for Sparse Single-Photon 3D Scene Reconstruction, Luke McEvoy[1], Daniel Tafone[1], Yong Meng Sua[1], Yuping Huang[1]; *[1]Stevens Inst. of Technology, USA.* Our study introduces inpainting through biharmonic functions for single-photon LiDAR reconstruction, omitting the need for artificial intelligence to reconstruct images. This lightweight approach, combined with dynamic masking, offers efficient real-time compressive data acquisition and reconstruction.

JTu4A.41

Supergrowth: Paving the Way to High-Intensity Superresolution, Sethuraj Karimparambil Raju[1], Tathagata Karmakar[1], Valeria C. Viteri-Pflucker[1], Sultan Abdul Wadood[3], Andrew N. Jordan[2,1], Nick Vamivakas[1]; *[1]Univ. of Rochester, USA; [2]Chapman Univ. System, USA; [3]Princeton Univ., USA.* We demonstrate the first experimental realization of supergrowing fields. Supergrowth will allow far-field superresolution at high intensity, overcoming limitations of superoscillation and enhancing imaging technology with higher signal-to-noise ratios.

JTu4A.42

Increasing the Precision of Transmission Spectroscopy by Optimization of Thin Film Surface Shapes, Florian Willomitzer[1], John M. Bass[1], Manuel Ballester[2], Susana Fernández[3], Aggelos Katsaggelos[4], Emilio Márquez[5]; *[1]Wyant College of Optical Sciences, Univ. of Arizona, USA; [2]Department of Computer Sciences, Northwestern Univ., USA; [3]Department of Energy, Centro de Investigaciones Energeticas Medioambientales y Tecnologicas, Spain; [4]Department of Electrical and Computer Engineering, Northwestern Univ., USA; [5]Department of Condensed-Matter Physics, Universidad de Cadiz, Spain.* While thin film transmission spectroscopy systems can measure semiconductor optical properties, the utilized optimization-based evaluation methods often introduce variances in the results. We introduce a method of optimizing film surface shapes that reduces this uncertainty.

JTu4A.43

Controlled Generation of Poincare Bessel-Gaussian Beams, Mansi Baliyan[1], Naveen K. Nishchal[1]; *[1]Indian Inst. of Technology Patna, India.* The study proposes a method for generating vector BG beams where scalar modes are created through cascaded dual-phase holograms superposition and then vector BG beams are generated from it through the implementation of modified Mach-Zehnder interferometer.

JTu4A.44

Multi-target detection through wavelet-modified maximum average correlation height filter, Rahul Kumar[1], Akash Pal[1], Naveen K. Nishchal[1], Ayman Alfalou[2]; *[1]Indian Inst. of Technology Patna, India; [2]ISEN, France.* Many correlation filters have been reported for correlation pattern recognition and classification. In this paper, we present a system in which objects present in the target scene can automatically be detected using wavelet-modified maximum average correlation filter.

JTu4A.45

Phase to binary amplitude hologram conversion for the projection of multiplane scenes, Alejandro Velez-Zea[1], Juan Andres Gonzalez Moncada[1], John Fredy Barrera-Ramírez[1]; [1]*Universidad de Antioquia, Colombia.* To take advantage of the high performance of state-of-the-art phase hologram generation methods, we introduce and compare two approaches to enable the conversion of phase holograms to binary amplitude holograms with minimal loss of accuracy.

JTu4A.46

Classification of Fingerprints to Study the Relationship between Fingerprint Types and Disease Lesions Using the Mach-Zehnder Interferometer Technique - Phase I: Classification of Fingerprints, Pachara Thonglim[3], Abdullahi Usman[2], Apichai Bhatranand[2], Prathan Buranasiri[1]; [1]*KMITL, Thailand;* [2]*Electronics and Telecommunication Engineering, King Mongkuts Univ. of Technology Thonburi Faculty of Engineering, Thailand;* [3]*Chulabhorn Royal Academy, Thailand.* The investigation of fingerprints was performed using the Mach-Zehnder interferometer technique to classify fingerprint types. Fingerprint type images have been applied to predict the probability of disease in humans for the next phase.

JTu4A.47

Superresolution of three point-sources assisted with machine learning, Bilal Benzimoun[1], Abdelali Sajia[1], Xiao-Feng Qian[1]; [1]*Stevens Inst. of Technology, USA.* We demonstrate super-resolved localization of three point sources with the assistance of a machine learning model that is based on the decomposition of the source signal into Hermite Gaussian modes. High fidelity of over 80\% is achieved.

JTu4A.48

Design rules for high refresh rate using piezo-MEMS multi-waveguide beam scanners, Matthew Zimmermann[1], Y. Henry Wen[1], Andrew Greenspon[1,2], Mark Dong[1,2], Andrew Leenheer[3], Gerald Gilbert[4], Matt Eichenfield[5,3], Dirk Englund[2]; [1]*The MITRE Corporation Bedford, USA;* [2]*Research Laboratory of Electronics, Massachusetts Inst. of Technology, USA;* [3]*Sandia National Laboratories, USA;* [4]*The MITRE Corporation Princeton, USA;* [5]*The Univ. of Arizona James C Wyant College of Optical Sciences, USA.* The integration of multiple PIC waveguides on a single scanning MEMS cantilevers enables the use of faster refresh rate scan patterns. We develop design rules for achieving optimal fill and refresh rate of doubly-resonant waveguide beam scanners.

JTu4A.49

Discovering nonlinear optical crystals and predicting their THz spectra through data mining and DFT calculations, Enoch Ho[1], Stacey Smith[1], David Michaelis[1], Jeremy Johnson[1]; [1]*Chemistry and Biochemistry, Brigham Young Univ., USA.* Combining data mining and DFT calculations, we identified crystals that were originally designed in other applications to be good nonlinear optical crystals for THz generation and predicted their generation spectra that matched our experiments.

JTu4A.50

Transfer Learning for Reservoir Computing Using a Semiconductor Laser, Atsushi Uchida[1], Rie Sakamaki[1], Masanobu Inubushi[2], Kazutaka Kanno[1]; *[1]Saitama Univ., Japan; [2]Tokyo Univ. of Science, Japan.* We perform transfer learning for photonic reservoir computing using a semiconductor laser. We demonstrate a task for the inference of one variable in chaotic laser dynamics whose parameter value is changed from the training scheme.

JTu4A.51
Optical image encryption using modified GS algorithm and DNA encoding, Sonu Rao[1], Rahul Kumar[1], Naveen K. Nishchal[1], Ayman Alfalou[2]; *[1]Indian Inst. of Technology Patna, India; [2]Yncrea, ISEN, France.* Optical image encryption using modified GS algorithm and deoxyribonucleic acid (DNA) encoding is proposed. The scheme provides a novel way to encode optically encrypted data into DNA sequences and its transmission through optical vortex beam.

JTu4A.52
In-plane rotation estimation through composite filter synthesis and log-polar mapping, Akash Pal[1], Rahul Kumar[1], Jyothish M[2], Naveen K. Nishchal[1]; *[1]Indian Inst. of Technology Patna, India; [2]Isro Inertial System Unit, India.* This paper proposes a rotation estimation method employing log-polar mapping with an optical correlator, supplemented by a composite filter to mitigate out-of-plane distortions with other benefits. Fast optical processing can lead this into numerous applications.

JTu4A.53
A novel single-shot geometry for transport of intensity equation, Ram Kumar[1], Naveen K. Nishchal[1]; *[1]Indian Inst. of Technology Patna, India.* Phase measurement is very important in several applications. In this paper, we present a novel optical module based on Michelson interferometer type geometry for intensity acquisition suitable for transport of intensity equation.

JTu4A.54
Binary annular phase mask for extended depth of field imaging system, José M. Reyes Alfaro[1], Carina Toxqui Quitl[1], Alfonso Padilla Vivanco[1], Enrique Gonzalez Amador[1]; *[1]Universidad Politécnica de Tulancingo, Mexico.* A digital-optical imaging that uses a binary phase mask to deliberately leave three phase shifts, one for each wavelength of red, green and blue, so all color channels are in focus for different axial lengths.

JTu4A.55
Opto-electronic Balanced Joint Transform Correlator as a Convolution Stage for Neural Networks, Aarushi Tiwari[1], Julian Gamboa[1], Tabassom Hamidfar[1], Xi Shen[1], Shamima Mitu[1], Selim Shahriar[1], Ruoxi Zhu[1]; *[1]Northwestern Univ., USA.* Opto-electronic correlators are able to perform high-speed convolutions with minimal processing and power requirements. Here, we propose the use of a balanced joint transform correlator as a convolution stage for a convolutional neural network.

JTu4A.56
Optical Phase Image Encryption Utilizing a Vortex Array Phase Mask in the Frequency Domain via Linear Canonical Transform, Hukum Singh[1]; *[1]NorthCap Univ., India.* It offers a security analysis on the generation of a vortex array, utilizing the Linear Canonical Transform (LCT). They have diverse applications, including cryptography, quantum computing, and the design of vortex lens.

JTu4A.57
Near-Eye Display Retina Images Analysis, Pingfan Wu[1]; [1]*Futurewei Technology, USA.* We conducted visual analysis of binocular near-eye displays and simulated them with a modified Arizona eye model. By varying optics aperture and display emission spectral bandwidth, we characterized retina image resolution and depth of focus.

JTu4A.58
Quantum-Enhanced Fourier-Basis Multibeam Photon-Counting Lidar, Kai-Ting Ting[1], Benjamin Scheck[1], Daniel Feldkhun[1,2], Joshua Combes[1], Kelvin Wagner[1]; [1]*Univ. of Colorado at Boulder, USA;* [2]*LambdaMetrics LLC, USA.* Photon streams backscattered by a target illuminated by a non-redundant Doppler-shifted beam array are detected and Fourier analyzed and display a quantum advantage of frequency-multiplexed multi-beam interferometry for Fourier telescopy.

JTu4A.59
Withdrawn

JTu4A.60
Color-conversion Arrays with Ultra-small Pixel Sizes for Micro-LED Displays, Ching-Fuh Lin[1], Chih-Yuan Tsai[1], Hao-Sung Chiu[1], Chen-Hsun Wu[1], Yu-Han Kung[1], Ting-Chun Lee[1], Shan-Yu Chen[1], Tzu-Yi Yang[1]; [1]*National Taiwan Univ., Taiwan.* We address mass transfer challenges using color-conversion technology, achieving ultrahigh-density microarrays: 11548 PPI for single color, 5774 PPI for full color, 72.98% and 65.36% conversion efficiencies for green and red, respectively, at 1.4-μm pixel size.

JTu4A.61
Experimental Quantification of Supergrowth Properties in Speckle, Valeria C. Viteri-Pflucker[1,2], Christopher J. Ryan[1,3], Sethuraj K. R.[1,2], Andrew N. Jordan[4,5], Nick Vamivakas[1,2]; [1]*The Inst. of Optics, Univ. of Rochester, USA;* [2]*Center for Coherence and Quantum Optics, Univ. of Rochester, USA;* [3]*Department of Physics, Univ. of Connecticut, USA;* [4]*Inst. for Quantum Studies, Chapman Univ. System, USA;* [5]*Department of Physics and Astronomy, Univ. of Rochester, USA.* Supergrowth, when a wave grows more rapidly than predicted by the bandlimit, has been proposed to achieve superresolved imaging. This work investigates supergrowth in speckle patterns, showing that supergrowth can naturally exist in optical fields.

JTu4A.62
Noise-Robust Algorithm for Partially-Coherent Ptychography, Benjamin Shearer[1], Henry Kapteyn[1,2], Margaret Murnane[1]; [1]*Univ. of Colorado Boulder, USA;* [2]*Kapteyn-Murnane Laboratories Inc, USA.* We demonstrate a ptychography algorithm called PaCMAN that is capable of imaging at ~100x lower flux density as ePIE. This algorithm can enable sub-10 nm imaging with table-top soft x-ray high harmonic supercontinua.

JTu4A.63
Estimation of Multiple Far-Subwavelength Object Parameters with Relative Motion in Structured Illumination, Christopher M. Lacny[1], Justin A. Patel[2], Kevin J. Webb[1]; [1]*Purdue Univ., USA;* [2]*Carnegie Mellon Univ., USA.* Estimation of multiple far-subwavelength object features using far-field intensity measurements with relative motion in structured illumination is

presented. This indicates new super-resolution microscopy and other sensing opportunities, and one thousandth of a wavelength resolution.

JTu4A.64
Imaging the Invisible (Quantum Fluctuations), Charris Gabaldon[1], Pratik Barge[2], Hwang Lee[2], Irina Novikova[1], Lior Cohen[3], Eugeniy Mikhailov[1]; [1]*William & Mary Arts & Sciences, USA;* [2]*Louisiana State Univ., USA;* [3]*Univ. of Colorado Boulder, USA.* We extract spatial and squeezed quantum information from a mixture of individual squeezed modes where the decomposition of covariance matrices are measured with single pixel imaging and homodyning techniques.

JTu4A.65
Meshing Strategies and its Effect during Finite Element Method based Simulations, Ritu Raj Singh[1], Shalini Vardhan[1]; [1]*Netaji Subhas Univ. of Technology, India.* This paper discusses the effect of different meshing sizes on 2D geometry. The results indicate that the desired surface have balance accuracy and computational resources for mesh elements with size ≤1/5 of the minimum dimension.

JTu4A.66
Direct Phase Modulation for Computational Fresnel Diffraction Imaging, Hsuan-Ting Chang[1], Tai-Jyun Dong[1], Chien-Yu Chen[2]; [1]*Electrical Engineering, National Yunlin Univ. of Science and Technology, Taiwan;* [2]*Color and Illumination Technology, National Taiwan Univ. of Science and Technology, Taiwan.* In this paper, we propose two methods which can directly modulate the phase-only function retrieved by using Gerchberg Saxton algorithm (GSA) so that the same target image can be reconstructed with a new wavelength or at a different diffraction distance from those used in the original GSA.

JTu4A.67
Fluorescence spectroscopy of a targeted photosensitizer for photodynamic therapy of breast cancer, Ernestina Domey[1], Md Nafiz Hannan[1], Zihao Li[1], Timothy M. Baran[1]; [1]*Univ. of Rochester, USA.* This study validated a fluorescence spectroscopy system for improved real-time monitoring of photodynamic therapy in murine breast cancer models, with a focus on precise drug delivery and tumor response to optimize treatment protocols.

JTu4A.68
Homogeneous-Like Nonlinear Discrete Optical Vortices in a Nonlinear Multicore Fiber with Unequal Coupling for Two Polarizations, Shamaem Khushhali[1], Andrea Marini[2], Samudra Roy[1]; [1]*Department of Physics, Indian Inst. of Technology Kharagpur, India;* [2]*Department of Physical and Chemical Sciences, Univ. of L'Aquila, Italy.* We study homogeneous-like nonlinear discrete optical vortices (NL-DOVs) in a nonlinear multicore fiber with unequal coupling for both polarizations $C_{11} \neq C_{22}$ for a magnetized core in presence of an external magnetic field.

JTu4A.69
Nano Tweaks to Ultrafast Non-Equilibrium Dynamics, Linjie Dai[2,1], Neil C. Greenham[2]; [1]Massachusetts Institute of Technology, USA; [2]University of Cambridge, United Kingdom. Understanding and control of ultrafast non-equilibrium processes in semiconductors are key to leveraging quantum states. Here, we demonstrate the manipulation of interactions between

carriers, phonons, and spins using quantum confinement and symmetry breaking through nanomorphology.

14:00 -- 15:30
Room: Bluebird Ballroom - Posters
JTu5A • Joint Poster Session II

JTu5A.1

Photoluminescence in Pr^{3+}-doped $Ba_{0.96}Ca_{0.04}Ti_{0.85}Hf_{0.15}O_3$ Ceramics, Ming Zheng[1], Yixiao Zhang[1], Pengfei Guan[1]; [1]*China Univ. of Mining and Technology, China.* The stable crystal structure of $Ba_{0.96}Ca_{0.04}Ti_{0.85}Hf_{0.15}O_3$ ceramics enables Pr^{3+} to have excellent photoluminescence properties. When Pr^{3+}-doped concentration is 0.8% mol, the photoluminescence intensity reaches the maximum and the relative change of photoluminescence intensity reaches 304.3%.

JTu5A.2

OAM degree of coherence, Sushil Pokharel[1], Olga Korotkova[1]; [1]*Univ. of Miami, USA.* A new scalar quantity, Orbital Angular Momentum (OAM) Degree of Coherence (DOC), is introduced to characterize radial correlations in a random beam among various OAM modes, in similarity with previously introduced EM DOC.

JTu5A.3

Trapping Locations of Microscopic Particles Held via Photophoresis in a Laser Beam, Justin B. Peatross[1], Samuel Kunzler[1], Andrew Jones[1], Michael Ware[1]; [1]*Brigham Young Univ., USA.* We image opaque microscopic particles trapped by photophoresis in a laser beam. Trapping locations are characterized relative to structure in the beam both radially and axially, which gives insight into trapping stability.

JTu5A.4

Scattering of light that is partially coherent and partially polarized, Taco D. Visser[1], Hugo F. Schouten[1]; [1]*Vrije Universiteit Amsterdam, Netherlands.* In practice light is neither fully polarized nor is it spatially fully coherent. We present a generalized Mie scattering theory for this situation, and present its first results.

JTu5A.5

Enhanced-resolution monitoring of Laser Powder Bed Fusion melt track formation with single-element-detection Spatial Frequency Modulation Imaging, Scott A. Hunter[1], Daniel W. Scarbrough[1], Seth Cottrell[1], Jeff Squier[1]; [1]*Colorado School of Mines, USA.* Laser Powder Bed Fusion faces imaging challenges due to low numerical aperture optics, fast laser-scanning speeds, and scattering media. Using Spatial Frequency Modulation Imaging, we achieved scatter-robust, enhanced-resolution imaging of melt track formation in-situ.

JTu5A.6

Novel Pump Architecture for High Average Power Optical Parametric Amplifiers at 1.5 µm Wavelength, Will Hettel[1], Grzegorz Golba[1], Rachel Larsen[1], Drew Morrill[1], Daniel Carlson[1], Jeremy Thurston[1], Peter Chang[2,1], Scott Diddams[2,1], Margaret Murnane[1], Henry Kapteyn[1,3], Michaël Hemmer[1]; [1]*Physics, Univ. of Colorado Boulder, USA;* [2]*Electrical, Computer and Energy Engineering, Univ. of Colorado Boulder, USA;* [3]*Kapteyn-Murnane Laboratories Inc, USA.* We report our progress developing a high average power ultrafast OPCPA at 1.5-µm pumped by a multi-channel Yb-fiber laser. The pump laser delivers 200-µJ, 250-fs pulses at 1-MHz repetition rate and parametric amplification was demonstrated.

JTu5A.7
X-ray Sources from Relativistic Laser-matter Interaction at ELI Beamlines, Jaroslav Nejdl[1]; [1]*Radiation Physics and Electron Acceleration, ELI Beamlines, Czechia.* The ELI Beamlines facility advances laser-driven sources of high-flux, coherent XUV and X-ray pulses. Key developments also include advanced sources based on relativistic laser-matter interaction, employing both under-critical and over-dense plasmas.

JTu5A.8
A fundamental elegant mode to construct and extend elegant Hermite-Gauss beams, Alfonso I. Jaimes-Nájera[1]; [1]*Tecnologico de Monterrey, Mexico.* We construct elegant traveling wavefields and show that elegant Hermite-Gauss beams are a particular superposition of them. This shows their fundamental character and allows to easily define new elegant structures with self-healing and quasi-non-diffracting properties.

JTu5A.9
Optical matrix multiplication as an analogue for quantum computing, Isaac M. Nape[1], Mwezi Koni[1], Hadrian Bezuidenhout[1], Andrew Forbes[1]; [1]*Univ. of Witwatersrand, South Africa.* We report a technique for executing quantum computing protocols that are inspired by photonic matrix multiplication and exploits the inherent tensor product structure of transverse spatial modes.

JTu5A.10
Thermal Conductivity Measurement of a Thin Layer of The Single Crystals of SnO Using Time Domain Thermoreflectance, Sagar K. Verma[1], Sieun Chae[1], Nirmala Kandadai[1]; [1]*School of Electrical Engineering and Computer Science, Oregon State Univ., USA, USA.* This work reports the thermal conductivity of a thin layer of the single crystals of tin monoxide (SnO) using a pump probe technique called time domain thermoreflectance (TDTR) and this was estimated to be $0.85 Wm^{-1}K^{-1}$.

JTu5A.11
An Experimental Study of the Polarization-dependent Optical Response of Single Layer Graphene to Polarized Light, Christabel M. Isagi[1]; [1]*Multimedia Univ. of Kenya, Kenya.* This study investigates the polarization-dependent optical responses of Single-Layer Graphene (SLG) using Fresnel equations, showing 96.7% transmittance and 2.2% absorbance, validating its potential for data storage and polarization analysis.

JTu5A.12
Nonlinear Optical Properties of NV-doped Diamond Crystal Studied Using Z-Scan Method, Wojciech Talik[1,2], Mariusz Mrózek[1], Adam Wojciechowski[1], Krzysztof Dzierzega[1]; [1]*Uniwersytet Jagiellonski w Krakowie Wydzial Fizyki Astronomii i Informatyki Stosowanej, Poland;* [2]*Doctoral School of Exact and Natural Sciences, Jagiellonian Univ., Poland.* Employing the Z-scan technique, the nonlinear properties of diamonds doped with NV centers of different concentrations were investigated. We found that presence of NV centers significantly modifies these properties.

JTu5A.13

Removal and reuse of coated glass substrate without polishing using chemical stripping method, Prachi Arora[2,1], Suman Tewary[3], Neelam Kumari[2]; *[1]IIIT Una, India; [2]Thin Film Coating Facility Lab, CSIR Central Scientific Instruments Organisation, India; [3]Advanced Materials and Processes, CSIR-National Metallurgical Laboratory (CSIR-NML), India.* This paper presents the removal of coating from the optical component without disturbing the performance of the substrate by using the chemical treatment method. After the coating is etched from the substrates, the results are analysed using a reflectometer.

JTu5A.14

Ultrafast Nematic Dynamics of FeSe Film, Larry Theran[1], Alexander Bartenev[1], Adrian Rua[1], Camilo Verbel[1], Armando Rua[1], Sergiy Lysenko[1]; *[1]Univ. of Puerto Rico, USA.* Femtosecond spectroscopy of FeSe film shows distinct transient nematic behavior below and above superconducting critical temperature. Results reveal correlations between photoinduced nematicity, quasiparticle formation, superconducting and pseudogap openings, emphasizing electronic correlations and preformed electron pairing.

JTu5A.15

Measurements of Stimulated Brillouin Scattering Gain Coupling Coefficients in Low Pressure Gases, Stephen Messing[1], Thomas Reboli[1], Andrey E. Mironov[1,2], Conner Galloway[2], John M. Gjevre[3], J. Gary Eden[1], Robert Fedosejevs[3]; *[1]Univ. of Illinois Urbana-Champaign, USA; [2]Excimer Energy, USA; [3]Univ. of Alberta, Canada.* Stimulated Brillouin scattering (SBS) gain profiles were recorded for Kr, Ar, and N_2 at a pumping wavelength of 266 nm. Use of low-pressure (<10 atm) gas shows a transition from the typical hydrodynamic regime into the kinetic regime.

JTu5A.16

Measuring Intrinsic Material Response From Nonlinear Spectroscopy With Laser Normalization, Adam Halaoui[1], Geoffrey Diederich[2], Oliver C. Schwarm[1], Mark Siemens[1]; *[1]Univ. of Denver, USA; [2]Physics, Univ. of Maryland Baltimore County, USA.* We show analytically that the intrinsic material (impulsive) response can be obtained from a nonlinear spectrum by dividing the detected signal by the laser spectrum, and demonstrate on experimentally-measured 4th-order multidimensional coherent spectra.

JTu5A.17

Morphology and Chemical Composition study of Thin Films on Transparent Substrates, deposited with Laser-Induced Backward Transfer (LIBT), Andrei Buzykin[1], Alejandro Ramos-Velazquez[2], John Amiaga[3]; *[1]Sankt-Peterburgskij politehniceskij universitet Petra Velikogo, Russian Federation; [2]Nacional'nyj issledovatel'skij universitet ITMO, Russian Federation; [3]IPG Photonics Corp, Germany.* Film deposition on glass surface by laser induced backward transfer was investigated. Correlations between energy and characteristics of the film, such as thickness and structural properties, are carried out for the first time.

JTu5A.18

Higher-Harmonic Generation in Strained Metal Thio/SelenoPhosphates Thin Film, Aamir Mushtaq[2], Troie journigan[2], Volodymyr Turkowski[2], Dylan A. Jeff[2], Rayan Siebenaller[1], Saiful Khondaker[2], Michael A. Susner[3], Enam Chowdhury[1], Michael Chini[2]; *[1]Ohio State Univ., USA;*

[2]*Physics, Univ. of Central Florida, USA;* [3]*Materials and Manufacturing Directorate, Air Force Research Laboratory, 2179 12th Street, Wright-Patterson Air Force Base, Ohio 45433, USA, USA.* We observed the effect of stain on higher harmonics generation (HHG) in Copper Indium Thiophosphate (CIPS) film. HHG in strain sample enhanced by 1 order of magnitude compared to pure CIPS.

JTu5A.19
Femtosecond Laser Ablated blind-Holes by Different Micromachining Parameters in Solid Oxide Fuel Cells, Mohamed Ahmed M. Baba[1], Bartlomiej Lemieszek[2], Mantas Sriubas[3], Gazy Khatmi[3,1], Brigita Abakeviciene[1,3], Sigitas Tamulevicius[1,3], Sebastian Molin[2], Tomas Tamulevicius[1,3]; [1]*Inst. of Material Science, Kaunas Univ. of Technology, Lithuania;* [2]*Advanced Materials Center, Politechnika Gdanska Wydzial Elektroniki Telekomunikacji i Informatyki, Poland;* [3]*Department of Physics, Kauno technologijos universitetas, Lithuania.* The efficacy of solid oxide fuel cell (SOFC) induced by femtosecond laser micromachining. A scanning electron microscope and impedance electrochemical spectroscopy were used to assess the SOFC. The structured cell performed 18 percent superior to the reference cell.

JTu5A.20
Bypassing Intrinsic Noise of On-Chip Integrated Frequency Combs Through Kerr-Induced Synchronization, Pradyoth Shandilya[2], Jordan Stone[3], Curtis Menyuk[2], Kartik Srinivasan[1,3], Gregory Moille[1,3]; [1]*Joint Quantum Inst., USA;* [2]*Univ. of Maryland Baltimore, USA;* [3]*National Inst. of Standards and Technology, USA.* We demonstrate all-optical quenching of integrated frequency comb intrinsic noise through Kerr-induced synchronization (KIS). Despite using free-running lasers, KIS enables repetition rate noise below the thermo-refractive noise limit, with narrow individual comb lines across an octave.

JTu5A.21
Switching of Single Photons in Position-disordered Few-Body Chiral Waveguide Quantum Electrodynamics Ladders, Amgain Nishan[1], Imran Mirza[1]; [1]*Miami Univ., USA.* We numerically study single-photon switching from one port to another in a waveguide quantum electrodynamics (wQED) ladder architecture in position-disordered dipole-dipole atomic chains.

JTu5A.22
Measuring the formation of a nonlinear vortex, Patrick Ford[1], Andrew A. Voitiv[1], Chuanzhou Zhu[2], Mark T. Lusk[2], Mark Siemens[1]; [1]*Univ. of Denver, USA;* [2]*Physics, Colorado School of Mines, USA.* We measure dynamics of optical vorticies with propagation through a nonlinear medium. Experiments are performed with a variable-length nonlinear fluid medium in order to observe the nonequilibrium dynamics of soliton formation.

JTu5A.23
Investigation of Broadband Ho-doped Gain Media for Efficient and Versatile 2 µm Amplifiers, Grzegorz Golba[1], Rachel Larsen[1], Will Hettel[1], Drew Morrill[1], Margaret Murnane[1], Henry Kapteyn[1,2], Michaël Hemmer[1]; [1]*Univ. of Colorado Boulder, USA;* [2]*Kapteyn-Murnane Laboratories Inc, USA.* We report emission cross-section, absorption cross-section and excited-state lifetime measurements of Ho:CaF 2 and Ho:YLF at room and cryogenic temperatures. We also report numerical simulations confirming sub-ps amplification to the 10-mJ, 1-kHz level using these materials.

JTu5A.24
Moved to JD4A.108

JTu5A.25
Retention of Radiation on a Reflective Glass Surface with Energy Release when a Voltage is Applied Across its Surface, Cristian Bahrim[1], Rishi Bharadwaj[1]; *[1]Lamar Univ., USA.* We modify the surface reflectivity of silica glasses to a weak 532nm laser radiation through the interference with another stronger 532nm laser beam assisted by an isotropic source of energy for producing an optoelectronic switch.

JTu5A.26
The invariance and spatially varying nature of non-separability in classical and quantum states of light, Cade R. Peters[1], Pedro Ornelas[1], Mitchell Cox[2], Alice Drozdov[2], Isaac Nape[1], Andrew Forbes[1]; *[1]School of Physics, Univ. of the Witwatersrand Johannesburg Faculty of Science, South Africa; [2]Electrical and Information Engineering, Univ. of the Witwatersrand Johannesburg Faculty of Engineering and the Built Environment, South Africa.* We report on the first real-world experimental evidence of the invariance of the non-separability of vectorial light through atmospheric turbulence and its spatially varying nature in the transverse plane.

JTu5A.27
Moved to JD4A.109

JTu5A.28
Fiber-based Seed Laser for a 2 mm Wavelength Pumped 3 mm Optical Parametric Chirped Pulse Amplifier, Rae Larsen[3], Will Hettel[3], Grzegorz Golba[3], Drew Morrill[1], Daniel Carlson[2], Peter Chang[4,3], Tsung-Han Wu[4,3], Scott Diddams[4,3], Henry Kapteyn[5], Margaret Murnane[3], Michaël Hemmer[1]; *[1]JILA, Univ. of Colorado Boulder, USA; [2]JILA, USA; [3]Physics, Univ. of Colorado Boulder, USA; [4]Electrical, Computer, and Energy Engineering, Univ. of Colorado Boulder, USA; [5]Kapteyn-Murnane Laboratories Inc, USA.* We report on a compact fiber-based front-end that delivers multi-nJ, 2 mm wavelength optical pulses at 100 MHz tailored to seed a high energy Ho:YLF regenerative amplifier and synchronous with broadband 2.5-3.5 mm pulses.

JTu5A.29
Moved to JD4A.110

JTu5A.30
Moved to JD4A.111

JTu5A.31
Advanced Methods for Monochromatic and Precisely Tunable High Harmonic Generation, Jaroslav Nejdl[1]; *[1]ELI Beamlines, Czechia.* Two novel techniques for generating (quasi)monochromatic XUV radiation through high-order harmonic generation will be presented. One utilizes Bessel-Gauss laser beams and density-modulated media, while the other employs UV driving beam for precise and stable wavelength tuning of the generated pulses.

JTu5A.32
Compact synthesis setup for space-time wave packets, Murat Yessenov[1], Oussama Mhibik[1], Tina M. Hayward[2], Rajesh Menon[2], Ivan Divliansky[1], Ayman F. Abouraddy[1]; *[1]Univ. of Central Florida, CREOL, USA; [2]Department of Electrical and Computer Engineering, Univ. of Utah Health, USA.* We introduce an ultra-compact and robust system to generate space-time wave packets based on chirped volume Bragg gratings to spatially resolve the spectrum, which reduced the volume of the synthesis setup down to 25 x 25 x 8 mm^3.

JTu5A.33
Experimental exploration of quantitative optics-mechanics connection, Guogan Zhao[1], Abdelali Sajia[1], Pawan Khatiwada[1], Xiao-Feng Qian[1]; *[1]Stevens Inst. of Technology, USA.* We experimentally investigate polarization, entanglement, and complementary behavior of a light beam, and the center of mass and moment of inertia of a two-mass system, confirming an unexpected quantitative link between wave optics and mechanics.

JTu5A.34
Improving the Signal-to-Noise Ratio in Dual-Comb Electro-Optic Sampling, Matthew Heyrich[2,1], Alexander Lind[2,1], Scott Diddams[2,1]; *[1]Physics, Univ. of Colorado Boulder College of Arts and Sciences, USA; [2]Electrical, Computer, Energy, Univ. of Colorado Boulder College of Engineering and Applied Science, USA.* We experimentally investigate approaches to enhance signal-to-noise ratio scaling in dual-comb electro-optic sampling. We demonstrate that chirping the sampling pulse directly before photodetection leads to improved linearity and higher SNR at higher optical powers.

JTu5A.35)
Spectral Broadening and Pulse Shaping in the Deep Ultraviolet, Julia Codere[1], Brett J. Pearson[2], Brian Kaufman[3], Martin G. Cohen[1], Matthew Bain[3], Thomas Weinacht[1], Ruaridh Forbes[3,4]; *[1]Department of Physics and Astronomy, Stony Brook Univ., USA; [2]Department of Physics and Astronomy, Dickinson College, USA; [3]Linac Coherent Light Source, SLAC National Accelerator Laboratory, USA; [4]Department of Chemistry, Univ. of California Davis, USA.* We demonstrate the production of shaped pulses in the deep ultraviolet using a stretched, hollow-core fiber and an acousto-optic modulator based pulse-shaper.

JTu5A.36
Non-perturbative quantum nature of high harmonic generation driven by non-classical light, Yang Xu[3], Saumya Choudhary[1], Zahirul Alam[2], Robert Boyd[3,2]; *[1]The Inst. of Optics, Univ. of Rochester, USA; [2]Department of Physics, Univ. of Ottawa, Canada; [3]Department of Physics and Astronomy, Univ. of Rochester, USA.* We measure the second-order correlation function of the high-harmonic emission of ZnO driven by an intense squeezed vacuum. The statistics of the superbunching high-harmonic photons show a significant deviation from the perturbation theory prediction.

JTu5A.37
Complete control of the quantum state with oscillating magnetic field, Arash Dezhang Fard[1]; *[1]Jagiellonian Univ., Poland.* In this conference, we demonstrate the full control over the quantum state and reconstruction of it based on the quantum-state tomography technique, showcasing our advancements in precision and accuracy in manipulating and measuring quantum systems.

JTu5A.38

Transfer Efficiency in a Light-Harvesting Trimer System Using a Pair of Time-Delayed Laser Pulses, Ethan A. Wyke[1], Abuenameh Aiyejina[2], Roger Andrews[1], Andrew Greentree[3]; *[1]Univ. of the West Indies, STA, Trinidad and Tobago; [2]School of Science, Computing and Artificial Intelligence, The Univ. of the West Indies, Antigua and Barbuda; [3]ARC Centre of Excellence for Nanoscale BioPhotonics, School of Science, RMIT Univ., Australia.* We analytically derive the wavefunction for a light-harvesting trimer system excited by time-delayed laser pulses. We find suppression and enhancement of the transfer efficiency depending on the time delay between the pair of laser pulses.

JTu5A.39

Hot Atoms and Light Cooperating, Hagan Hensley[1,2], Braden Larsen[1,2], James Thompson[1,2]; *[1]JILA, USA; [2]Physics, Univ. of Colorado Boulder, USA.* Here we demonstrate a limited-infrastructure cavity QED platform by probing transits of thermal Rb atoms through a narrow optical cavity. We detail our progress towards resolving single-atom transits and creating a non-classical source of light.

JTu5A.40

Development of an Electron Spectrometer for Laser-Accelerated Electrons, Vitória Macêdo C. Brandão[1], Nilson D. Júnior[1], Ricardo E. Samad[1]; *[1]Center of Lasers and Applications, Instituto de Pesquisas Energeticas e Nucleares, Brazil.* We present the development of an electron spectrometer with an imaging system to determine the energy spectrum of laser-accelerated electrons, and the equation that describes the electron deviation.

JTu5A.41

Exploration of Soliton Rain and Bound-State Soliton Regimes in MXene-Coated EDF Fiber Lasers, Kwanil Lee[1], Radomyr Diachenko[1]; *[1]Korea Inst. of Science & Technology, Korea (the Republic of).* This research explores unconventional regimes like soliton rain and bound-state soliton in EDF fiber lasers with MXene-coated etched optical fibers, aiming for ultrafast pulse generation and high repetition rates.

JTu5A.42

Scattering of arbitrary beams from spherical dielectric particles, Shawn Divitt[1], Matthew B. Hart[1], Vasanthi Sivaprakasam[1], Abbie T. Watnik[1]; *[1]US Naval Research Laboratory, USA.* We present a refined method for calculating the scattered field of spherical dielectric particles illuminated by arbitrary optical beams, validated through experimental measurements, offering improvements over previous methodologies in light scattering analysis.

JTu5A.43

Orbitalization properties of random light beams, Sushil Pokharel[1], Sebastian Martinez[2], Olga Korotkova[1]; *[1]Univ. of Miami, USA; [2]Carnegie Mellon Univ., USA.* New properties characterising the pairs of the OAM modes in a scalar random beam such as the degree of orbitalization and the orbitalization ellipse are introduced, in similarity with those of polarization theory.

JTu5A.44
A Proposed Experiment to Measure Saturated Nonlinear Optical Susceptibilities, Zachary H. Levine[1]; *[1]Quantum Measurement Division, National Inst. of Standards and Technology, USA.* The Z-scan method for determining nonlinear optical susceptibilities can be inaccurate if the Kerr coefficient is intensity dependent. A new method, Phase Retrieval of Modes (PROM), is proposed to improve measurement accuracy.

JTu5A.45
Moved to JD4A.115

JTu5A.46
Moved to JD4A.116

JTu5A.47
Adiabatic Nanofocusing Resolving Hot Electron Dynamics in Gold Nano-Tips, Elizabeth S. Kane[1], Fabian Menges[2], Alexey Belyanin[3], Markus B. Raschke[1]; *[1]Physics and JILA, Univ. of Colorado Boulder, USA; [2]Max Planck Inst. for Chemical Physics of Solids, Germany; [3]Physics and Astronomy, Texas A&M Univ. System, USA.* Combined four wave mixing and hot electron photoluminescence signals from plasmonic nanotips are observed in adiabatic nanofocusing of ultrafast pulses. From decoherence and hot electron evolution we infer on the different few-fs dissipation pathways.

JTu5A.48
All-fiber Generation of Fractional Vortex Beams, Rodolfo A. Carrillo Betancourt[1], Josué I. Gómez Méndez[2], Daniel A. May Arrioja[3], Amado Velázquez Benítez[4], Natanael Cuando Espitia[2,5], Juan Hernández Cordero[1]; *[1]Instituto de Investigaciones en Materiales, Universidad Nacional Autonoma de Mexico, Mexico; [2]Applied Physics Group, DICIS, Univ. of Guanajuato, Mexico; [3]Centro de Investigaciones en Óptica, Mexico; [4]Instituto de Ciencias Aplicadas y Tecnología, Universidad Nacional Autonoma de Mexico, Mexico; [5]CONAHCyT, Mexico.* We report on the generation of fractional vortex beams with an all-fiber device incorporating a multi-mode interferometer and a few-mode fiber. Upon combining different modes at the input, complex patterns resembling OAM beams are generated.

JTu5A.49
Random Laser Effect on a Bacterial Cellulose Aerogel using Rhodamine 6G as Gain Medium, Marcelo d. Cruz[1], Beatriz Damasio de Freitas[2], Leonardo Marchiori[2], Roberta Silva Pugina[2], Elias P. Ferreira-Neto[3], Pablo I. Pincheira[4], Anderson S. Gomes[5], Sidney José Lima Ribeiro[2], Leonardo De Boni[1]; *[1]São Carlos Inst. of Physics (IFSC - USP), Universidade de Sao Paulo, Brazil; [2]Inst. of Chemistry, Universidade Estadual Paulista Julio de Mesquita Filho, Brazil; [3]Inst. of Chemistry, Universidade Federal de Santa Catarina, Brazil; [4]Departamento de Ciencias Físicas, Universidad de La Frontera, Chile; [5]Physics Department, Universidade Federal de Pernambuco, Brazil.* The Random Laser action was investigated on bacterial nanocellulose coated with SiO2 and TiO2 doped with RH6G. In samples of different thicknesses, a narrowing of the FWHM value and threshold lasing energy was both observed.

JTu5A.50
Evidencing the Hanle Effect with Polarization Spectroscopy for the D_2 Line of Cesium, Gabriel Jiménez[1], Jose Ricardo Mejia Mora[1], Mayerlin Nuñez-Portela[1]; *[1]Departamento de*

Física, Universidad de los Andes, Colombia. Hanle effect is evidenced in a polarization spectroscopy scheme for the cesium D_2 line. The effect is observed in the anisotropy signal for the F=4->F'=5 hyperfine transition. Results are promising for applications in quantum magnetometry.

JTu5A.51
Absorption and Time-Resolved Spectroscopy Measurements of the $^3H_4 \rightarrow {}^3H_6$ Transition in Tm:YLF Between 75–300 K, Kavita Desai Kabelitz[1], Austin W. Steinforth[1], Andrey E. Mironov[1], J. Gary Eden[1], Thomas Galvin[2], Thomas Spinka[2]; *[1]Univ. of Illinois Urbana-Champaign, USA; [2]Lawrence Livermore National Laboratory, USA.* Spectroscopic measurements of the $^3H_4 \rightarrow {}^3H_6$ transition in Tm:YLF were conducted. Absorption spectra, emission spectra, and spontaneous emission lifetime are reported as a function of both temperature and doping concentration.

JTu5A.52
Quantifying the Decay Rates of Tetraphenylporphyrin Isomers with Neutral and Cationic Ligands, Diego F. de Oliveira[3], Maria Amparo Faustino[2], Leonardo De Boni[1]; *[2]Universidade de Aveiro, Portugal; [3]Universidade de Sao Paulo, Brazil.* This work investigates the excited state dynamics of new tetraphenylporphyrin isomers with neutral and cationic ligands, quantifying their decay rates. Results show that cationic samples have an increased probability of going through intersystem crossing and internal conversion.

JTu5A.53
Two-Photon Absorption Cross-Section of Neutral and Cationic Tetraphenylporphyrins, Diego F. de Oliveira[2], Maria Amparo Faustino[1], Leonardo De Boni[3]; *[1]Universidade de Aveiro, Portugal; [2]Universidade de Sao Paulo, Brazil.* This study explores new tetraphenylporphyrins with neutral and cationic ligands to determine their two-photon absorption cross-section. Results indicate parity forbidden transitions are still observable, while stronger parity allowed transitions appear inside the first biological window.

JTu5A.54
Simulating Solar Eclipse Shadow Bands Utilizing a Spatial Light Modulator, Jessica P. Conry[1], Amber Harrington[1]; *[1]Arkansas Tech Univ., USA.* This study simulates shadow bands observed during solar eclipses using a low-power HeNe laser, a null mask, and a phase mask displayed on a spatial light modulator, replicating atmospheric conditions in a controlled laboratory environment.

JTu5A.55
A Study on Axial Resolution Improvement Using Wiener Filter in SS-OCT Based Digital Photonic Sensor, Takanori Yamauchi[1], Naoki Sono[1], Hiroki Goto[1], Takuma Shirahata[1], Nobuki Kotake[1]; *[1]Information Technology R&D Center, Mitsubishi Electric Corporation, Japan.* In this research, we improved the axial resolution of a non-contact ranging system using a swept-source optical sensor and Wiener filter, traditionally applied in radar signal processing, and examined the wavelength dependency of the resolution.

JTu5A.56
Raman Spectroscopy, Laser Induced Breakdown Spectroscopy (LIBS) And Principal Component Analysis (PCA) Combined For Identification Of Polystyrene Microplastics In

Plastic Bottled Drinking water, Brian O. Osoro[1], Robinson Ndegwa[2], Jared O. Gwaro[1], Wilson Ombati[3]; *[1]Mathematics and Physical Sciences, Maasai Mara Univ., Kenya; [2]Physics, Univ. of Nairobi, Kenya; [3]Metrology, Kenya Bureau of Standards, Kenya.* Microplastics contamination is a growing concern. Here, Raman Spectroscopy, LIBS, and PCA were used to detect and identify polystyrene microplastics in bottled drinking water. Spectral findings were compared with standard polystyrene samples, enhancing microplastic identification.

JTu5A.57

Enhanced zero-phonon line emission from an ensemble of W centers in circular Bragg grating cavities, Vijin Kizhake Veetil[1], Nikki Ebadollahi[2], Junyeob Song[3], Aaron Katzenmeyer[3], Pradeep Namboodiri[3], Joshua Pomeroy[3], Marcelo Davanco[3], Kartik Srinivasan[2,3], Matthew Pelton[1]; *[1]Univ. of Maryland Baltimore County, USA; [2]Univ. of Maryland, USA; [3]National Inst. of Standards and Technology, USA.* We fabricated circular Bragg grating cavities containing an ensemble of silicon color centers. For cavities whose modes are resonant with the zero-phonon line emission of the color centers, we observed a 5.5-fold enhancement in the emitted intensity combined with a 1.3-fold increase in the decay rate.

JTu5A.58

Coherence synthesis with quadratic nonlinear photonic crystals, Zihao Pang[1], Ady Arie[1]; *[1]Tel Aviv Univ., Israel.* We show that that the spatial coherence of a second harmonic beam can be synthesized by shaping the fundamental beam. Our method is experimentally validated by synthesizing, in a second harmonic generation process, the coherence of vortex beams and Airy beams.

JTu5A.59

Generation of Non-Diffracting, Arbitrary Structured Light Sets Using a Modified HOBBIT System, Jaxon Wiley[1], Evan Robertson[1], Tyler Cramer[1], Matthew Reid[1], J. Keith Miller[1], Eric Johnson[1,2]; *[1]Clemson Univ., USA; [2]CREOL, Univ. of Central Florida, USA.* Customizable, non-diffracting light modes are dynamically generated using a modified HOBBIT system. amplitude control is realized to create the intensity distributions, allowing for highly complex structured modes that are tailorable to desired functions.

JTu5A.60

Pulse characterization via two-photon auto- and cross-correlation, Keegan Finger[1,2], Spencer Walker[1,2], Andreas Becker[1,2]; *[1]JILA, USA; [2]Department of Physics, Univ. of Colorado Boulder, USA.* We present the application of a multiple-Gaussian approach to characterize ultrashort vacuum and deep ultraviolet pulses via auto- and cross-correlation methods. We compare characterizations obtained via both methods with chirped and unchirped Gaussians.

JTu5A.61

Laser Beam Interaction With Rough Surfaces: a New Tool to Simulate Dynamic Laser Speckle, Filippo Tonti[2,1], Michele Moresco[2,1], Andrea Miglio[2,1]; *[1]Osservatorio di Astrofisica e Scienza dello Spazio di Bologna, Italy; [2]Universita degli Studi di Bologna, Italy.* Analyzing speckle interference patterns generated by laser illumination on rough or contaminated surfaces poses challenges for advanced optical systems. We introduce an algorithm to simulate static and dynamic speckle phenomena, critical for optimizing optical performance.

JTu5A.62

Strengthening and Accelerating Optics and Photonics in the Philippines, Joyce Ann T. De Guzman[1], Edna Nacianceno[1], Clarinda Reyes[1], Desiree Vera[1], Jenica Uy[1], Tony Rose Tumaneng[1], Hannah Marie T. Mejia[1], Enrico C. Paringit[1]; *[1]Department of Science and Technology-, Philippine Council for Industry, Energy, and Emerging Technology Research and Development (DOSTPCIEERD), Philippines.* This research explores key challenges, strategies and priority programs for the transformation and advancement of photonics in the Philippines. The identified priority research areas include optical communication, computational optics, fabrication, laser systems, and optoelectronics.

JTu5A.63
Fieldable Combs For Next-generation Quantum Applications, Alina Spiess[1], Cole Smith[1], Bennett Sodergren[1], Henry Timmers[1], Kevin Knabe[1], Evan Barnes[1], Andrew Attar[1], Kurt Vogel[1]; *[1]Vescent Photonics, USA.* Operation of miniaturized optical frequency combs throughout large temperature ranges and harsh vibration profiles will be presented, showing suitability for deployed applications such as optical clocks, time and frequency transfer, and dual comb spectroscopy.

JTu5A.64
Influence of the Spatial Coherence Pump Laser on PCF Supercontinuum Generation, Camilo Hurtado Ballesteros[1], Julian Orozco[1], Raul Alzate[1], Rodrigo Acuna[1], Pedro Torres[1]; *[1]Universidad Nacional De Colombia, Colombia.* The impact of spatial coherence on supercontinuum generation in photonic crystal fibers is experimentally investigated using a rotating ground glass diffuser within a two-lens configuration, exploring variations in spectral width and envelope shape.

JTu5A.65
Probing the Oxidation levels of Low-Density Lipoprotein Using the Z-scan Technique, Husam H. Abu-Safe[1]; *[1]German Jordanian Univ., Jordan.* The oxidation levels of low-density lipoprotein (LDL) using the z-scan method was investigated. The LDL samples were oxidized using copper sulfate. The amplitude of the z-scan signal modeled the changes in the oxidization levels.

JTu5A.66
Theoretical Investigation on Differential Trapping by Femtosecond Optical Tweezers, Deepak Kumar[1], Krishna Kant Singh[1], Ajitesh Singh[1], Debabrata Goswami[1]; *[1]Indian Inst. of Technology Kanpur, India.* Femtosecond laser pulses with Gaussian intensity profile can differentiate nanoparticles by creating three distinct trapping sites based on their non-linear optical properties. This "differential trapping" method enables non-contact and non-invasive micro- or nanomanipulation of nanoparticles.

JTu5A.67
Tight Focusing of Fractional Ellipse Field Polarization Singularities, Sushanta K. Pal[1], Leslie A. Rusch[1]; *[1]Université Laval, Canada.* We study the tight focusing of fractional ellipse field polarization singularities. For these optical fields, the strengths of transverse components at the focal plane depend on the value of the orbital angular momentum of the vortex beam.

JTu5A.68
Moved to JD4A.117

JTu5A.69
Attenuation Resilient Underwater Ranging Using Petal-Like Structured Light with Tailorable Longitudinal Intensity, Yingning Wang[1], Yuxiang Duan[1], Ruoyu Zeng[1], Huibin Zhou[1], Zile Jiang[1], Yue Zuo[1], Muralekrishnan Ramakrishnan[1], Robert Bock[2], Mo Mojahedi[3], Moshe Tur[4], Alan E. Willner1; [1]University of Southern California, USA; [2]R-Dex Systems Inc., USA; [3]Department of Electrical and Computer Engineering, University of Toronto, Canada; [4]School of Electrical Engineering, Tel Aviv University, Israel. We experimentally demonstrate a petal-like attenuation-resilient ranging beam with a ~9.5-dB central power enhancement at a 0.4-meter ranging distance, achieving 5 mm average ranging errors over 0-0.4 m in scattering water (γ = 5.1 m-1).

JTu5A.70
Non-destructive Distributed Multi-Physics Sensing for CPO based on Optical Frequency Domain Reflectometry, Feifei Cheng[1], Cheng Li[1], Fan Fan[1], Dekang Chen[1]; [1]Intel, USA. We propose an OFDR (Optical Frequency Domain Reflectometry) based non-destructive distributed multi-physics sensing method for Optical Packaging. This sensing method aims to optimize design, enhance reliability, and facilitate High Volume Manufacturing for Co-packaged Optics applications.

JTu5A.72
Non-Invasive Imaging Through Dynamic Diffusers in the Photon Counting Regime, Adrian Makowski[1,2], Pawel Szczypkowski[1], Wojciech Zwolinski[1], Bernard Gorzkowski[1], Sylvain Gigan[2], Radek Lapkiewicz[1]; [1]Institute of Experimental Physics, Faculty of Physics, University of Warsaw, Poland; [2]Laboratoire Kastler Brossel, ENS-PSL Universite, CNRS, Sorbonne Universite, College de France,, France. Scattering poses a significant challenge in optical imaging, particularly in microscopy with dynamic scatterers like biological tissues. We introduce a non-invasive imaging technique for dynamic diffusers, operating effectively even with a few photons per pixel.

JTu5A.73
FTIR Microspectroscopy-Based Differentiation of Pleural Empyema from Pleural Effusion, Souvik Das[1], Kartikeya Bharti[2], Pooja Lahiri[2], Basudev Lahiri[2]; [1]Advanced Technology And Development Centre, Indian Institute of Technology Kharagpur, India; [2]Electronics and Electrical Engineering Department, Indian Institute of Technology Kharagpur, India. We in this experiment have differentiated pleural empyema (PL_EMPY) from pleural effusion (PL_EFFU) effusion using FTIR micro-spectroscopy. We analyzed samples from clinically, radiologically, and pathologically reported patients with the above two diseases.

JTu5A.74
Unraveling the Use of Methylene Blue Efficacy on Treating Bacterial Pneumonia Using an In Vitro Alveolar Model, Ana J. Tomé[1], Giulia Kassab[2], Maria Luiza Ferreira Vicente[1,3], Cristina Kurachi[1]; [1]Physics Institute, Universidade de Sao Paulo, Brazil; [2]University Health Network, Canada; [3]Institut Mediterraneen d'Oceanologie, France. Bacterial infections might surpass cancer deaths by 2050. Pneumonia, a top cause of death in children under 5, underscores the

need for new treatments. Based on this photodynamic inactivation emerges as a promising approach.

JTu5A.75
Investigating a Transition in the Dynamics of Strong-Field Double Ionization in an Intense Bicircular Laser Pulse, Jan L. Chaloupka[1]; [1]University of Northern Colorado, USA. Using a classical ensemble method, we probe the double ionization of rare gases in intense bicircular laser pulses across a range of intensities and ionization potentials. We uncover a dramatic transition in the dynamics that lead to non-sequential double ionization, and establish a classical interpretation of the well-known Keldysh parameter.

15:30 -- 17:00
Room: 3A
FTu6A • Virtual Reality and Augmented Vision Theme: Enabling Technologies
Presider: Praneeth Chakravarthula; UNC-Chapel Hill

FTu6A.1 • 15:30 (Invited)
Meta-optics for AR/ VR System, Arka Majumdar[1]; *[1]Electrical and Computer Engineering, Univ. of Washington, USA.* By co-designing the meta-optics and computational backend, we demonstrated broadband imaging as well privacy preserving imaging for augmented/ virtual reality application. We also reported large field of view eyepiece.

FTu6A.2 • 16:00 (Invited)
Sub-Wavelength Spatial Light Modulator Enabling Compact Holographic Augmented Reality, Andrzej Kaczorowski[1], Edward Buckley[1], Richard Stahl[1], Dmitri Choutov[1], Theodore Marescaux[1], Michael Noonen[1]; *[1]Swave Photonics, UK.* Augmented Reality holds potential to transform our daily lives, but adoption has been limited. Holography overcomes many shortcomings of current AR. We review the history of Holographic Augmented Reality and present recent developments at Swave.

FTu6A.3 • 16:30 (Invited)
Spatial Light Modulators for Applications in Holography, AR/VR, Microscopy and Telecommunication, Andreas Hermerschmidt[1]; *[1]HOLOEYE Photonics AG, Germany.* Liquid crystal on silicon-based devices enable dynamic shaping of light fields in terms of amplitude, phase, or polarization. In this talk we discuss current and future parameters of existing and emerging devices and technologies.

15:30 -- 17:00
Room: 3B
FTu6B • Cytometry, Deflectormetry and Diffractive Networks
Presider: Hui Cao; Yale Univ., USA and Juergen Czarske; TUD | Dresden Univ. of Technology, Germany

FTu6B.1 • 15:30 (Invited)
Advancing Image Flow Cytometry Systems Beyond Fluorescence via Computational Label-Free Microscopy, Pietro Ferraro[1]; *[1]Inst. of Intelligent Systems ISASI, Italy.* We show that

advanced imaging flow cytometry systems, integrating label-free computational holographic microscopy, could open new avenues in overcoming traditional fluorescence methods, offering improved cellular analysis capabilities and potential applications in diverse research and diagnostics.

FTu6B.2 • 16:00
Quantitative phase imaging of cancerous cell by inverted polarization digital holographic microscope, Mohit Rathor[1], Shivam K. Chaubey[1], Rupen Tamang[2], Biplob Koch[2], Rakesh K. Singh[1]; *[1]Banaras Hindu Univ. Indian Inst. of Technology Varanasi, India; [2]Zoology, Banaras Hindu Univ., India.* We present a digital holographic microscope in the inverted geometry to extract the real-time quantitative polarization information of cancerous cells. Our technique is non-invasive and uses a single-shot intensity measurement for complete wavefront measurement.

FTu6B.3 • 16:15
Deflectometric Eye-tracking on Human Eyes, Jiazhang Wang[2,1], Tianfu Wang[3], Jiwon Choi[1], Oliver Cossairt[2], Florian Willomitzer[1]; *[1]The Univ. of Arizona, USA; [2]Northwestern Univ., USA; [3]Eidgenossische Technische Hochschule Zurich, Switzerland.* We introduce a new technique and experiments for deflectometric eye tracking on real human eyes in vivo. Our technique utilizes the teachings of our previous eye-tracking research, by combining the captured deflectometric information in a novel fashion

FTu6B.4 • 16:30
All-Optical Complex Field Imager, Yuhang Li[1], Jingxi Li[1], Tianyi Gan[1], Che-Yung Shen[1], Mona Jarrahi[1], Aydogan Ozcan[1]; *[1]ECE, Univ. of California Los Angeles, USA.* We present a diffractive complex field imager that uses an intensity-based optoelectronic sensor array to directly capture both the amplitude and phase images of input fields in a snapshot without digital processing.

FTu6B.5 • 16:45
Multiplexed All-Optical Permutation Operations Using Diffractive Networks with Layer Rotations, Guangdong Ma[1], Xilin Yang[1], Bijie Bai[1], Jingxi Li[1], Yuhang Li[1], Tianyi Gan[1], Yijie Zhang[1], Yuzhu Li[1], Mona Jarrahi[1], Aydogan Ozcan[1]; *[1]Univ. of California, Los Angeles, USA.* We demonstrate an all-optical design to perform a large set of permutation operations using diffractive networks with diffractive layer rotations. Experimental validation of this rotatable design was demonstrated at the terahertz part of the spectrum.

15:30 -- 17:00
Room: 3C
FTu6C • Quantum Information, Communication, and Sensing
Presider: Brian Smith; Univ. of Oregon, USA

FTu6C.1 • 15:30 (Invited)
Quantum Information and Sensing with Structured Light, Vincenzo D'Ambrosio[1]; *[1]Univ. of Naples Federico II, Italy.* The ability to tailor the structure of light forms a powerful concept in modern optics. We will discuss some recent results in sensing and quantum information enabled by light modes structured in polarization.

FTu6C.2 • 16:00

Optical, Microwave, and Acoustic Control of Spin Qubit Arrays in a Scalable Integrated Nanophotonics Platform, David A. Golter[1], Genevieve Clark[1,2], Kevin J. Palm[1], Andrew Greenspon[1,2], William Yzaguirre[1], Kevin Chen[2], Linsen Li[2], Andrew Leenheer[3], Matt Eichenfield[4,3], Gerald Gilbert[5], Dirk Englund[2]; *[1]The MITRE Corporation, USA; [2]Massachusetts Inst. of Technology, USA; [3]Sandia National Laboratories, USA; [4]The Univ. of Arizona James C Wyant College of Optical Sciences, USA; [5]The MITRE Corporation Princeton, USA.* We demonstrate a piezo-actuated system-on-chip capable of simultaneously implementing optical, microwave, and strain controls on multiple photonics integrated, diamond tin-vacancy center spins.

FTu6C.3 • 16:15

Demonstration of scalable and programmable Gaussian gate operations on optical non-Gaussian states, Daichi Okuno[3], Takato Yoshida[3], Ryoko Arita[3], Takahiro Kashiwazaki[1], Takeshi Umeki[1], Shigehito Miki[2], Fumihiro China[2], Masahiro Yabuno[2], Hirotaka Terai[2], Shuntaro Takeda[3]; *[1]Nihon Denshin Denwa Kabushiki Kaisha, Japan; [2]Kokuritsu Kenkyu Kaihatsu Hojin Joho Tsushin Kenkyu Kiko, Japan; [3]Tokyo Daigaku, Japan.* We demonstrate a programmable and multi-step squeezing gate on an optical non-Gaussian state by using a loop-based optical circuit, which paves the way for universal large-scale quantum computing.

FTu6C.4 • 16:30

No Fundamental Sensing Advantage from Exceptional Point Sensors, Hudson A. Loughlin[1], Vivishek Sudhir[1]; *[1]MIT, USA.* We present a theory of quantum noise in exceptional point sensors. We find that these sensors have no sensing advantage relative to traditional sensors limited by fundamental quantum or thermal noise.

FTu6C.5 • 16:45

SNSPD Arrays for Deep Space Optical Communication, Antonio Guardini[1], Henri Vlot[1], Lieuwe Locht[1], Amin Fakhree[1], Katyayani Seal[1], Andreas Fognini[1]; *[1]Single Quantum B V, Netherlands.* A free-space coupled 6x6 array of Superconducting Nanowire Single-Photon Detectors (SNSPDs) developed for Deep Space Optical Communication has enabled datarates of hundreds of Megabits/second for specific protocols, with a pathway for further extension.

15:30 -- 17:00
Room: 3D
FTu6D • Metasurfaces and Nanophotonics
Presider: Arka Majumdar; Tunoptix Inc, USA

FTu6D.1 • 15:30

High Efficiency Metasurfaces Using Fourier-Based Shape Optimization, Paulo Dainese[1], Louis A. Marra[1], Davide Cassara[2], Ary Portes[2], Jaewon Oh[2], Jun Yang[1], Alfonso Palmieri[2], Janderson Rocha Rodrigues[1], Ahmed Dorrah[2], Federico Capasso[2]; *[1]Corning Incorporated, USA; [2]Harvard John A Paulson School of Engineering and Applied Sciences, USA.* We demonstrate a shape optimization inverse design for metasurfaces that enables high efficiency devices while providing direct control of the structure complexity. Numerical and experimental results are presented.

FTu6D.2 • 15:45
MEMS-based twisted bilayer flat optics for multidimensional optical modulation and hyperimaging, Haoning Tang[1], Beicheng Lou[2], Fan Du[1], Guangqi Gao[1], Mingjie Zhang[1], Xueqi Ni[1], Evelyn Hu[1], Amir Yacoby[1], Yuan Cao[3], Shanhui Fan[2], Eric Mazur[1]; *[1]Harvard Univ., USA; [2]Stanford Univ., USA; [3]Univ. of California Berkeley College of Engineering, USA.* Our MEMS-based twistoptics device enables precise control of interlayer gaps and twist angles in photonic crystals, achieving high-accuracy, multidimensional light manipulation with significant potential in reconfigurable nanophotonics.

FTu6D.3 • 16:00
Hybrid photonic integration of color centers in designer nanodiamond with SiN nanophotonic devices, Kinfung Ngan[2], Yuan Zhan[2], Constantin Dory[1], Jelena Vuckovic[1], Shuo Sun[2]; *[1]E. L. Ginzton Laboratory, Stanford Univ., USA; [2]JILA and Department of Physics, Univ. of Colorado Boulder, USA.* We developed a new technique that enables deterministic assembly of diamond color centers in a SiN photonic circuit. Using this technique, we observed Purcell enhancement of SiV centers coupled to a silicon nitride ring resonator.

FTu6D.4 • 16:15
High Power Photonic Wavelength Conversion Using Nanopatterned Microresonators, Lindell M. Williams[1,2], Grant M. Brodnik[1,2], Haixin Liu[1,2], David R. Carlson[3], Jennifer A. Black[2], Scott B. Papp[1,2]; *[1]Physics, Univ. of Colorado Boulder, USA; [2]Time and Frequency Division, NIST Boulder Laboratories, USA; [3]Octave Photonics, USA.* We demonstrate microresonators with sub-wavelength, periodic patterns for high output power optical-parametric oscillation. Precise control of phase-matching using the nanopattern enables output power exceeding 70 mW and side-mode suppression greater than 50 dB.

FTu6D.5 • 16:30 (Invited)
Metalens, Metasurface, Robert Devlin[1]; *[1]Metalenz Inc, USA.* Abstract not available.

15:30 -- 17:00
Room: 3E
FTu6E • Ultrafast Lasers and Applications I
Presider: Lyuba Kuznetsova; San Diego State Univ., USA

FTu6E.1 • 15:30 (Invited)
Single-Mode Regenerative Amplification in Multimode Fiber, Frank W. Wise[1]; *[1]Cornell Univ., USA.* We demonstrate the scaling of femtosecond fiber amplifiers by mode area through regenerative amplification in multimode fiber. Initial results for high-gain amplification will be presented and possible future directions will be described.

FTu6E.2 • 16:00 (Invited)
Dual-Comb Spectroscopy in the Deep Ultraviolet for Laser Plasma Characterization, R. Jason Jones[1]; *[1]Univ of Arizona, Coll of Opt Sciences, USA.* We utilize time-resolved dual-comb spectroscopy in the deep ultraviolet (260nm) to measure the evolution of ionic and atomic species within a laser plasmas. Spectral analysis yields information on column densities, temperatures, and electron densities.

FTu6E.3 • 16:30
Narrow Linewidth Tabletop Vacuum-Ultraviolet Laser at 8.4 eV, Jeremy M. Thurston[1], Liam Weiner[2], Drew Morrill[1], Tika R. Kafle[1], Margaret Murnane[1], Henry Kapteyn[1,2]; *[1]JILA, USA; [2]Kapteyn-Murnane Laboratories Inc, USA.* We generate bright coherent tabletop VUV harmonics with linewidths <30 meV in a xenon-filled anti-resonant hollow core fiber, providing an efficient and compact approach for direct excitation of the low energy ^{229m}Th nuclear isomer.

FTu6E.4 • 16:45
Imaging Through Scattering Media with Ultrafast Spatiotemporal Gating on Epsilon-Near-Zero Materials, Yang Xu[1], Saumya Choudhary[1], Zahirul Alam[2], Robert Boyd[1,2]; *[1]Univ. of Rochester, USA; [2]Department of Physics, Univ. of Ottawa, Canada.* We use a femtosecond spatiotemporal gated four-wave mixing on ITO to image objects through scattering media. The selected ballistic photons give an excellent enhancement of the signal-to-noise ratio in the presence of strong optical diffusers.

15:30 -- 17:00
Room: 3F
LTu6F • Laser-Based Precision Metrology
Presider: Galan Moody; Univ. of California Santa Barbara, USA

LTu6F.1 • 15:30 (Invited)
At the Quantum Limit of Gravitational-Wave Detection, Victoria Xu[1]; *[1]Univ. of California Berkeley, USA.* Abstract not available.

LTu6F.2 • 16:00
Kerr squeezing across a full Nyquist window with a 1 GHz frequency comb, Daniel I. Herman[1], Molly Kate Kreider[1,2], Mathieu Walsh[3], Alexander Lind[1], Noah Lordi[2], Eugene Tsao[1], Matthew Heyrich[1,2], Joshua Combes[1], Jérôme Genest[3], Scott Diddams[1,2]; *[1]Electrical, Computer and Energy Engineering, Univ. of Colorado Boulder, USA; [2]Physics, Univ. of Colorado Boulder, USA; [3]Centre d'Optique, Photonique et Laser, Universite Laval, Canada.* We demonstrate a simple setup for amplitude-squeezed frequency comb generation in polarization-maintaining highly nonlinear fiber. Without optical amplification, injection of <20 pJ pulses results in >3.0 dB of squeezing.

LTu6F.3 • 16:15 (Invited)
Enhancing Optical Clock Performance with Multiple Atomic Ensembles, Shimon Kolkowitz[1]; *[1]Univ. of California Berkeley, USA.* I will explain the motivation and operating principles of our multiplexed strontium optical lattice clock. We use this miniature clock network to bypass limitations to atomic clock comparisons and achieve new levels of precision.

LTu6F.4 • 16:45
Compact ^{88}Sr Optical Lattice Clock System with Metasurface Optics for Laser Cooling, Zheng Luo[1,2], Andrew R. Ferdinand[1,2], Sindhu Jammi[1,2], Zachary L. Newman[3], Grisha Spektor[1,2], Okan Koksal[4], Parth Patel[5], Dan Sheredy[5], William Lunden[5], Akash Rakholia[5], Martin Boyd[5], Amit Agrawal[4], Wenqi Zhu[4], Travis C. Briles[2], Scott B. Papp[1,2]; *[1]Department of Physics, Univ. of Colorado Boulder, USA; [2]Time and Frequency Division, National Inst. of Standards and Technology, USA; [3]Octave Photonics, USA; [4]Microsystem and Nanotechnology Division,*

National Inst. of Standards and Technology, USA; [5]Vector Atomic Inc., USA. We demonstrate a scalable, integrated photonics infrastructure for compact optical clocks. In this alignment-free MOT ^{88}Sr atoms are cooled to 3 μK and loaded into an optical lattice, ready for ultranarrow clock transition interrogation.

17:30 -- 18:30
Room: 3A
JTu7A • Joint Postdeadline Papers Session I
Presider: Alexey Turukhin; Cisco Systems Inc., USA

JTu7A.1 • 17:30
Single-Shot Synthetic Wavelength Imaging Through Scattering Media, Patrick Cornwall[3], Stefan Forschner[3], Manuel Ballester[2], Khaled Kassem[1], Aggelos Katsaggelos[2], Daniele Faccio[1], Florian Willomitzer[3,2]; [1]University of Glasgow, United Kingdom; [2]Northwestern University, USA; [3]The University of Arizona, USA. Synthetic Wavelength Imaging (SWI) has recently been exploited to image hidden objects through scatter. We present first SWI measurements of an extended object through a scatterer in single-shot, enabling the potential to measure dynamic scenes.

JTu7A.2 • 17:45
Combining HHG with an RF Frequency Comb Generator for High Frequency (>60 GHz), Element-Specific Spectroscopy, Michael Tanksalvala[1], Anthony Kos[1], Jacob Wisser[1], Scott Diddams[2,3], Hans Nembach[1], Justin Shaw[1]; [1]Applied Physics Division, National Institute of Standards and Technology, USA; [2]Time & Frequency Division, National Institute of Standards and Technology, USA; [3]Electrical, Computer & Energy Engineering, University of Colorado Boulder, USA. We have developed a tabletop-scale instrument to perform element-specific spectroscopic studies, such as x-ray detected ferromagnetic resonance spectroscopy, at high frequencies (>60 GHz) by combining an RF frequency comb generator with a high-harmonic generation source.

JTu7A.3 • 18:00
Two-optical cycle 3 µm mid-IR pulses via multi-pass cell nonlinear self-compression, Gabriella Seifert[1], Will Hettel[1], Daniel Carlson[1], Drew Morrill[1], Grzegorz Golba[1], Rae Larsen[1], Margaret Murnane[1], Henry Kapteyn[1,2], Michaël Hemmer[1]; [1]University of Colorado Boulder, USA; [2]Kapteyn-Murnane Laboratories Inc, USA. We report the generation of 250 µJ, near transform-limited 2.4-cycle duration, 3 µm wavelength pulses at 1 kHz repetition rate via nonlinear self-compression in a multi-pass cell.

JTu7A.4 • 18:15
Reconfigurable Optical Recognition of 3 Independent Data Patterns Using Intra-Symbol Time Multiplexing and Nonlinear Wave Mixing, Amir Minoofar[1], Abdulrahman Alhaddad[1], Wing Ko[1], Hongkun Lian[1], Huibin Zhou[1], Narek Karapetyan[1], Muralekrishnan Ramakrishnan[1], Zile Jiang[1], Ahmed Almaiman[2], Murali Annavaram[1], Moshe Tur[3], Jonathan Habif[1], Alan E. Willner[1]; [1]University of Southern California, USA; [2]King Saud University, Saudi Arabia; [3]Tel Aviv University, Israel. We demonstrate multiple pattern recognitions in a 1- and 3-Gbaud QPSK inputs using intra-symbol time multiplexing and nonlinear wave mixing. The concept is

experimentally validated, where the pattern-matching occurrences are represented by the top-right symbol of the output constellation for each pattern.

17:30 -- 18:30
Room: 3B
JTu7A • Joint Postdeadline Papers Session II
Presider: *Andrew Forbes; University of Witwatersrand, South Africa*

JTu7B.1 • 17:30
Efficient Telecom C-Band Single Photons using a Tapered Nanobeam, Mohammad Habibur Rahaman[3,4], Samuel Harper[3,4], Changmin Lee[3,4], Kyu-Young Kim[1], Mustafa Atabey Buyukkaya[3,4], Abhijit Biswas[3,4], Victor J. Patel[2], Samuel D. Hawkins[2], Je-Hyung Kim[1], Sadhvikas Addamane[2], Edo Waks[3,4]; [1]Ulsan National Institute of Science and Technology, Korea (the Republic of); [2]Sandia National Laboratories, USA; [3]Electrical and Computer Engineering, University of Maryland, USA; 4Institute for Research in Electronics and Applied Physics, University of Maryland, USA. We present an efficient fiber-coupled indistinguishable photon source in the telecom C-band with InAs/InP quantum dots and a tapered nanobeam. It achieves 0.015 ± 0.003 single photon purity and 0.84 ± 0.06 two-photon interference visibility.

JTu7B.2 • 17:45
Next Generation Optical Quantum State Synthesis: Observation of Fourfold Negativity in the Wigner Function, Mamoru Endo[5,1], Kan Takase[5,1], Takefumi Nomura[5], Tatsuki Sonoyama[5], Kazuma Takahashi[5], Takahiro Kashiwazaki[4], Asuka Inoue[4], Takeshi Umeki[4], Sachiko Takasu[2], Daiji Fukuda[2], Petr Marek[3], Radim Filip[3], Warit Asavanant[5,1], Akira Furusawa[5,1]; [1]Rikagaku Kenkyujo, Japan; [2]Sangyo Gijutsu Sogo Kenkyujo Tsukuba, Japan; [3]Univerzita Palackeho v Olomouci, Czechia; [4]Nihon Denshin Denwa Kabushiki Kaisha, Japan; [5]Tokyo Daigaku, Japan. An optical quantum state with fourfold Wigner negativity was generated without any loss correction. Generalized photon subtraction scheme, broadband squeezed light source, and high-temporal-resolution transition-edge sensor enabled generation rates of tens of counts per second.

JTu7B.3 • 18:00
A Coherent and Efficient One-Dimensional Atom, Alisa Javadi[1,2], Natasha Tomm[2], Nadia Antoniadis[2], Marcelo J. Broinizi Pereira[2], Matteo Brunelli[2], Rüdiger Schott[3], Sascha R. Valentin[3], Andreas Wieck[3], Arne Ludwig[3], Patrick Potts[2], Richard Warburton[2]; [1]University of Oklahoma, USA; [2]Universitat Basel, Switzerland; [3]Physics, University of Bochum, Germany. We achieve 99.2% extinction in cavity transmission using a quantum dot, enabling optical nonlinearities at the fundamental limit, between two photons. We observe a g2(0) = 587 for transmitted photons, the strongest reported to date.

JTu7B.4 • 18:15
A microscope for observing intracellular transport with molecular resolution on molecular timescales, Jeremy Axelrod[1], G. Edward Marti[1], Steven Chu[1,2]; [1]Molecular and Cellular Physiology, Stanford University, USA; [2]Physics, Stanford University, USA. We demonstrate an optical microscope that localizes gold nanoparticles to under 1 nm in 10 μs with illumination conditions compatible with live cell imaging. This enables molecular-scale measurements of molecular motor dynamics in intracellular transport.

Wednesday, 25 September

08:00 -- 09:00
Room: 3A
FW1A • Virtual Reality and Augmented Vision Theme: Applications I
Presider: Sundeep Jolly; Apple

FW1A.1 • 08:00 (Invited)
Title to be Announced, Murat Deveci[1]; [1]*OptoFidelity Inc., USA.* Abstract not available.

FW1A.2 • 08:30 (Invited)
Title to be Announced, Muniyandi Manivannan[1]; [1]*Indian Inst. of Technology Madras, India.* Abstract not available.

08:00 -- 09:00
Room: 3B
FW1B • Machine Learning Theme: Biomedical Applications I
Presider: G. Groot Gregory; Synopsys, Inc, USA

FW1B.1 • 08:00 (Invited)
Machine Learning in Ophthalmology: State of the Art and Future Directions, Nakul Shekhawat[1], Rama Chellappa[2]; [1]*Wilmer Eye Inst., Johns Hopkins Univ., USA;* [2]*Johns Hopkins Whiting School of Engineering, USA.* Ophthalmology has led deployment of artificial intelligence algorithms in clinical settings. This talk will review history, state of the art, and future directions of machine learning approaches to diagnosis, assessment, and prediction of eye diseases.

08:00 -- 09:00
Room: 3C
FW1C • Laser and Optical Technologies
Presider: Rodrigo da Silva Benevides; ETH Zurich, Switzerland

FW1C.1 • 08:00 (Invited)
Quantum-Walk Comb Laser: Harnessing Fast-Gain for Synthetic Lattice Dynamics, Alex Dikopoltsev[2], Ina Heckelmann[2], Mathieu Bertrand[2], Mattias Beck[2], Giacomo Scalari[2], Oded Zilberberg[1], Jerome Faist[2]; [1]*Universitat Konstanz Mathematisch-Naturwissenschaftliche Sektion, Germany;* [2]*Eidgenossische Technische Hochschule Zurich Departement Physik, Switzerland.* Locking cavity modes into a frequency comb is key for metrological applications. We show that fast-gain in modulated semiconductor ring lasers supports controllable active synthetic lattice dynamics that lead to novel forms of frequency combs.

FW1C.2 • 08:30
Coherent generation of decoherence-free states in nonlinear waveguide quantum electrodynamics, Aviv Karnieli[1], Offek Tziperman[2], Charles Roques-Carmes[1], Shanhui Fan[1]; [1]*Stanford Univ., USA;* [2]*Technion Israel Inst. of Technology, Israel.* We show that emitter arrays coupled to nonlinear parametric-amplifier waveguides support a unique, coherent inter-atomic

interaction. This allows for unitary adiabatic evolution and coherent generation of decoherence-free excited states in waveguide quantum electrodynamics.

FW1C.3 • 08:45
Non-Classical Quantum State Generation using Superconducting-Nanostrip Photon-Number Resolving Detector with Optical Sampling, Mamoru Endo[1,2], Kazuma Takahashi[1], Takefumi Nomura[1], Tatsuki Sonoyama[1], Shigehito Miki[3], Masahiro Yabuno[3], Hirotaka Terai[3], Takahiro Kashiwazaki[4], Asuka Inoue[4], Takeshi Umeki[4], Rajveer Nehra[1,5], Kan Takase[1,2], Warit Asavanant[1,2], Akira Furusawa[1,2]; *[1]Tokyo Daigaku, Japan; [2]Rikagaku Kenkyujo, Japan; [3]Joho Tsushin Kenkyu Kiko Mirai ICT Kenkyujo, Japan; [4]Nihon Denshin Denwa Kabushiki Kaisha NTT Device Innovation Center, Japan; [5]Univ. of Massachusetts Amherst, USA.* Superconducting-nanostrip photon detectors with optical sampling method now function as true photon-number resolving detectors in real-time without multiplexing. We applied this technique for quantum state generation vital for ultra-fast optical quantum computation.

08:00 -- 09:00
Room: 3D
FW1D • MEMS and Piezo-Optomechanical Devices
Presider: Karan Mehta; Cornell Univ., USA

FW1D.1 • 08:00
Resonantly Driven Programmable Multimode Interference in Photonic Integrated Circuits, Hugo Larocque[1], Mark Dong[2], Andrew Leenheer[3], Nils Otterstrom[3], Gerald Gilbert[4], Matt Eichenfield[3], Dirk Englund[1]; *[1]Massachusetts Inst. of Technology, USA; [2]The MITRE Corporation Bedford, USA; [3]Sandia National Laboratories, USA; [4]The MITRE Corporation Princeton, USA.* We implement a piezoelectrically programmable multimode interferometer exploiting mechanical resonances to enhance conversion between guided optical modes. Our results provide a new platform for spatio-temporal beam shaping using photonic integrated circuits.

FW1D.2 • 08:15
Piezo-Optomechanically Tunable Ultra-Low-Loss Linear Programmable Processors for Quantum Computing and Networking, Mayank Mishra[2], Gwangho Choi[2], Gina Talcott[1], Michael Gehl[1], Andrew Leenheer[1], Daniel Dominguez[1], Nils Otterstrom[1], Matt Eichenfield[2,1]; *[1]Sandia National Laboratories, USA; [2]The Univ. of Arizona James C Wyant College of Optical Sciences, USA.* We present on design, optimization, fabrication and characterization of reconfigurable and modulatable ultra-low-loss photonic integrated circuits, using low-confinement waveguides and piezo-optomechanical modulation to achieve dB/m class losses and high electro-optic responsivity at visible wavelengths.

FW1D.3 • 08:30
A High-Resolution and High-Bandwidth Nano-Optomechanical MEMS Accelerometer with Ultra-Wide Optical and Temperature Ranges, Chang Ge[1], Daniel Dominguez[2], Michael Miller[2], Matt Eichenfield[1,2]; *[1]The Univ. of Arizona, USA; [2]Sandia National Laboratories, USA.* We demonstrate a > 10 milligram, fiber-packaged, ultra-high-sensitivity nano-optomechanical MEMS accelerometer using an intrinsically differential Mach-Zehnder strain-sensing interferometer with 10 μg/√Hz resolution up to 100 kHz. The differential readout is insensitive to wavelength and temperature over ~40 nm and ~30 degree ranges, respectively.

FW1D.4 • 08:45

An Optically Broadband Piezo-Optomechanical Magnetometer with Wide Temperature Range: Towards Fieldable Devices, Zachary A. Castillo[1,2], Brandon Smith[2], Alex Will-Cole[2], Mark Dong[3], Konrad Bussmann[4], Peter Finkel[4], Matt Eichenfield[5,2]; *[1]Physics, The Univ. of New Mexico, USA; [2]Sandia National Laboratories, USA; [3]The MITRE Corporation, USA; [4]USA Navy, USA; [5]Wyant College of Optical Sciences, Univ. of Arizona, USA.* We demonstrate optically broadband piezo-optomechanical magnetometry, with performance comparable to state-of-the-art cavity optomechanical magnetometers. The devices are thermally insensitive and do not require laser locking, opening the door to operation outside the laboratory environment.

08:00 -- 09:00
Room: 3E
FW1E • Optical Interactions
Presider: James Millen; King's College London, UK

FW1E.1 • 08:00

Ultrafast Spin Dynamics in Multi-Element Alloys Uncovered using Extreme Ultraviolet High Harmonic Probes, Anya Grafov[1,2], Sinéad A. Ryan[1], Peter C. Johnsen[1], Mohamed F. Elhanoty[3], Na Li[1], Olle Eriksson[3], Henry Kapteyn[1], Oscar Grånäs[3], Margaret Murnane[1]; *[1]JILA, USA; [2]Physics, Univ. of Colorado Boulder, USA; [3]Uppsala Universitet, Sweden.* Ultrafast extreme ultraviolet light can probe light-induced spin dynamics in magnetic alloys with elemental specificity. We track spin transfer and spin reorientation dynamics of different elements to uncover the microscopic mechanisms underlying spin manipulation.

FW1E.2 • 08:15

Pseudospin Localization of Light in Nonlinear Optics, Shani Izhak[1], Aviv Karnieli[1], Ofir Yesharim[1], Shai Tsesses[2], Ady Arie[1]; *[1]Tel Aviv Univ., Israel; [2]Technion Israel Inst. of Technology, Israel.* We predict a new universal pseudospin localization phenomenon and demonstrate it experimentally in an optical analogue of a spin-glass material – a disordered sum-frequency generation process in a nonlinear photonic crystal.

FW1E.3 • 08:30

Photonic Crystal-Coupled Enhanced Steering Emission: A Prism-Free, Objective-Free and Metal-Free Lossless Technology for Biosensing, Seemesh Bhaskar[1,2], Weinan Liu[1,3], Joseph Tibbs[3,4], Brian T Cunningham[1,2]; *[1]Department of Electrical and Computer Engineering, Univ. of Illinois Urbana-Champaign, USA; [2]Carl R. Woese Inst. for Genomic Biology, Nick Holonyak Jr. Micro and Nanotechnology Laboratory, Univ. of Illinois Urbana-Champaign, USA; [3]Nick Holonyak Jr. Micro and Nanotechnology Laboratory, Univ. of Illinois Urbana-Champaign, USA; [4]Department of Bioengineering, Univ. of Illinois Urbana-Champaign, USA.* This work presents the design, fabrication and application of one-dimensional photonic crystal grating interfaces to accomplish a cost-effective prism-free, metal-free, and objective-free platform for augmentation of fluorescence emission collection efficiency by engineering the guided mode resonance (GMR).

FW1E.4 • 08:45

Resonant nonlinear optics: upper bounds & optimal quantum-well designs, Hao Li[1], Theodoros T. Koutserimpas[2], Francesco Monticone[2], Owen Miller[1]; *[1]Department of Applied Physics and Energy Sciences Inst., Yale Univ., USA; [2]School of Electrical and Computer Engineering, Cornell Univ., USA.* We establish tight bounds for resonant nonlinear optical susceptibilities based on Thomas-Reiche-Kuhn (TRK) sum rules, and demonstrate that inverse-designed quantum wells (QWs) can approach these bounds within 20%, for second-/third-harmonic generation and sum-frequency generation.

08:00 -- 09:00
Room: 3F
LW1F • Quantum Computing and Sensing
Presider: Alexander Senichev; Purdue Univ., USA

LW1F.1 • 08:00 (Invited)

Neutral Atom Quantum Computing with Ytterbium in Tweezer Arrays, Bichen Zhang[1], Genyue Liu[1], Pai Peng[1], Shuo Ma[1], Sebastian P. Horvath[1], Jeff D. Thompson[1]; *[1]Princeton Univ., USA.* Metastable qubits encoded with Yb convert a significant fraction of errors to erasures, leading to favorable error models for quantum error correction. I will discuss our experiments aimed at enhancing system performance through erasure conversion.

LW1F.2 • 08:30 (Invited)

Visible Light Photonic Integrated Circuits for Quantum Computing and Sensing, Cheryl M. Sorace-Agaskar[1]; *[1]MIT Lincoln Laboratory, USA.* This talk will cover our work on visible wavelength photonic integrated circuits as a pathway to miniaturization and increased scale and complexity of quantum computing and sensing systems, especially trapped-ion based systems.

09:15 -- 10:00
Room: 3A
FW2A • FiO Quantum Technologies Visionary Session II
Presider: P. Scott Carney; Optica, USA

FW2A.1 • 09:15 (Visionary)

Quantum Technologies: From Inspiration to Economic and Societal Value, Peter Knight[1]; *[1]Imperial College London, UK.* The journey from great research to practical realization is a difficult one, where building a collaborative ecosystem engaging researchers, entrepreneurs, investment capital, companies and government early adopters is essential. I will describe how such a committed ecosystem can be built, drawing together a diverse community, accelerating the journey from fundamental science to product.

09:15 -- 10:00
Room: 3F
LW2B • Laser Science Visionary Session II
Presider: Robert Kaindl; Arizona State Univ., USA

LW2B.1 • 09:15 (Visionary)
Optical Guiding of Ultrahigh Intensity Light: Overview and Applications, Howard Milchberg[1]; *[1]Univ. of Maryland at College Park, USA.* The remarkable increase in peak laser intensity over the past 30+ years has spurred new advances in laser-driven sources of relativistic charged particles and light, along with the new field of high intensity plasma optics. I will review some of these developments and their applications.

10:30 -- 11:30
Room: Showcase Theater
JW3A • Joint Plenary Session II
Presider: Susan Dexheimer; Washington State University, USA and Robert Kaindl; Arizona State Univ., USA

JW3A.1 • 10:30 (Plenary)
Putting High Harmonic Quantum Technologies to Work, Margaret Murnane[1]; *[1]Univ. of Colorado at Boulder, USA.* High harmonic upconversion of femtosecond lasers provides an exquisite source of short wavelength light, with unprecedented control over the spectral, temporal, polarization and orbital angular momentum (OAM) of the emitted waveforms, from the UV to the keV photon energy region.

11:30 -- 13:00
Room: Bluebird Ballroom - Posters
JW4A • Joint Poster Session III

JW4A.1
Withdrawn

JW4A.2
Controlled Excitation of Quantum Dot Spins on a Semiconductor Chip, Hamidreza Siampour[1]; *[1]Queen's Univ. Belfast, UK.* The goal of controlled excitation of quantum dot spins is to achieve coherent manipulation and readout of quantum information encoded in the spin states. By confining excitation to the chip, we develop compact, scalable platforms exploiting quantum dots' unique properties for advanced technological applications.

JW4A.3
Withdrawn

JW4A.4
Simultaneous Quantum Frequency Conversion and Spectro-Temporal Shaping of Single-Photon Pulses, Michal J. Mikolajczyk[1], Ali Golestani[1,2], Michal Karpinski[1]; *[1]Uniwersytet Warszawski Wydzial Fizyki, Poland; [2]Department of Electrical and Computer Engineering, Univ.*

of Toronto, Canada. We experimentally demonstrate a quantum pulse shaper by converting single-photon-level light with parameters typical for quantum dot emission to standard 1300 nm telecommunication channel by increasing spectral bandwidth from 5 GHz to 100 GHz with near-unity efficiency.

JW4A.5
Withdrawn

JW4A.6
Non-reciprocal Light Propagation in Spinning Ring Resonators Coupled with Two-level Atoms, Jaela Allen[1], Glenn A. Ochsner[1], Imran Mirza[1]; *[1]Miami Univ., USA.* We study the impact of two-level atomic couplings on the non-reciprocal light propagation in spinning optomechanical ring resonators with possible applications in hybrid quantum technologies.

JW4A.7
Exploration of the Hong-Ou-Mandel Effect with Cavity QED Single-photon Sources, Caden McCollum[1], Alexia Dudones[1], Imran Mirza[1]; *[1]Miami Univ., USA.* We use the quantum jump approach to study two-photon interference effects with cavity quantum electrodynamics (cQED) single photon sources arranged against a 50- 50 beam splitter.

JW4A.8
Potential Roughness Suppression in a Radio-Frequency AC Zeeman Chip Trap, William Miyahira[1], Seth Aubin[1]; *[1]William & Mary, USA.* We present work showing potential roughness suppression in an AC Zeeman atom chip trap operating on RF Zeeman transitions. RF trap roughness is compared with a DC trap with clear suppression in the RF trap.

JW4A.9
AI-assisted superresolution of two practical point sources, Abdelali Sajia[1], Bilal Benzimoun[1], Pawan Khatiwada[1], Guogan Zhao[1], Reshawna Curley[1], Xiao-Feng Qian[1]; *[1]Stevens Inst. of Technology, USA.* We investigate super-resolution of two spatially separated practical point sources using machine learning. High fidelity of over 90\% is achieved for separations that are 16 times smaller than the conventional resolution limit.

JW4A.10
Optimal superresolution of two point sources via Schmidt basis, Abdelali Sajia[1], Guogan Zhao[1], Pawan Khatiwada[1], Bilal Benzimoun[1], Xiao-Feng Qian[1]; *[1]Stevens Inst. of Technology, USA.* We investigate superresolution of two general point sources using continuous rotation of the observation basis. Optimal superresolution with maximum estimation accuracy is achieved when measurements are performed in the Schmidt basis.

JW4A.11
Simulating Quantum State Revival with Paraxial Beam Propagation, Pawan Khatiwada[1], Daniel Yu[1], Edward Yu[1], Xiao-Feng Qian[1]; *[1]Stevens Inst. of Technology, USA.* We explore the equivalence between paraxial optical beam propagation and 2D harmonic oscillator evolution. The phenomenon of quantum state revival of harmonic oscillator is shown to be simulated with the propagation of a focusing beam.

JW4A.12

Generation of Continuous Variable Entangled States from Quantum Dot Biexciton Coupled to Bimodal Cavity System, Samit K. Hazra[2], Lavakumar Addepalli[1], P. K. Pathak[1], Tarak N. Dey[2]; *[1]Indian Inst. of Technology Mandi, India; [2]Physics, Indian Inst. of Technology Guwahati, India.* We study the generation of continuous variable(CV) entangled states of the two-mode cavity fields coupled to a coherently pumped quantum dot(QD) biexciton. We further show the effect of exciton-phonon interactions using polaron theory on generating CV entangled states.

JW4A.13

Impact of pressure on the magnetocaloric effect in InSb quantum wire: Rashba SOI and crossed electromagnetic field, Priyanka Priyanka[1], Rinku Sharma[2]; *[1]Delhi Technological Univ. Department of Applied Physics, India.* The impact of hydrostatic pressure on the magnetocaloric effect in an InSb quantum wire has been investigated. First, eigenenergies are obtained using the diagonalization method, then entropy and magnetic entropy (magnetocaloric effect) are calculated numerically.

JW4A.14

Frequency Conversion in OP-GaAsP for MLWIR Operation, Vladimir Tassev[1], Shivashankar R. Vangala[1], Samuel Linser[1,2], Duane D. Brinegar[1,2], Valentin Petrov[3]; *[1]Air Force Research Laboratory, USA; [2]KBR, USA; [3]Max Born Inst. for Nonlinear Optics and Ultrafast Spectroscopy, Germany.* 600 µm thick orientation-patterned GaAsP quasi-phase matching structures were grown by hydride vapor phase epitaxy on OP-GaAs templates. Frequency conversion in the mid IR exceeding 19 % conversion efficiency was demonstrated via second harmonic generation.

JW4A.15

Demonstration of Quantum Gate Design Using Linear Photonic Components in Lumerical, Farah A. Abdelrazek[1], Thomas Mikhail[1], Mohamed A. Swillam[1]; *[1]The American Univ. in Cairo, Egypt.* This paper presents the design and simulation of photonic components using Ansys Lumerical software. These components were integrated into circuits to apply quantum operations.

JW4A.16

Simple Characterization of Linear Optical Multiport Devices, Amos Smith[1], Shannon Ray[2], Daniel Koch[1], Sam Ellis[2], Christopher C. Tison[1], Paul M. Alsing[1]; *[1]ARFL, USA; [2]Griffiss Institute, USA.* We describe a minimal set of classical measurements for characterizing and calibrating optical multiport devices that leads to a direct element by element measurement of the device's unitary transfer function matrix.

JW4A.17

Iodine-frequency-stabilized AlGaInP-based VECSEL at 689 nm, Charlotte A. Hodges[1], Paulo Hisao Moriya[1], Jennifer E. Hastie[1]; *[1]Inst. of Photonics, SUPA, Department of Physics, Univ. of Strathclyde, UK.* We demonstrate a high-brightness, iodine-locked AlGaInP-based VECSEL at 689 nm with estimated linewidth of 6.6(5) kHz and reduced frequency drift, targeting neutral Sr-based timing applications.

JW4A.18

Two-Photon Lithography-Based Miniaturised Heavy Metal Sensing Platform, Akanksha Sharma[1], Sweta Rani[1], Tejas Suryawanshi[1], Arun Jaiswal[1], Rahul K. Das[1], Sumit Saxena[1], Shobha Shukla[1]; [1]*Indian Inst. of Technology Bombay, India.* We report a two-photon lithography-based fabrication of fluorescent micro/nanostructures using non-metal doped-carbon quantum dots incorporated with a photosensitive resin. These micro/nanostructures serve as a platform for sensitive detection of heavy metal ions in water bodies.

JW4A.19

Experimental Studies of Phase Profile of Hermite-Gauss Laser Beams, Apoorva Bisht[1,2], Reeta Vyas[1], Surendra Singh[1]; [1]*Univ. of Arkansas, USA;* [2]*Univ. of Colorado Boulder, USA.* Experimental investigations of interference of HG laser beams with a plane wave and their diffraction by a single slit shed new light on their phase structure revealing features that had been overlooked.

JW4A.20

Quantum Phase Imaging with Undetected Photons Immune to Phase Noise, Chandler R. Tarrant[1], Mayukh Lahiri[1]; [1]*Department of Physics, Oklahoma State Univ. The College of Arts and Sciences, USA.* We present an interferometric quantum phase imaging technique that (1) does not detect the photons interacting with the object and (2) applies when standard interferometry-based phase imaging schemes fail due to uncontrollable, random phase fluctuations.

JW4A.21

Quantum State Tomography of Two-Qubit Photonic States with Undetected Photons, Salini Rajeev[1], Mayukh Lahiri[2]; [1]*Department of Physics, Oklahoma State Univ. The College of Arts and Sciences, USA.* We present a novel, quantum interferometric method of performing quantum state tomography of two-qubit photonic mixed states. The method does not require detecting one of the photons and therefore allows covering of wider spectral ranges.

JW4A.22

Exploiting Quadratic and Cubic Nonlinearities in Developing Novel Integrated Heralded Single-Photon Sources, Mahmoud H. Almassri[1], Mohammed F. Saleh[1]; [1]*Heriot-Watt Univ., UK.* We develop a quantum model to study and characterize a novel integrated single-photon source that is based on the interplay of two simultaneous nonlinear parametric processes. The model predicts the generation of high-pure single photons.

JW4A.23

Transverse-Mode Nonlinear Interactions in Strongly Coupled Integrated Waveguides, Lisi Xia[1], Peter van der Slot[1], Maximilian Timmerkamp[2], Carsten Fallnich[2], Klaus Boller[1,2]; [1]*Universiteit Twente, Netherlands;* [2]*Universitat Munster, Germany.* We experimentally investigate control and analysis of spatio-temporal nonlinear interactions by implementing simultaneous supercontinuum generation in transverse modes of chip-integrated dual-core waveguides. The approach can be important for progress in multimode integrated nonlinear photonics.

JW4A.24

The Role of Optical Pumping on the Line Profile of the 6P State in ^{85}Rb for the Double Resonance Spectroscopy, Dorothy K. Mringie[1], Elijah O. Nyakang'o[1], Geoffrey K. Rurimo[1]; [1]*Multimedia Univ. of Kenya, Kenya.* A theoretical framework to determine how optical pumping affects the ^{85}Rb 6P state's line profiles. Precise measurement is challenged by the line broadening effect of optical pumping, which makes it hard to resolve the peaks.

JW4A.25

Inverse-Designed Metasurface for Multidimensional Spatial Photon State Reconstruction, Yuming Niu[1], Kai Wang[1]; [1]*Department of Physics, McGill Univ., Canada.* We report inverse-designed metasurfaces for transforming multidimensional states of light represented in the Hermite-Gaussian basis into optimally designed spatial states, where a simple imaging can accurately extract the full multidimensional state including amplitude, phase, and coherence.

JW4A.26

High Efficiency Inverse-Designed Grating Coupler in a Suspended Gallium Arsenide Platform, Austin Granmoe[2,1], Shuo Sun[2,1]; [1]*Univ. of Colorado Boulder, USA;* [2]*JILA, USA.* In this talk, I will present our recent simulation results that showcase an inverse-designed grating coupler in a suspended gallium arsenide (GaAs) platform that achieves higher coupling efficiencies than state-of-the-art.

JW4A.27

Generation of temperature-insensitive polarization-entangled photon pairs in a single-domain crystal, Chin Jia Boon[1], Diane Prato[1], Alexander Ling[1,2]; [1]*Centre for Quantum Technologies, Singapore;* [2]*Physics, National Univ. of Singapore, Singapore.* Noncritical Birefringent Phasematched Type-II Spontaneous Parametric Downconversion in single-domain KTiOPO4 was used to generate temperature-insensitive polarization-entangled photon pairs. The idler wavelength drifted by 10nm and entanglement visibility remained >95% over a temperature change of 70°C.

JW4A.28

Manipulating Incident Light to Create Complex States and Control Spatial Correlations in SPDC, Tianhong Wang[1], Pascal Bassène[1,2], Moussa N'Gom[1,3]; [1]*Physics, Applied Physics, and Astronomy, Rensselaer Polytechnic Inst., USA;* [2]*Center for Materials, Devices, and Integrated Systems (CMDIS), Rensselaer Polytechnic Inst., USA;* [3]*Center for Ultrafast Optical Sciences, Univ. of Michigan, USA.* We use a spatial light modulator (SLM) to precisely control the pump beam of a type-I spontaneous parametric down-conversion (SPDC) process and generate complex SPDC signals. The method can be extended to a type-II phase-matching and stacked type-I crystals.

JW4A.29

Exploiting Twisted Nematic SLMs for a Single-Pixel Camera with Individual Photons, Sebastian A. Bordakevich[1,2], Lorena Rebón[3,4], Silvia Ledesma[1,2]; [1]*Universidad de Buenos Aires, Facultad de Ciencias Exactas y Naturales, Departamento de Física, Argentina;* [2]*Consejo Nacional de Investigaciones Científicas y Técnicas (CONICET), Argentina;* [3]*Departamento de Ciencias Básicas, Facultad de Ingeniería, Universidad Nacional de La Plata, Argentina;* [4]*Instituto de Fisica de La Plata, UNLP - CONICET, Argentina.* We explore the use of a twisted nematic liquid crystal display to represent spatially distributed complex amplitudes, in addition to the Hadamard bases required to reconstruct such distributions using a single pixel detector.

JW4A.30
Linewidth Reduction of Optical Self-Injection-Locking for Quantum-Dot Coherent-Comb Lasers, Yang Qi[1], Chunying Song[1], Philip Poole[1], Guocheng Liu[1], Jiaren Liu[1], Youxin Mao[1], Martin Vachon[1], John Weber[1], Pedro Barrios[1], Xiaoran Xie[1], Ping Zhao[1], Mohamed Rahim[1], Philip Waldron[1], Zhenguo Lu[1]; *[1]National Research Council Canada, Canada.* An optical self-injection-locking feedback loop is designed for quantum-dot coherent-comb lasers to reduce linewidth, achieving significant linewidth reduction from 5.958MHz to 3.483kHz and maximum 35dB intensity enhancement, providing promising potential for diverse applications.

JW4A.31
Photon Number and Wait-time Distributions for Superposed Light States, Eric Seglem[1], Reeta Vyas[2]; *[1]Department of Physics, Univ. of Arkansas, USA.* Photon-number and wait-time distributions are studied for superposed coherent states (SCS), and superposed squeezed-vacuum states (SSVS). The odd-cat (even-cat) states always show antibunching (bunching), generalized SCS show bunching and antibunching, and SSVS always show bunching.

JW4A.32
Low SWaP Modular Laser Architecture for Laser-Cooled Quantum Sensors and Atomic Clocks, Evan Barnes[1], Nate Phillips[1], Cole Smith[1], Andrew Attar[1], Henry Timmers[1], Bennett Sodergren[1], Kurt Vogel[1], Alina Spiess[1], Kevin Knabe[1]; *[1]Vescent, USA.* A modular laser system based on a master/follower laser architecture is under development at Vescent. This system addresses the need for a serviceable and adaptable commercial laser systems for applications including cold-atom sensors.

JW4A.33
Simultaneous co-existence of polarization-entangled photons and classical signal for quantum networks in C band, Nishant K. Pathak[1], Bhaskar Kanseri[1,2]; *[1]Department of Physics, Indian Inst. of Technology Delhi, India; [2]Optics and Photonics Center, Indian Inst. of Technology Delhi, India.* We demonstrate the coexistence of polarization-entangled photons and classical signals in the C band at a received power within most receivers' sensitivity, enabling direct-to-home quantum key distribution.

JW4A.34
Acoustoelectric RF Mechanical Oscillator with Optomechanical Readout, Johnathan Mack[1], Matthew J. Storey[2], Nils Otterstrom[2], Ryan O. Behunin[4], Andrew Starbuck[2], Andrew Leenheer[2], Kate Musick[2], Douglas Trotter[2], Peter Rakich[3], Matt Eichenfield[1,2]; *[1]The Univ. of Arizona James C Wyant College of Optical Sciences, USA; [2]Sandia National Laboratories, USA; [3]Department of Applied Physics, Yale Univ., USA; [4]Department of Applied Physics and Materials Science, Northern Arizona Univ., USA.* We present a CMOS-fabricated optomechanical microdisk resonator with acoustoelectric gain for a 949 MHz mechanical mode. Applying +5V of DC bias results in a 9.5 dB increase in the optically-detected RF power of the microdisk.

JW4A.35
Withdrawn

JW4A.36
A Reinforcement Learning Architecture for Inverse Design of Nanophotonic Devices, Marco Butz[1,2], Alexander Leifhelm[1,2], Marlon Becker[3], Benjamin Risse[3], Carsten Schuck[1,2]; *[1]Department for Quantum Technology, Univ. of Münster, Germany; [2]Center for Soft Nanoscience, Germany; [3]Inst. for Geoinformatics, Univ. of Münster, Germany.* We demonstrate universally applicable black-box optimization of pixel-discrete nanophotonic devices relying on established reinforcement learning modules. We showcase our method for a silicon-on-insulator waveguide-mode converter, achieving over 95% conversion efficiency, and seamlessly integrate fabrication constraints.

JW4A.37
Adaptive Spectro-temporal Control of Supercontinuum Generation Using a Programmable Photonic Chip, Bruno P. Chaves[1], Van Thuy Hoang[1], Alexis Bougaud[1], Vincent Couderc[1], Brent E. Little[2], Sai T. Chu[3], David J. Moss[4], Roberto Morandotti[5], Benjamin Wetzel[1]; *[1]XLIM Research Inst., France; [2]QXP Technologies Inc., China; [3]City Univ. of Hong Kong, Hong Kong; [4]Swinburne Univ. of Technology, Australia; [5]Institut national de la recherche scientifique Centre energie Materiaux Telecommunications, Canada.* We experimentally show the spectro-temporal control of supercontinuum generation using an on-chip programmable delay line and an X-FROG setup. Through optimization processes, we demonstrate supercontinua with the desired temporal separation between different wavelength components.

JW4A.38
Optomechanical Interactions in Microspheres: Experimental Excitation and Characterization of Spheroidal Acoustic Mode Resonances, Juan Julian Barriel[1], Martina Delgado-Pinar[1,2], Antonio Díez[1,2], Miguel V. Andrés[1,2]; *[1]Universitat de Valencia Institut Universitari de Ciencia dels Materials, Spain; [2]Applied Physics and Electromagnetism, Universitat de Valencia, Spain.* We present an experimental study of spheroidal mechanical mode resonances of a silica microsphere. These modes were generated by a pulsed laser via electrostriction and they were detected using optical whispering-gallery modes of the sphere.

JW4A.39
Foundry Fabricated Silicon EO Mach-Zehnder Modulator with 7-bit Resolution, Amir Begovic[1], Meng Zhang[1], Daniel Crowley[1], Zhaoran R. Huang[1]; *[1]Rensselaer Polytechnic Inst., USA.* We present a silicon electro-optic Mach-Zehnder Modulator fabricated at AIM Photonics Foundry achieving 7-bit resolution at 500 MHz, enhancing photonic tensor core computing for AI and ML applications.

JW4A.40
Optimized Silicon Nitride-Based Passive Components for 850 nm OCT on Photonic Chips, Jiawei Meng[1], Senyue Hao[1], Aaron J. Adkins[1], Weiyan Zhou[1], Chao Zhou[1]; *[1]Washington Univ. in St. Louis, USA.* For optical coherence tomography (OCT) on photonic chips, we designed and validated optimized silicon nitride-based passive components for photonic integrated circuits. Centered at 850 nm, these components offer high sensitivity, axial resolution, and bandwidth stability.

JW4A.41

Near and Mid-Infrared Open-Path Dual-Comb Spectroscopy for Urban Atmospheric Monitoring, Ryan T. Rhoades[1], Griffin J. Mead[1], Nathan Malarich[1], Nathan Sweet[1], James Kasic[1], Brian R. Washburn[1], Ian Coddington[1], Kevin Cossel[1]; [1]*National Inst. of Standards and Technology, USA.* Open-path dual-comb spectroscopy in the near and mid-infrared was conducted for atmospheric monitoring campaigns over New York City and Salt Lake City, allowing for horizontal path-integrated molecular concentrations to be measured above urban environments.

JW4A.42

Phase Behaviors of MMI Couplers and Their Application to Spectrally Flat WDM Optical Filters, Seok-Hwan Jeong[1], Heuk Park[2], Joon Ki Lee[2]; [1]*The Univ. of Suwon, Korea (the Republic of);* [2]*Electronics and Telecommunications Research Inst., Korea (the Republic of).* Phase behaviors of several types of 2:2 MMI couplers were theoretically identified and experimentally demonstrated in a Si-wire waveguide-based interferometer scheme. Optimization of the aforementioned MMI phase properties could make the Si-wire-type optical demultiplexer more efficient and easier to fabricate.

JW4A.43

Dynamic Emission Control using Epsilon Near Zero Media, Arun Mambra[1], Ravi Pant[1], Joy Mitra[1]; [1]*IISER Thiruvananthapuram, India.* We demonstrate active emission tailoring from quantum emitters embedded in a low-loss Epsilon Near Zero (ENZ) thin film by controlling the coupling between non-radiative and radiative modes using a simple device architecture.

JW4A.44

Europium-Doped Niobate-Based Phosphors for Enhanced Red Emission in Phosphor-Converted White LEDs, Kanishk Poria[2], Nisha Deopa[1], Jangvir Singh Shahi[2]; [1]*Physics, Chaudhary Ranbir Singh Univ., India;* [2]*Physics, Panjab Univ., India.* Europium-doped niobate-based phosphors were synthesized via solid-state reaction, exhibiting promising luminescent properties. These phosphors demonstrate efficient red emission under near-UV/blue excitation, making them strong candidates for enhancing color rendering in white LEDs.

JW4A.45

Electrically Tunable SERS Substrate Using Gold Nanopyramids on Graphene, Ary V. Reis Portes[1], Felipe M. Teixeira[1], Talles Emanuel Moreira Marques[1], Jhonattan Cordoba Ramirez[1]; [1]*Universidade Federal de Minas Gerais, Brazil.* This work presents electrically tunable SERS devices, consisting of gold nanopyramids on a graphene-coated dielectric substrate. Simulations reveal significant improvements in absorbance and precise modulation of field enhancement, offering promising avenues for biosensing applications.

JW4A.46

Compact 6-bit Resolution, Band-Edge Operated, Single Bragg-Grating Modulator for Optical Computing Applications, Meng Zhang[1], Alexander Chen[1], Amir Begovic[1], Daniel Crowley[1], Nicholas Gangi[1], Zhaoran R. Huang[1]; [1]*Rensselaer Polytechnic Inst., USA.* We demonstrated 6-bit DAC resolution on a 1D photonic crystal based optical modulator operated at band edge at 250kH clock frequency and achieved NMSE ~ 0.025, enabling weight static photonic tensor computing for edge-AI applications.

JW4A.47

Ultra-Sensitive Quantitative Detection of Ethanol using Metal Organic Framework Integrated Metasurface, Norhan A. Salama[2], Salah S. Obayya[1], Mohamed A. Swillam[2]; [1]*Centre for Photonics and Smart Materials, Zewail City of Science and Technology, Egypt;* [2]*Physics, The American Univ. in Cairo, Egypt.* We report a novel quantitative ethanol gas sensor based on a metal organic framework (MOF) integrated metasurface. The MOF (e.g., ZIF-8) increases refractive index upon adsorption, leading to high sensitivity (300nm/RIU for 50ppm) with remarkable Q-factor (6544).

JW4A.48

GHz-Frequency Acousto-Optic Modulation of Visible Light in a CMOS-Fabricated Photonic Circuit, Jacob M. Freedman[1], Matthew J. Storey[2], Daniel Dominguez[2], Andrew Leenheer[2], Nils Otterstrom[2], Matt Eichenfield[2]; [1]*Univ. of Arizona Wyant College of Optical Sciences, USA;* [2]*Sandia National Laboratories Microsystems Engineering, Science and Applications, USA.* We present the design and fabrication of an integrated, resonant acousto-optic phase and frequency modulator for visible wavelengths. We use a 2.6 GHz mechanical resonance to achieve low-V-pi phase modulation and large modulation depth at 730 nm.

JW4A.49

Optimization and Characterization of Foundry Fabricated SiN Mode Converters for Enhanced Misalignment Tolerance for On-Chip Laser Diodes, Amir Begovic[1], Meng Zhang[1], Daniel Crowley[1], Colin Mcdonough[2], Amit Dikshit[2], Zhaoran R. Huang[1]; [1]*Rensselaer Polytechnic Inst., USA;* [2]*AIM Photonics, USA.* We present and characterize various coupler designs developed in the AIM Photonics Foundry for efficient mode conversion from integrated lasers to on-chip waveguides, focusing on maximizing misalignment tolerance.

JW4A.50

Bandwidth Estimation of a Silicon Strip Waveguide Based Optical Modulator, Ahmed Shariful Alam[1], Hao Sun[2], Md Mahadi Masnad[2], José Azaña[2], J. Stewart Aitchison[1]; [1]*Electrical and Computer Engineering, Univ. of Toronto, Canada;* [2]*Institut national de la recherche scientifique, Canada.* We report a novel strip waveguide-based silicon modulator with an estimated 3-dB bandwidth (f_{3dB}) of ~9.3 GHz with the possibility to enhance this value beyond 40 GHz after further optimization.

JW4A.51

Terahertz half-wave plate leveraging Exceptional Points in Non-Hermitian System, Parul Sharma[1], Brijesh Kumar[1], Lekshmi Eswaramoorthy[1], Anshuman Kumar[1]; [1]*Physics, Indian Inst. of Technology Bombay, India.* This study explores terahertz (THz) optical sensors leveraging exceptional points (EPs) in non-Hermitian systems, using split-ring resonators. We demonstrate the use of anisotropic metasurface as half-wave plates and their enhanced conversion efficiency around EP.

JW4A.52

Conditional Fisher Information Identifies Best Machine-learned, Diffractive-Encoded, Polarimetric Compressed Predictions, Altai Perry[1], Xiaojing Weng[1], Ji Feng[2], Luat Vuong[1]; [1]*Univ. of California Riverside, USA;* [2]*Univ. of Washington, USA.* We analyze the machine-learned, multi-parameter predictions of emitter polarization and diffractive-window angle with conditional Fisher Information. Randomness and blur enhance the compression and improve the machine-learned predictions.

JW4A.53
A Plasmonic Wavelength Division Demultiplexer for 1310/1550/1650 nm Based on a Compact-Size Air-Gap Filter, Rami A. Wahsheh[1], Luay Wahsheh[2]; [1]*Princess Sumaya Univ for Technology, Jordan;* [2]*Univ. of North Georgia, USA.* We introduce a novel design and analysis of an ultra-compact plasmonic wavelength division demultiplexer using an air-gap filter. Our results indicate that the proposed design can sort 1310/1550 nm and 1310/1650 nm wavelengths.

JW4A.54
Moved to JD4A.113

JW4A.55
Photon-pair generation using inverse-designed thin-film lithium niobate mode converters, Kiwon Kwon[1,2], Hyungjun Heo[2], Dongjin Lee[1], Hyeongpin Kim[1], Hyeong-Soon Jang[2,3], Woncheol Shin[1], Hyang-Tag Lim[2], Yong-Su Kim[2], Sang-Wook Han[2], Sangin Kim[3], Heedeuk Shin[1], Hyounghan Kwon[2], Hojoong Jung[2]; [1]*Pohang Univ. of Science and Technology, Korea (the Republic of);* [2]*Korea Inst. of Science and Technology, Korea (the Republic of);* [3]*Ajou Univ., Korea (the Republic of).* Spontaneous parametric down-conversion (SPDC) generates entangled photon pairs. We employ modal phase matching in a straight waveguide with an inverse-designed mode converter. This approach significantly improves SPDC efficiency compared to a waveguide without a converter.

JW4A.56
Polarization-Entangled Visible-Telecom Photon Pair Generation using SiN Waveguides, Vijay Vijay[1], Joyee Ghosh[1], Vivek Venkataraman[1]; [1]*Indian Inst. of Technology Delhi, India.* We propose an integrated source of polarization-entangled visible-telecom photon pairs (~520-1509 nm) via SFWM in SiN waveguides, with a maximum concurrence of ~0.98. Such sources could be used for quantum communication, sensing, computing, and networking.

JW4A.57
Micro-Integrated Photonic Modules for Quantum Technology Applications on Ground and in Space, Alina Hahn[1], Ahmad Bawamia[1], Jonas Hamperl[1], Janpeter Hirsch[1], Simon Kubitza[1], Christian Kürbis[1], Max Schiemangk[1], Marvin Schilling[1], Andreas Wicht[1]; [1]*Ferdinand-Braun-Institut gGmbH, Germany.* We present our narrow-linewidth micro-integrated diode laser modules that have already been successfully used for quantum technology applications on ground and in space, as well as our new generation of photonic modules.

JW4A.58
Silicon-Based Schottky Photodetectors Use a Microstructures Resonant Cavity Design to Extend MWIR Sensitivity, Yao-Han Dong[1], Kun-Rong Lin[1], Ching-Fuh Lin[1,2]; [1]*Graduate Inst. of Photonics and Optoelectronics, National Taiwan Univ., Taiwan;* [2]*Graduate Inst. of Electronics Engineering, National Taiwan Univ., Taiwan.* The resonant cavity design of inverted pyramid structures allows silicon-based photodetectors to measure MWIR wavelengths up to 6 µm. Additionally, the design of the inverted truncated-pyramid structure's base enhances the response at specific wavelengths.

JW4A.59

Integrated-Photonic Mid-Wave Infrared Devices in an Unmodified Wafer-Scale Foundry Platform, Milica Notaros[1], Mo Soltani[1]; *[1]RTX BBN Technologies, USA.* We propose and design low-loss and high-confinement mid-wave infrared (MWIR) integrated photonic devices based on germanium, silicon, and silicon-nitride layers, for fabrication in an unmodified wafer-scale commercial fabrication process at AIM Photonics.

JW4A.60

Parallel optical processer based on mode multiplexing, Yang Gao[1], Lin Wang[1], Lei Zhang[1], Kun Yin[1], Hui Yu[1]; *[1]Zhejiang Lab, China.* A novel parallel optical tensor core based on mode multiplexing is designed through mode overlap theory and its optical convolution processing ability is experimentally demonstrated on LN platform.

JW4A.61

A True Panoramic Camera for Smartphone Applications, Jian Ma[1], Shenge Wang[1], Yunwen Li[2], Adrian Giura[1], Chris Miclea[1], Sergio Goma[1]; *[1]Qualcomm Technologies, Inc., USA; [2]Qualcomm Semiconductor Limited, Taiwan.* We present the True Panoramic Camera (TPC), which utilizes novel prism optics and image processing algorithms to seamlessly stitch together images captured by dual cameras. The TPC achieves a panoramic FOV of 140°x53° without optical distortion.

JW4A.62

Design of an Ultra-compact, Energy-efficient Non-volatile Photonic Switch Based on Phase Change Materials, Khoi Phuong Dao[2], Juejun Hu[2], Richard Soref[1]; *[1]Department of Engineering, Univ. of Massachusetts Boston, USA; [2]Department of Materials Science and Engineering, Massachusetts Inst. of Technology, USA.* We present a non-volatile 2 × 2 switch design leveraging the strong interactions of light with phase change materials (PCMs), thereby realizing a compact, efficient photonic switch with low crosstalk and large bandwidth.

JW4A.63

Thermal Inverse Design for Phase-change Reconfigurable Photonics, Khoi Phuong Dao[1], Juejun Hu[1]; *[1]Department of Materials Science and Engineering, Massachusetts Inst. of Technology, USA.* We present, for the first time, a generic, scalable thermal inverse design method to optimize the doped-silicon micro-heater design achieving on-demand operating temperature profiles for phase-change reconfigurable photonic applications.

JW4A.64

Slant-Path Dual-Comb Spectroscopy to a Tethered Balloon, James Kasic[3,4], Ian Coddington[3], Mathieu Walsh[1], Kevin Cossel[3], Darielle Dexheimer[2], Roger Ding[2], Carlos Ruiz[2], Aaron Van Tassel[2], Junji Urayama[2], Peter Schwindt[2]; *[1]Universite Laval, Canada; [2]Sandia National Laboratories, USA; [3]National Inst. of Standards and Technology, USA; [4]Atmospheric and Oceanic Sciences, Univ. of Colorado Boulder, USA.* Dual-comb spectroscopy was used to sample kilometer-scale paths between the ground and a tethered balloon on a flight exceeding 500 m altitude. Active tracking maintained signal while vertical profiles of CO2 and H2O were measured.

JW4A.65

Dual-Wavelength, Polarization-Sensitive Wearable Photoplethysmographic Sensor on Diverse Skin Tones, Rutendo Jakachira[1,2], Wenyuan Yan[1], Joshua A. Burrow[1], Kimani Toussaint[1,3]; *[1]School of Engineering, Brown Univ., USA; [2]Physics, Brown Univ., USA; [3]Brown-Lifespan Center for Digital Health, USA.* We demonstrate a wireless, wearable photoplethysmography (PPG) sensor that incorporates polarization gating. Our results yield PPG signals with higher signal-to-noise ratios for two wavelengths, and across a range of skin tones, in comparison to traditional PPG sensors.

JW4A.66

Integrated-optic exclusive OR logical gate capable of processing arbitrary number of bits, Koichi Takiguchi[1], Hironori Nishihara[1]; *[1]Ritsumeikan Univ., Japan.* We report an integrated-optic exclusive OR gate comprising a slab star coupler-type optical discrete Fourier transform circuit. We realized the gate for processing four bits and verified its operation using parallel four-bit 40 GHz pulses.

JW4A.67

Optimization of Bent 3-dB Adiabatic Couplers by Adiabaticity Map, Jiun-Zhu Lai[1], Li-Fu Chang[1], Shuo-Yen Tseng[1]; *[1]National Cheng Kung Univ., Taiwan.* The optimal mode evolution path of bent 3-dB adiabatic couplers is identified on the adiabaticity map. The coupler has a short evolution length of 22.7μm, with splitting ratios within 48-52% over a bandwidth of 145nm.

JW4A.68

Gas Sensing with Undetected Light Using Silicon Photonic Chips, Haichen Zhou[1], Arthur Cardoso[1], Imad Faruque[1], Lawrence Rosenfeld[1], Sabine Wollmann[2], Weijie Nie[1], Jinghan Dong[1], Jingrui Zhang[1], Alex Clark[1], John Rarity[1]; *[1]Univ. of Bristol, UK; [2]Heriot-Watt Univ., UK.* Nonlinear interference in silicon integrated photonic devices can be used for high sensitivity gas detection. By analyzing the change in signal interference fringes we can quantify the variation in the intensity of an idler beam which interacts with a gas, without direct idler detection.

JW4A.69

Inverse design of silicon nitride mode-division multiplexer, Aditya Paul[2,1], Danxian Liu[2], Tianyi Zeng[2], Egemen Bostan[2], Jesse Lu[3], Kiyoul Yang[2]; *[1]Department of Electrical Engineering and Computer Science, Massachusetts Inst. of Technology, USA; [2]Harvard John A Paulson School of Engineering and Applied Sciences, USA; [3]SPINS Photonics, Inc., USA.* We experimentally demonstrate an inverse-designed mode-division multiplexer on an 800-nm-thick silicon nitride platform. The multiplexer is optimized within a 14.4×9.6 μm footprint. The measured insertion loss and crosstalk are 2.11 dB and 17.1 dB, respectively.

JW4A.70

Compact Silicon Micro-Ring Resonators with Optimized Low-loss Bends, Chih-Chieh Hsia[1], Shuo-Yen Tseng[1]; *[1]National Cheng Kung Univ., Taiwan.* Compact micro-ring resonators with optimized inner circumferences using Bezier curves for low bending losses are proposed. For a resonator with 2μm outer radius, Q of 19532, FWHM of 0.078nm, and FSR of 57nm are obtained.

JW4A.71

Measurement of the Frequency Response of Surface Bragg Gratings for Extended Cavity Diode Lasers at 1064 nm, Sten Wenzel[1], Olaf Brox[1], Joerg Fricke[1], Igor Nechepurenko[1], Andreas Wicht[1]; [1]*Ferdinand-Braun-Institut (FBH), Germany.* We present and discuss measurement results of up to 4 mm long surface Bragg gratings in ridge-waveguides around 1064 nm for monolithic extended cavity diode lasers.

JW4A.72

Capillary-Interactions for Fabrication of Mechanochromic Devices based on Plasmon Hybridized Nanostructures, Renu Raman Sahu[1], Tapajyoti Das Gupta[1]; [1]Indian Institute of Science, India. A scalable and single-step method exploiting capillary interactions for creating sub-100nm non-coalescent metallic(Ga) nanodroplets enabling controlled plasmon-hybridization, is shown herein. It enables tuneable gap-plasmonic resonances between the nanodroplets, thus allowing mechanochromic sensing and display applications.

JW4A.73

Wafer-scale fabrication of low-noise vacuum-gap Fabry-Pérot resonators with 10−13 stability, Naijun Jin[1], Yifan Liu[2,3], Takuma Nakamura[2], Haotian Cheng[1], Charles McLemore[2,3], Samuel Halladay[1], Yizhi Luo[1], David Mason[1], Scott Diddams[3,4], Franklyn Quinlan[2,4], Peter Rakich[1]; [1]Yale University, USA; 2National Institute of Standards and Technology, USA; 3Department of Physics, University of Colorado Boulder, USA; 4Electrical, Computer and Energy Engineering, University of Colorado Boulder, USA. We present a wafer-level fabrication method for compact vacuum-gap Fabry-Pérot resonators. With fractional frequency stability better than 10−13 at 1 second, these resonators are well-suited across a range of applications as low-noise optical frequency references.

JW4A.74

Using the Temperature Degree of Freedom to Prevent Overfitting in Infrared Spectroscopic Ellipsometry, Shenwei Yin[1], Demeng Feng[1], Jin-Woo Cho[1], Tanuj Kumar[1], Chenghao Wan[1], Hongyan Mei[1], Mikhail Kats[1]; 1Electrical and Computer Engineering, University of Wisconsin-Madison, USA. We performed high-precision measurements of the mid-infrared (5–25 μm) optical properties of fused-silica glass, from room temperature to 600C, using variable-angle spectroscopic ellipsometry. We developed a technique that limits overfitting of ellipsometric data using the additional information available via the temperature-dependent measurements.

14:00 -- 15:30
Room: Bluebird Ballroom - Posters
JW5A • Joint Poster Session IV

JW5A.1

Experimental Demonstration of Active GaAs Retroreflectors, Jason Sun[1]; [1]*US Army research Lab, USA.* Under an applied electric field of approximately 1.8 kV/cm, the optical transmission measurements of the GaAs active retroreflectors show a retroreflected beam intensity modulation at a wavelength of 895 nm.

JW5A.2

Study and Fabrication of a Multimode Interference Offset Tapered No-core Fiber Refractometer Enhanced by Taper Positioning, Abraham A. Quinones[2], José Rafael R. Guzmán Sepulveda[1], Arturo A. Castillo Guzmán[2]; *[1]Centro de Investigacion y de Estudios Avanzados del Instituto Politecnico Nacional, Mexico; [2]Universidad Autonoma de Nuevo Leon Facultad de Ciencias Fisico Matematicas, Mexico.* A fiber optic refractometer is demonstrated based on the multimode interference phenomenon utilizing a tapered no-core fiber with an offset. The sensor's sensitivity is enhanced by choosing the taper's placement to enable higher-order mode excitation.

JW5A.3

Interoperability between Free-Space and Fiber Channels for QKD Enabled by the Intermodal Approach, Francesco Picciariello[3], Ilektra Karakosta-Amarantidou[3], Edoardo Rossi[3], Marco Avesani[3], Giulio Foletto[3], Luca Calderaro[1], Giuseppe Vallone[3,2], Paolo Villoresi[3,2], Francesco Vedovato[3,2]; *[1]ThinkQuantum, Italy; [2]Padua Quantum Technologies Research Center, Italy; [3]Universita degli Studi di Padova Dipartimento di Ingegneria Dell'Informazione, Italy.* Intermodal QKD integrates fiber networks and free-space channels for a global quantum network. The trial described, conducted in daylight, tested a free-space and fiber link in Padova, confirming interoperability and a consistent kbps secret key rate across both channels, showcasing a cost-effective, trusted QKD network solution.

JW5A.4

Optimization of Length of Two-Mode FBG Sensors, Ajay Kumar[1], Anurag Sharma[1]; *[1]Indian Inst. of Technology, India.* Two-mode (LP_{01} and LP_{11}) fiber Bragg gratings have been proposed for simultaneous measurement of temperature and refractive index. We have optimized the length of the FBGs to prevent the excitation of unwanted LP_{02} mode.

JW5A.5

Ultra-low Loss Highly Multi-mode Hollow-core Anti-resonant Fiber Designs, Mohammad A. Mahfuz[1], Md. Selim Habib[1]; *[1]Florida Inst. of Technology, USA.* We present a next-generation ultra-low loss highly multi-mode hollow-core anti-resonant fiber design with strong-inhibited mode-coupling properties. The fiber supports >50 distinct spatial modes with losses under 100 dB/km.

JW5A.6

Single-Sided Cavity QED Effect on an Optical Nanowire, Subrat Sahu[1], Kali P. Nayak[2], Rajan Jha[1]; *[1]Nanophotonics and Plasmonics Laboratory, School of Basic Sciences, IIT Bhubaneswar, India; [2]Department of Engineering Science, Univ. of Electro-Communications, Japan.* A single-sided photonic crystal cavity structure on an optical nanowire is proposed to realize cavity quantum electrodynamics. Unidirectional coupling of single photons can be achieved into the guided mode of nanowire from a quantum emitter.

JW5A.7

Accelerating Distributed Machine Learning with an Efficient AllReduce Routing Strategy, Zilong Ye[1,2], Philip Ji[2], Giovanni Milione[2], Ting Wang[2]; *[1]California State Univ. Los Angeles, USA; [2]NEC Laboratories America Inc, USA.* We propose an efficient routing strategy for AllReduce transfers, which compromise of the dominant traffic in machine learning-centric datacenters, to achieve fast parameter synchronization in distributed machine learning, improving the average training time by 9%.

JW5A.8
Experimental Investigation of S-band Optical Amplifiers in Long Haul Coherent Transmission, Dini Pratiwi[1], Pratim Hazarika[1], Mingming Tan[1], Aleksandr Donodin[1], Ian Phillips[1], Paul Harper[1], Wladek Forysiak[1]; *[1]Aston Univ., UK.* We experimentally compare the performance of S-band amplifiers in a long-haul coherent transmission system using 30 GBaud DP-16QAM signals over up to 1650 km of standard single-mode fibre.

JW5A.9
Transverse Mode Control in Few Mode Fiber using Transmission Matrix Engineering, Shuin Jian Wu[1], Anindya Banerji[1], Yaron Bromberg[2], Alexander Ling[1]; *[1]Centre for Quantum Technologies, Singapore; [2]Hebrew Univ. of Jerusalem, Israel.* We use mechanical perturbations controlled by a computational optimization algorithm to selectively guide a single mode of light in a few mode fiber that supports multiple transverse modes.

JW5A.10
Polymer Waveplate Enabled Polarization Independent-LCoS Adaptive Optic System, Qirui Zhang[1], Isaac Zachmann[1], Lianhua Ji[1], Chongchang Mao[1]; *[1]The Ohio State Univ., USA.* We propose a PI-LCoS phase modulator based adaptive optic system in FSO transceivers to mitigate atmospheric turbulence and simplify polarization management, enhancing overall performance and optical power coupling efficiency.

JW5A.11
Robust Bayesian Optimization of a Photonic Y-splitter Using a Tunable Acquisition Function, Uttara Chakraborty[1], Zhengqi Gao[1], Duane S. Boning[1]; *[1]Electrical Engineering and Computer Science, Massachusetts Inst. of Technology, USA.* We use Bayesian optimization with a new tunable acquisition function to design a photonic Y-splitter robust to fabrication variations. Compared to conventional acquisition functions, our method yields more robust solutions across varying metrics and datasets.

JW5A.12
Polarization QKD with Room-temperature Telecom Single-Photon Source over 32.5 km Fiber, Xingjian Zhang[1], Alexander Ling[1], Haoran Zhang[2], Weibo Gao[2]; *[1]Center of Quantum Technologies, NUS, Singapore; [2]SPMS,NTU, Singapore.* We report a polarization-encoded BB84 experiment using a telecom GaN Single-Photon Source (SPS), over a 32.5km fiber spool. A Quantum Bit Error Rate (QBER) of 6.4% and a secure key rate of 47.3 bps are obtained.

JW5A.13
Fiber Optic Interferometer Estimating Conditions of the Measured Metal Surfaces, Karolina M. Rychert[1], Patryk Sokolowski[1], Jacek Lubinski[1]; *[1]Gdansk Univ. of Technology, Poland.* The research aims to explore the potential of fiber optic distance measurement through reflected light analysis on surfaces from real-life machine contacts, including stainless steel. Conducted measurements enable the evaluation of abrasion of machine components. Range of measurements was 10 to 500 um making fiber optic an ideal method of measurement.

JW5A.14

Ultra Low Bit Error Rate for Line-Of-Sight and Non-Line-Of-Sight Free-space Communication with Fractal-encoded Beams, Travis M. Crumpton[2], Erandi Wijerathna[1], Luat Vuong[1]; [1]*Mechanical Engineering, Univ. of California Riverside, USA;* [2]*Electrical and Computer Engineering, Univ. of California Riverside, USA.* Fractal-structured light offers misalignment and turbulence-robust beam structures for FSO communication and sensing. We show the machine-learned predictions of high SVD-entropy diffractals exhibit ultra-low bit error rates.

JW5A.15

Defect-mediated band engineering of PEG-coated CeO_2 nanostructures for amplified non-invasive photothermal treatment of cervical cancer, Sayoni Sarkar[1], Ajit Kulkarni[1], Rohit Srivastava[1]; [1]*Indian Inst. of Technology Bombay, India.* We demonstrate $V_O^{\bullet}$-driven photothermal response of PEG-CeO_2 nanostructures for cervical cancer theranostics. Under laser irradiation, an unprecedented 86.8% reduction in HeLa cells within 48 hours is achieved, with no adverse effects on adjacent healthy cells.

JW5A.16

Integration of Non-Invasive Optical Tools for In-Situ Temperature Measurements of Cryopreserved Biological Systems During Nano Laser Rewarming, Carla Berrospe[1], Crysthal Alvarez[1], Guillermo Aguilar[1]; [1]*Mechanical Engineering, Texas A&M Univ. System, USA.* We present the use of two non-invasive optical tools, Raman Spectroscopy and Digital Holography Interferometry (DHI), working in parallel, to provide a full map of temperature changes experienced by cryoprotective agents and embryos during laser rewarming.

JW5A.17

Identification of ellipsoidal biological particles in holographic nanoparticle imaging, Ahmad S. Azzahrani[1]; [1]*Northern Border Univ., Saudi Arabia.* Digital holographic microscopy is a marker-free technique for determining the hologram of individual, nonspherical cells. The cell structure holds significant importance in a biological context and provides an effective means for its measurement in a biological application.

JW5A.18

Understanding Photoreceptor Directionality without Waveguiding, Brian Vohnsen[1], Amy Fitzpatrick[1], Aishwarya C. Babu[1], Chiara Maria Mariani[1], Sunil Kumar Chaubey[1]; [1]*Univ. College Dublin, Ireland.* Photoreceptors are directional in their capture of light and in their backscattering in imaging. Here, we analyze the directionality using psychophysical tests of the Stiles-Crawford effects with Newtonian versus Maxwellian view and compare with theory.

JW5A.19

Co-Registered Photoacoustic and Ultrasound Imaging with Deep Learning for Breast Imaging and Tumor Localization, Emily Zheng[1], Huijuan Zhang[1], Ermelinda Bonaccio[2], Kazuaki Takabe[2], Wenyao Xu[1], Jun Xia[1]; [1]*Univ. at buffalo, USA;* [2]*Roswell Park Comprehensive Cancer Center, USA.* We developed a novel breast imaging configuration that integrates Photoacoustic (PA) and Ultrasound (US) modes. A deep learning model trained via the clinical imaging results allows tumor localization within the breast tissue in three dimensions.

JW5A.20

Patients' awareness of their color vision deficiency, Zane Jansone-Langina[1]; *[1]Univ. of Latvia, Latvia.* Color vision testing identifies deficiencies impacting safety and professional performance. Our study of 60 patients showed most first learn of their deficiency during mandatory driver's license exams. Many are unaware of their specific type of deficiency, highlighting diagnostic gaps.

JW5A.21

Inflatable Foley Catheter Based Speculum-Free Probe Design for Cervix Imaging, Sandeep Kumar[1], Pratyush Bhushan[1], Mohammed A. Hussain[1], Uttam M. Pal[2], Arpita Anantharaju[3]; *[1]Department of Mechanical Engineering, Indian Inst. of Information Technology Design and Manufacturing Kancheepuram, India; [2]Department of Electronics and Communication Engineering, Indian Inst. of Information Technology Design and Manufacturing Kancheepuram, India; [3]Department of Obstetrics and Gynaecology, Jawaharlal Inst. of Postgraduate Medical Education and Research, India.* The work proposes a configuration of Foley catheter around the GynoSight transvaginal imaging probe for speculum-free imaging of cervical tissues.

JW5A.22

2D-material enhanced plasmonic biosensor using electrostatic optical phase modulation, Shaodi Zhu[1], Ting Huang[1], Heifei Lv[2], Wei Luo[1], Zhaoli Gao[1], Ho-Pui Ho[1], Wu Yuan[1]; *[1]The Chinese Univ. of Hong Kong, Hong Kong; [2]Wuhan Univ. of Technology, China.* We have successfully demonstrated motion-free active optical phase modulation on a plasmonic biosensor enhanced with 2D-material, achieved through electrostatic gating. Our experiment revealed a voltage-regulated lateral beam shift on the plasmonic sensor surface.

JW5A.23

Real-time measurement of greenhouse gas emissions from microalgae with dual-frequency comb, Liang-Chun Lin[1,2], Nathan Malarich[1], Grace Jenkins[1,2], Esther Baumann[1], Brian R. Washburn[1], Ian Coddington[1], Kevin Cossel[1]; *[1]NIST, USA; [2]Physics, Univ. of Colorado Boulder, USA.* Pls see the paper file uploaded.

JW5A.24

Transient Absorption Microscopy of Live Fibroblasts, Arya Mugdha[1], Adam Chicco[1], Marisa Friederich[2], Johan Van Hove[2], Jesse Wilson[3]; *[1]Colorado State Univ., USA; [2]Univ. of Colorado Anschutz Medical Campus, USA.* We demonstrate that visible-wavelength transient absorption microscopy, which utilizes femtosecond laser pulses to measure sub pico-second excited state relaxation mechanisms of electron transport chain (ETC) hemeproteins, can produce images of live, cultured human fibroblasts.

JW5A.25

Two-Dimensional Nonlinear Structured Illumination Microscopy with rsEGFP2, Shaoheng Li[1], Peter Kner[1], Ryo Tamura[1], Daichi Kamiyama[1]; *[1]Univ. of Georgia, USA.* Nonlinear structured illumination microscopy (NSIM) can extend the resolution beyond the 120 nm limit of linear SIM. By combining patterned depletion with rsEGFP2, we achieved 2D-NSIM imaging of live U2OS cells with 75 nm resolution.

JW5A.26

Automatic Classification and Detection of Premalignant Cervical Lesions on the Colposcopic (VIA) Images Using Artificial Intelligence, Humaira Firdowse[2], Sakthiprian S[2], Karthikeyan S[2], Keerthana A[1], Rohini P[1], Subhankar Layek[1], Kala N[1], Sukanya S[1], Karthiga Dr[1], Murali S[1], Uttam M. Pal[2], Arpitha Anantharaju[1]; *[1]JIPMER Puducherry, India; [2]Indian Inst. of Information Technology Design and Manufacturing Kancheepuram, India.* Development of an automatic artificial intelligence based classification model for the detection of cervical lesions on a dataset of colposcopic cervix images with acetic acid

JW5A.27

Superconducting Nanowire Detectors Enable Deep Brain Imaging with Short-Wave Infrared 2PE Microscopy, Amr Tamimi[2], Martin Calderola[1], Niels Noordzij[1], Johannes Los[1], Antonio Guardini[1], Hugo Kooiman[1], Juan Carlos Boffi[2], Sebastian Hambura[2], Ling Wang[2], Christian Kieser[2], Andreas Fognini[1], Katyayani Seal[1], Robert Prevedel[2]; *[1]Single Quantum B V, Netherlands; [2]European Molecular Biology Laboratory, Germany.* We developed a free-space coupled SNSPD array for in-vivo mouse brain vasculature imaging using two-photon excitation and emission entirely in the short-wave infrared (SWIR) region.

JW5A.28

Metasurface with an Asymmetrically Varying Point Spread Function for Single-shot Hyperspectral Imaging, Hyeongyu Choi[1,2], Yeongmyeong Park[1,2], Hyunwoo Son[1,2], Yoonchan Jeong[1,2]; *[1]Department of Electrical and Computer Engineering, Seoul National Univ., Korea (the Republic of); [2]Inter-Univ. Semiconductor Research Center, Seoul National Univ., Korea (the Republic of).* We propose a single-shot hyperspectral imaging system operating in the 400 – 700 nm wavelength range, based on a complex amplitude metasurface with an asymmetrically varying point spread function with respect to wavelength.

JW5A.29

Development of a High-Speed Light Scattering Measurement Technique for Analyzing Light Field Imaging of a Single Microparticle, Kazuki Shigyo[1], Yusuke Ito[1], Masaharu Imaki[1], Nobuki Kotake[1]; *[1]Mitsubishi Electric Corporation, Japan.* We introduce a novel method to measure angular scattering of light from microparticles at high speeds using a lens-array, enabling light field measurements without mechanical scanning, and improving efficiency and accuracy.

JW5A.30

Impact of Femtosecond Laser on Post-Cataract Surgery Refractive Accuracy, Zane Jansone-Langina[1,2], Andrei Solomatin[2], Maksim Solomatin[2], Igors Solomatins[1,2]; *[1]Univ. of Latvia, Latvia; [2]Dr. Solomatin eye center, Latvia.* Cataracts, common after age 40, often require surgery. This study examined 780 eyes post-cataract surgery, assessing visual acuity and refraction changes based on cataract type. Nuclear cataract patients exhibited the largest residual spherical component and myopic refraction.

JW5A.31

Classification and Grading of Bright Field Microscopic Tissue Images using Convolutional Neural Network, Sindhoora K. M[1], Spandana K U[1], Sharada Rai[1], Krishna K. Mahato[1], Nirmal Mazumder[1]; *[1]Manipal Academy of Higher Education, India.* Deep learning based classification and grading of the pathological specimen plays an important role in the biomedical field. In the current study, we discuss automated classification and grading of squamous cell carcinoma tissue with convolutional neural network.

JW5A.32
Development of Stokes Mueller based polarimeter for tissue characterization, Kausalya N. Makkithaya[1], Sindhoora K. M[1], Guan-Yu Zhuo[2], Nirmal Mazumder[1]; *[1]Department of Biophysics, Manipal Academy of Higher Education, India; [2]Inst. of Translational Medicine and New Drug Development, China Medical Univ. Hospital, Taiwan.* Tissue characterization is vital for diagnosing and treating diseases. Measuring tissues' optical properties aids in identifying abnormalities and tracking disease progression. Polarimetry offers detailed insights into the polarization state of light transmitted through tissue samples.

JW5A.33
Measuring Subcellular cAMP Levels Using FRET-Based Biosensing and Confocal Microscopy, Debasmita Banik[1]; *[1]Univ. of St Andrews, UK.* Accurate measurement of second messenger levels underpins our ability to model subcellular compartments. We combine confocal-based sensitized emission fluorescence resonance energy transfer (FRET) to tailored data analysis to extract accurate concentrations of nuclear cAMP.

JW5A.34
Multifocusing for Spatially Metasensing Live Cells, Abhirupa Saha[1], Bhaskar Gupta[2]; *[1]Georgia Inst. of Technology, USA; [2]Department of Electronics and Telecommunication Engineering, Jadavpur Univ., India.* We demonstrate a multi-focusing visible light sensor that diagnoses multiple locations of brain tissue. The designed all-dielectric silicon-carbide metalens distributes, bends, and spatially focuses impinged light for multi-spectral imaging neurons useful for remotely augmented surgery.

JW5A.35
Picosecond Laser Ablation and Graphitisation of Plasma-deposited Nano-films, Sophie R. Cottam[1,2], Marcela Bilek[1,2], Clara Tran[1,2]; *[1]School of Biomedical Engineering, Univ. of Sydney, Australia; [2]School of Physics, Univ. of Sydney, Australia.* We examine ablation threshold changes in plasma-deposited nano-films under 10 ps 532 nm laser irradiation across various substrates. Results reveal the capability to graphitise nano-films on a wide range of substrates, useful for biological applications.

JW5A.36
Radial-balanced Phase Transfer Function for Accurate Retrieval in Differential Phase Contrast Microscopy, Cheng Yu[1,2], Ching-En Lin[3,4], Sunil Vyas[2], Hao-Pin Chiu[5], Yuan Luo[2,5]; *[1]Department of Medicine, National Taiwan Univ. College of Medicine, Taiwan; [2]Inst. of Medical Device and Imaging, National Taiwan Univ. College of Medicine, Taiwan; [3]Department of Physics, National Taiwan Univ., Taiwan; [4]Leung Center for Cosmology and Particle Astrophysics, National Taiwan Univ., Taiwan; [5]Department of Biomedical Engineering, National Taiwan Univ., Taiwan.* Conventional illumination in DPC microscopy limits phase retrieval accuracy due to unbalanced radial PTF. We propose a novel illumination pattern and theoretical framework that enhance accuracy by aligning PTF profiles with retrieval algorithms. Simulations show improved performance, indicating significant potential for DPC advancements.

JW5A.37

Fourier-Domain Mode-Locked Laser-Based Depth-Resolved Vibrometry Indicates Involvement of Superficial Hair in the Sound Detection of Snapping Shrimp, Tillmann Spellauge[1,2], Marco Bonesi[2,1], Jami Shepherd[2,1], Craig Radford[3], Frédérique Vanholsbeeck[2,1]; *[1]The Dodd-Walls Centre, New Zealand; [2]Department of Physics, The Univ. of Auckland, New Zealand; [3]Inst. of Marine Science, Leigh Marine Laboratory, The Univ. of Auckland, New Zealand.* We present a Depth-resolved vibrometry system using a Fourier-domain mode-locked laser based optical coherence tomography system. We further present the first measurements of mechanical responses of snapping shrimp superficial hair to acoustic particle motion stimuli.

JW5A.38

Line Focus Generation via a Scattering Medium, Viet Tran[1], Tianhong Wang[1], Pascal Bassène[1,2], Moussa N'Gom[1,3]; *[1]Physics, Applied Physics, and Astronomy, Rensselaer Polytechnic Inst., USA; [2]Center for Materials, Devices, and Integrated Systems, Rensselaer Polytechnic Inst., USA; [3]Center for Ultrafast Optical Sciences, Univ. of Michigan, USA.* Using interference phenomena between different propagation planes, we experimentally generate a line-focus behind a biology sample. Compared to line-focus from a Bessel Gaussian beam, we demonstrate high control over the length and resolution limit of our beam profile.

JW5A.39

A Novel Deep Learning Framework for Enhanced Acute Lymphoblastic Leukemia Detection, Shaik Ahmadsaidulu[2], Akash Suresh Kanase[1], Puneet Kumar Jain[1], Earu Banoth[2]; *[1]Computer Science & Engineering, National Inst. of Technology Rourkela, India; [2]Biotechnology & Medical Engineering, National Inst. of Technology Rourkela, India.* In this work a deep-learning model using enhanced YOLOv8(You Only Look Once) for classifying Acute Lymphoblastic Leukemia (ALL) and other normal cells. Achieving 98% accuracy for ALL and 91% for combined (ALL & Normal) classification enhances clinical decision-making.

JW5A.40

3D phase profile for biological particle characterization using digital holographic microscopy, Ahmad S. Azzahrani[2], Ahmed C. Kadhim[1], Bakr Taha[3]; *[1]Univ. of Technology-Iraq, Iraq; [2]Northern Border Univ., Saudi Arabia; [3]Universiti Kebangsaan Malaysia, Malaysia.* A hybrid digital holographic microscope is used to record a hologram of biological cells with fluorescent and phase information. The resultant hologram is processed for phase recovery using the deep learning algorithm to extract 3D phase distribution

JW5A.41

Quantitative analysis of three-dimensional refractive index distribution in a biological volume sample for biomedical applications, Ahmad S. Azzahrani[2], Ahmed C. Kadhim[1], Bakr Taha[3]; *[1]Univ. of Technology-Iraq, Iraq; [2]Northern Border Univ., Saudi Arabia; [3]Universiti Kebangsaan Malaysia, Malaysia.* In this paper, the spatial distribution of refractive index components is performed using quantitative phase imaging (QPI) and optical path difference. The outcomes provide a three-dimensional projection of RI which helps in cell identification.

JW5A.42

Can Holographic Lenses Provide Vision Correction? Modelling the Limitations, Matt Hellis[1], Jorge Lasarte[1], Suzanne Martin[1], Matthew Sheehan[1], Kevin Murphy[1]; *[1]Centre for Industrial and Engineering Optics, Technological Univ. Dublin, Ireland.* Focus/defocus

Holographic Optical Lenses were modelled to determine their limitations for vision refractive error correction. The parameters of holographic thickness, spatial frequency, refractive index modulation and diffraction efficiency were modelled computationally for a +3.5-dioptre power.

JW5A.43

Correlative Imaging Approaches to Bioindicator Element Distribution in Skin Tumors, Hana Koprivova[1], Katerina Kiss[2,3], Václav Stejskal[2,4], Lukáš Krbal[2,4], Jakub Buday[1,5], Lukas Brunnbauer[6], Erik Képeš[1], Pavel Porizka[1,5], Milan Kaška[2,4], Andreas Limbeck[6], Jozef Kaiser[1,5]; *[1]CEITEC Brno Univ. of Technology, Czechia; [2]Department of Surgery, Charles Univ., Faculty of Medicine, Czechia; [3]Department of Plastic Surgery, Charles Univ., Third Faculty of Medicine, Czechia; [4]The Fingerland Department of Pathology, Univ. Hospital, Czechia; [5]Faculty of Mechanical Engineering, Brno Univ. of Technology, Czechia; [6]Inst. of Chemical Technologies and Analytics, Technical Univ. of Vienna, Austria.* This study uses laser ablation techniques LIBS and LA-ICP-MS to bioimage elements of skin tumors and extends traditional histological examination with innovative approaches.

JW5A.44

Polarimetric Second-Harmonic Imaging of Collagen Fibrils in the Lamina Cribrosa of the Eye, Aishwarya C. Babu[1], Brian Vohnsen[1], Ian A. Sigal[2]; *[1]School of Physics, Univ. College Dublin, Ireland; [2]Department of Ophthalmology, Univ. of Pittsburgh, USA.* The collagen-rich lamina cribrosa of the eye provides mechanical support and neural pathways to the visual cortex. Here, we present second harmonic optical imaging of the lamina cribrosa using polarimetric sensing for orientational analysis.

JW5A.45

Sensitivity of Time-Resolved Diffuse Reflectance To Optical Coefficients In Bilayered Tissues, Suraj Rajasekhar[1], Karthik Vishwanath[2,1]; *[1]Cellular, Molecular and Structural Biology, Miami Univ., USA; [2]Physics, Miami Univ., USA.* Theoretical sensitivity of diffuse reflectance from a bilayer turbid tissue model using time-domain diffusion theory are estimated across varying source-detector separations. We establish limits for recovery of absorption and scattering properties of each layer.

JW5A.46

Nonlinear Thomson Scattering: Velocity Asymmetry Inherent in Electron Figure-8 Motion, Michael Ware[1], Luke Robins[1], Kimberly Barr[1], Andrew Jones[1], Yance Sun[1], Nuno Sa[2], Justin B. Peatross[1]; *[1]Brigham Young Univ., USA; [2]Science, Universidade dos Acores, Portugal.* We present measurements of nonlinear Thomson scattering in both emission hemispheres. The asymmetries in these measurements unambiguously confirm for the first time the figure-8 motion of electrons in the average rest frame.

JW5A.47

High-Speed, Single-Shot Measurement of the Intensity and Phase of Optical Waveforms, Daniel J. Kane[1]; *[1]Mesa Photonics, LLC, USA.* A hybrid optical and electric linear pulse measurement system capable of the measurement of the intensity and phase of sub-picosecond optical waveforms is presented. Multishot verification and single-shot acquisition at 1 MHz is demonstrated.

JW5A.48
Carrier Dynamics and Transport Properties of Ge using Optical–Pump Terahertz–Probe Spectroscopy, Amit Haldar[1], Jingwen Li[2], Chia-Jung Yang[2], Kush Saha[1], Shovon Pal[1]; *[1]School of Physical Sciences, National Inst. of Science Education and Research, India; [2]Department of Materials, Eidgenossische Technische Hochschule Zurich, Switzerland.* We investigate the evolution of THz conductivity in Ge via optical pump THz-probe spectroscopy. The transient photo-conductivity deviates from the Drude to Drude- Lorentz/Smith models depending on the 1s–2p transition and backscattering process.

JW5A.49
Effect of silver metallic particles on the luminescence characteristics of Samarium doped Barium borate glasses, B.R. Reddy[1], Aaron Johnson[1]; *[1]Alabama A&M Univ., USA.* Barium borate glasses embedded with Silver and Samarium oxides were made by the melt quenching technique. Silver metallic particles were induced by heat treatment. The influence of Ag particles on the Sm^{3+} luminescence was very significant. .

JW5A.50
Distortions in the Angular Distribution of Nonlinear Thomson Scattering as a Focal Diagnostic, Yance Sun[1], Kimberly Barr[1], Andrew Jones[1], Nuno Sa[2], Michael Ware[1], Justin B. Peatross[1]; *[1]Brigham Young Univ., USA; [2]Science, Universidade dos Acores, Portugal.* We present measurements of nonlinear Thomson scattering out the side of an intense laser focus, showing how subtle defects in laser field including spatial chirp imprint on the angular distribution of the scattered light.

JW5A.51
Study of Biphoton Spatial Correlations via Single Photons Detection, Emma C. Brambila Tamayo[1,2], René Sondenheimer[4,1], Marta Gilaberte Basset[1,2], Valerio Gili[1], Markus Gräfe[3,1]; *[1]Fraunhofer IOF, Germany; [2]Inst. of Applied Physics, Friedrich-Schiller-Univ. Jena, Germany; [3]Inst. of Applied Physics, Technische Universitat Darmstadt, Germany; [4]Inst. of Condensed Matter Theory and Optics, Friedrich-Schiller-Univ. Jena, Germany.* We study spatial correlations of nondegenerate photon pairs by detecting only one photon. Our work is based on nonlinear interferometers. We present a detailed theoretical analysis and experimental results.

JW5A.52
Temporal entanglement and wavepacket shaping based on the interference of two photons through a beam splitter, Zhaohua Tian[1], Qi Liu[1], Yu Tian[1], Ying Gu[1]; *[1]Department of Physics, Peking Univ., China.* We analytically study the interference of two photons with different temporal shapes through a beam splitter, then propose its application in temporal entanglement and shaping of photons.

JW5A.53
Bi-chromatic Intensity Squeezing at Telecom Wavelength using Four-Wave Mixing in Rb Vapor, Ziqi Niu[1], Jianming Wen[2], Chuanwei Zhang[3], Shengwang Du[4], Irina Novikova[1]; *[1]College of William & Mary, USA; [2]Kennesaw State Univ., USA; [3]Washington Univ. in St Louis, USA; [4]The Univ. of Texas at Dallas, USA.* We optimized four-wave mixing gain in a double-ladder system in Rb vapor, and observed more than 2dB of two-mode intensity squeezing between amplified 795nm probe and generated 1324nm conjugate optical fields.

JW5A.54
Moved to JD4.114

JW5A.55
Moved to JD4A.112

JW5A.56
Moved to JTu4A.69

JW5A.57
Understanding the Influence of Capping Layer on Magnetization dynamics: An In-Depth Investigation with a Custom Time-Resolved Magneto-Optical Kerr Effect Setup, Debkanta Ghosh[1], Chitra Dolai[1], Shailab Singh Bodra[1], Biswajeet Nayak[2], Prasana K. Sahoo[2], Prasanta Kumar Datta[1]; *[1]Physics, Indian Inst. of Technology Kharagpur, India; [2]Materials Science Centre, Indian Inst. of Technology Kharagpur, India.* The study examines ultrafast magnetization dynamics of Ni thin films using TRMOKE technique, examining films with and without capping layers. It reveals influence of external magnetic fields on spin-wave modes and impact of capping layers on Gilbert damping parameter.

JW5A.58
Advancing photonic design with topological latent diffusion generative model, Yuheng Chen[1,2], Michael Bezick[1], Blake Wilson[1,2], Omer Yesilyurt[1,2], Alexander Kildishev[1], Alexandra Boltasseva[1,2], Vladimir Shalaev[1,2]; *[1]Elmore Family School of Electrical and Computer Engineering, Purdue Univ., USA; [2]Quantum Science Center, Oak Ridge National Laboratory, USA.* Conventional photonic design often relies on inefficient trial-and-error. The proposed Topological Latent Diffusion Model (TLDM) captures high-level features from topology dataset and outperforms state-of-the-art Generative Adversarial Networks and Variational Autoencoders methods in high-efficiency metasurface design.

JW5A.59
A Comparison of Integrated Photonic Platforms for Broadband Entangled-Pair Generation, Liao Duan[1], Trevor Steiner[1], Paolo Pintus[1,2], Lillian Thiel[1], Joshua Castro[1], John Bowers[1], Galan Moody[1]; *[1]UCSB, USA; [2]Physics, Univ. of Cagliari, Monserrato, Italy.* We report nonlinear integrated photonic microresonator designs enabling > 1 THz/mW2 broadband pair generation rates. Simulations show a novel cross-polarized type- 1 four-wave mixing phase-matching technique to further extend the bandwidth deeper into the visible spectrum.

JW5A.60
Achieving High-Fidelity Bell States Through Interferometric Short-Pulsed Laser Techniques, Tomis Tomis[1], V Narayanan[1]; *[1]IIT JODHPUR, India.* We present a method for creating Bell states using an interferometric approach with a short-pulsed laser. A Bell state was created by type-II spontaneous parametric down-conversion (SPDC), achieving a fidelity and visibility close to ∼ 90%.

JW5A.61
Collinear Optical 2D Coherent Spectroscopy with 5-kHz Repetition Rate Femtosecond Laser, Stephen Revesz[1], Rustam Gatamov[1], Adolfo Misiara[1], Hebin Li[1]; *[1]Florida International Univ., USA.* We demonstrate optical two-dimensional coherent spectroscopy in a collinear

geometry on rubidium vapor with time-integrated fluorescence detection using a low-repetition rate femtosecond laser for both excitation and as reference with a pulse shaper.

JW5A.62
Electrically Tunable TiN/SiO_2 Metamaterials, Joseph Garbarino[1], John Jones[2], Peter Stevenson[2], Cynthia Bowers[2,3], Krishnamurthy Mahalingam[2,3], Lyuba Kuznetsova[1]; *[1]San Diego State Univ., USA; [2]Air Force Research Laboratory/RXEEG, USA; [3]UES, Inc., an Eqlipse Technologies Company, USA.* Electrically tunable TiN/SiO_2/TiN epsilon-near-zero photonic structures were fabricated using DC magnetron sputtering. Reflectance spectra in visible/near-IR for bulk and multilayered TiN/SiO_2/TiN structures with optimal parameters exhibit spectral shift at the epsilon-near-zero spectral point up to ~10 nm due to applied voltage (12 V).

JW5A.63
Generation of Multiple Bound States in the Continuum without Symmetry Breaking, Tetsuyuki Ochiai[1]; *[1]National Inst. for Materials Science, Japan.* We present a scenario to generate multiple bound states in the continuum (BICs) in photonic membranes without breaking system symmetries. It involves the accidental BIC at a critical parameter for a degenerate eigenmode at Γ. The two bands with the degenerate eigenmode exhibit the multiple off-Γ BICs at off-critical parameters.

JW5A.64
Enabling elliptically polarized high harmonic generation with short cross polarized laser pulses, Bejan Ghomashi[2], Spencer Walker[2,1], Andreas Becker[2]; *[1]Physics, The Ohio State Univ., USA; [2]JILA, USA.* Based on results of numerical simulations we shed new light on a controversy between experiment and theoretical predictions on the generation of harmonics with large ellipticity using cross-polarized bichromatic laser pulses.

JW5A.65
Spectral and Temporal Characteristization of UV Resonant Dispersive Waves, Chelsea Kincaid[1,2], Brian Kaufman[2], Felix Allum[2], Mathew Britton[2], Jose Godínez[2], Matthew Bain[2], Michael Chini[1], Ruaridh Forbes[2], Kirk A. Larsen[2]; *[1]Univ. of Central Florida, USA; [2]LCLS, SLAC National Accelerator Laboratory, USA.* Using rare gas-filled hollow-core-fibers we generate tunable UV pulses with bandwidths that support few-cycle duration via Resonant Dispersive Wave emission, which are temporally compressed and characterized using a home-built SD-FROG, demonstrating few-femtosecond pulse widths.

JW5A.66
Tuning the conversion efficiency of high-order harmonic signals via variation of the Porras factor, Bejan Ghomashi[1], Andreas Becker[1]; *[1]JILA, USA.* We investigated the effects of a novel phase term for short driving laser pulses on optimizing the macroscopic HHG process. We theoretically analyze the HHG yield, resulting in an increase of the harmonic yield by a few orders of magnitude.

JW5A.67
Nondegenerate Two-photon Lasing in a Single Quantum Dot, Samit K. Hazra[2], Lavakumar Addepalli[1], P. K. Pathak[1], Tarak N. Dey[2]; *[1]Indian Inst. of Technology Mandi, India; [2]Department of Physics, Indian Inst. of Technology Guwahati, India.* We propose a two-mode, two-photon microlaser using a single semiconductor quantum dot (QD) grown inside a two-mode

microcavity. We explore incoherent and coherent pumping mechanisms incorporating phonon interaction at low temperatures. In coherently pumped QD, large two-mode, two-photon lasing occurred due to the reduced single-photon emission.

JW5A.68

End-to-End Optimization Approach for Super-Resolution Imaging of Human Silhouettes through Coded Illumination and Reconstruction Network, Shunsuke Sakoda[1], Tomoya Nakamura[1], Yasushi Yagi[1]; *[1]Osaka Univ., Japan.* We proposed a super-resolution human-silhouette imaging system using end-to-end optimization of coded illumination and a reconstruction network, increasing resolution without altering camera hardware. We experimentally verified the performance and analyzed it using pseudo-color-based visualization.

JW5A.69

A Real-Time Pretraining Optical Neural Network Boosts Classification Accuracy, Altai Perry[1], Luat Vuong[1]; [1]University of California Riverside, USA. We introduce a real-time image feature distiller using generalized random calibration data and vortex-phase encoders to demonstrate classification accuracies as high as 97% with the challenging CIFAR dataset.

JW5A.70

Magneto-Optical Effects in NaGdF4 Nanorods, Shahriar Esmaeili[2], Navid Rajil[3], Ayla hazrathosseini[3], Zhenhuan Yi[2], Philip Hemmer[2,1], Marlan Scully[2]; [1]Department of Electrical and Computer Engineering, Texas A&M University, USA; [2]Institute for Quantum Science and Engineering, Texas A&M University, College Station, TX 77843, Texas A&M University, USA. Exploring the magneto-optical effects of NaGdF4:Yb/Er nanorods, this study employs hydrothermal synthesis and polarized light to unveil the potential of these nanoparticles in advanced sensing and optical device applications.

JW5A.71

Effective Photonic Modes and Quantization Volume for Cavity Quantum Electrodynamics, Michael Taylor[1], Pengfei Huo[2,1]; [1]Institute of Optics, University of Rochester, USA; [2]Chemistry, University of Rochester, USA. Cavity light-matter coupling strength scales inversely on quantization volume, yet strong coupling occurs in Fabry-Perot cavities with macroscopic mirrors. We demystify this apparent contradiction by transforming the Hamiltonian into effective photonic modes, showing mirror-size independence.

JW5A.72

Quantum Machine Learning Performance Analysis: Accuracy and Efficiency Trade-offs in Linear Classification, Sara Aminpour[1,2], Yaser M. Banad[1], Sarah Sharif[1,2]; [1]School of Electrical and Computer Engineering, The University of Oklahoma, USA; [2]Center for Quantum Research and Technology, The University of Oklahoma, USA. We introduce the Nelder-Mead minimization method for data reuploading and assess quantum machine learning algorithms for linear classification, analyzing accuracy and computation time across different qubit numbers and training sample sizes, highlighting performance-efficiency trade-offs.

15:30 -- 17:00
Room: 3A
FW6A • Virtual Reality and Augmented Vision Theme: Applications II
Presider: Praneeth Chakravarthula; UNC-Chapel Hill

FW6A.1 • 15:30 (Invited)
Withdrawn

FW6A.2 • 16:00 (Invited)
Cloud-Native AI-Mediated 3D Telepresence, Jonghyun Kim[1]; *[1]NVIDIA Corporation, USA.* Abstract not available.

FW6A.3 • 15:30 (Invited)
VRAR Theme Invited Speaker: Title to be Announced, Mohammed Safayet Arefin1; *1Colorado State University, USA*. Abstract not available.

15:30 -- 17:00
Room: 3B
FW6B • Machine Learning Theme: Optical Design Applications
Presider: Keisuke Kojima; Boston Quantum Photonics

FW6B.1 • 15:30 (Invited)
Synergy Between Machine Learning and Optical Physics for Expansive Design Space Exploration in Advanced Optical Design, Zhaocheng Liu[1]; *[1]Meta Platforms Inc, USA.* We will introduce machine learning-assisted optical design to handle an extensive range of parameters, focusing on innovative physics-informed AI approaches for applications in both ray optics and photonic devices.

FW6B.2 • 16:00 (Invited)
AI in and for Optical System Design: A Lens Designer Point of View, Simon Thibault[1]; *[1]Universite Laval, Canada.* In lens design, we've been talking about AI for 40 years, it's time to ask how we can optimize the use of these new opportunities in optical design at work and for teaching.

FW6B.3 • 16:30 (Invited)
Machine Learning for Nonlinear Fiber Optics, Goëry Genty[1]; *[1]Tampereen yliopisto Tekniikan ja luonnontieteiden tiedekunta, Finland.* In this talk, we will review our recent work on the application of the techniques of machine learning to control, predict, and analyse nonlinear dynamics in optical fiber systems.

15:30 -- 17:00
Room: 3C
FW6C • Quantum Computing and Communication
Presider: Rodrigo da Silva Benevides; ETH Zurich, Switzerland

FW6C.1 • 15:30 (Invited)
Generating Quantum Entanglement between Optical and Microwave Photons with a Chip-Scale Transducer, Srujan Meesala[1]; *[1]California Inst. of Technology, USA.* We prepare entangled states of single optical and microwave photons using a piezo-optomechanical quantum transducer. This chip-scale device can serve as an entanglement generator between GHz-frequency superconducting qubits and telecom-wavelength photonic qubits in optical fiber.

FW6C.2 • 16:00
Programmable Generalized Time-Bin Measurements using Complex Media, Vatshal Srivastav[1], Dylan Danese[1], Saroch Leedumrongwatthanakun[1], Will McCutcheon[1], Mehul Malik[1]; *[1]Heriot-Watt Univ., UK.* We harness the spatio-temporal coupling of light inside a commercial step-index multi-mode fibre to program generalized projective measurements for photonic time-bin in dimension up to 7 and use them to certify high-dimensional time-bin entanglement.

FW6C.3 • 16:15
Demonstration of continuous-variable quantum machine learning using optical circuits, Shion Ikehara[1], Keitaro Anai[1], Yoshichika Yano[1], Daichi Okuno[1], Shuntaro Takeda[1]; *[1]Tokyo Daigaku, Japan.* We demonstrate the implementation of the classification task with the continuous-variable (CV) quantum kernel method on a programmable photonic quantum processor. We experimentally prove that the CV quantum kernel method successfully classifies several datasets robustly.

FW6C.4 • 16:30
Universal Gate-Based Quantum Computer With Individual Optical Addressing of Neutral Atom Qubits, Alexander G. Radnaev[1], on behalf of Infleqtion's Sqorpius team[1]; *[1]Infleqtion, USA.* Infleqtion's universal quantum computer uses individual optical addressing of neutral atom qubits, an architecture which promises fast gate operations on logical qubits. I will report on gate fidelities and other progress towards fault tolerance.

FW6C.5 • 16:45
Design and Fabrication of a MEMS-Enabled Quantum Socket for the Control of All Photonic and Spin Degrees of Freedom of an Artificial Atom in a High-Cooperativity Diamond Microdisk, Aileen Zhai[1], Genevieve Clark[2], Mark Dong[2,3], Johnathan Mack[1], Y. Henry Wen[2], Matt Saha[2], Andrew Greenspon[2,3], Kevin J. Palm[2], Daniel Dominguez[4], Andrew Leenheer[4], Gerald Gilbert[5], Dirk Englund[3], Matt Eichenfield[1,4]; *[1]Univ. of Arizona, USA; [2]The MITRE Corporation Bedford, USA; [3]Massachusetts Inst. of Technology Research Laboratory of Electronics, USA; [4]Sandia National Laboratories, USA; [5]The MITRE Corporation Princeton, USA.* We design and simulate the performance of a diamond microdisk resonator hosting group-IV defects heterogeneously integrated with MEMS-enabled piezo-optomechanical Si_3N_4 photonics, which allows control over all degrees of freedom of the defect and emitted photons.

15:30 -- 17:00
Room: 3D
FW6D • Imaging Exploiting Encoding and Decoding
Presider: Juergen Czarske; TUD | Dresden Univ. of Technology, Germany and Pietro Ferraro; Inst. of Intelligent Systems ISASI, Italy

FW6D.1 • 15:30 (Invited)
3D Diffuser Encoded Imaging and Physics-Informed Neural Network Reconstruction, Tom Glosemeyer[1], Julian Lich[1], Robert Kuschmierz[1], Juergen W. Czarske[1]; *[1]Technische Universitat Dresden, Germany.* Minimally invasive fiber endoscopy offers a high potential for biomedical imaging applications. By utilizing a diffuser for encoding and a coherent fiber bundle in conjunction with neural networks for reconstruction, single-shot 3D imaging enabled.

FW6D.2 • 16:00
Fully Unsupervised Deep-Learning with Dimension Expansion for Nanophotonic Design, Shuo Huang[1], Mahsa Torfeh[1], Yonggang Shi[1], Chia Wei Hsu[1]; *[1]Univ. of Southern California, USA.* We propose a fully unsupervised deep-learning approach using dimension expansion for nanophotonic design. The neural network generates binary broadband integrated Y-splitters with average efficiency 98% and splitting error 2%, without any pre-generated dataset.

FW6D.3 • 16:15
Imaging Complex Objects Through Heavy Scatter Using Motion in Structured Illumination, David W. Alexander[1], Ryan L. Hastings[1], Kevin J. Webb[1]; *[1]Purdue Univ., USA.* We demonstrate imaging of complex objects completely obscured by heavily scattering media, with coherent light, object motion, a calibration process, and phase retrieval. Applications include terrestrial imaging through atmospheric turbulence and biological methods.

FW6D.4 • 16:30
Wavelength-multiplexed Multiplane Quantitative Phase Imaging Using Diffractive Visual Processing, Che-Yung Shen[1], Jingxi Li[1], Tianyi Gan[1], Yuhang Li[1], Langxing Bai[1], Mona Jarrahi[1], Aydogan Ozcan[1]; *[1]Univ. of California Los Angeles, USA.* We present a wavelength-multiplexed diffractive optical processor that can transform the phase profiles of input objects at multiple axial depths into intensity variations at different wavelengths, enabling rapid multiplane quantitative phase imaging (QPI).

FW6D.5 • 16:45
Complex-valued linear transformations and image encryption through a spatially incoherent diffractive optical network, Xilin Yang[1], Md Sadman Sakib Rahman[1], Bijie Bai[1], Jingxi Li[1], Aydogan Ozcan[1]; *[1]Univ. of California Los Angeles, USA.* We present a spatially incoherent diffractive processor, performing complex-valued linear transformations between its input and output apertures. This framework expands potential applications of diffractive optical processors for image processing and encryption under spatially incoherent illumination

15:30 -- 17:00
Room: 3E
FW6E • Ultrafast Optical Interactions in Nanostructured Materials
Presider: Lyuba Kuznetsova; San Diego State Univ., USA

FW6E.1 • 15:30 (Invited)
Neuromorphic Imaging and Control of Levitated Particles, James Millen[1,2]; *[1]King's College London, UK; [2]London Centre for Nanotechnology, UK.* Levitated microparticles are mechanical sensors with low dissipation, with applications including detecting gravitational waves and searching for dark matter. We deploy neuromorphic imaging to track arrays of levitated sensors, and individually cool their motion.

FW6E.2 • 16:00
Tailoring Fano Resonance Characteristics for GSS4T1-based Reconfigurable Photonics, Stavroula Foteinopoulou[1], Nikolaos L. Tsitsas[2]; *[1]Univ. of New Mexico, USA; [2]School of Informatics, Aristotle Univ. of Thessaloniki, Greece.* We present a GSS4T1-based metagrating designed to exhibit a homogeneous optical-medium response, when GSS4T1 amorphous, or a judicious Fano response, when GSS4T1 crystalline, which enables a negative beam steering that can be switched on and off.

FW6E.3 • 16:15
Unity-Order Four-Wave Mixing Efficiencies in an Epsilon-Near-Zero-Based Cavity, Yaswant V. Vaddi[1], Theng-Loo Lim[1], Zahirul Alam[1], Shivashankar R. Vangala[2], Jeremy Upham[1], Joshua R. Hendrickson[2], Robert W. Boyd[1,3]; *[1]Department of Physics, Univ. of Ottawa, Canada; [2]Sensors Directorate, Air Force Research Laboratory, USA; [3]Inst. of Optics, Univ. of Rochester, USA.* We demonstrate four-wave mixing efficiencies up to 0.35 in an optical nanocavity containing a subwavelength-thick epsilon-near-zero mirror, surpassing silica glass by 20 orders of magnitude. The time-varying nature of the cavity allows $\sim$100~nm idler tunability.

15:30 -- 17:00
Room: 3F
LW6F • Quantum Photonics and Entanglement
Presider: Galan Moody; Univ. of California Santa Barbara, USA

LW6F.1 • 15:30 (Invited)
Nonlinear Integrated AlGaAs Chips for Quantum Information, Sara Ducci[1], Othmane Meskine[1], Lorenzo Lazzari[1], Italo Pio DeSimeone[1], Marco Ravaro[1], Maria Ines Amanti[1], Florent Baboux[1]; *[1]Laboratoire Matériaux et Phénomènes Quantiques, Université Paris Cité, France.* The talk will review our recent developments on monolithic and hybrid AlGaAs integrated devices, demonstrate their versatility for generating and manipulating quantum states, and show their potential for flexible entanglement-distribution networks.

LW6F.2 • 16:00
AlGaAs Microring Resonator Array for Dense Spectral Multiplexing and Multi-Mode Entangled-Pair Generation, Yiming Pang[1], Liao Duan[2], Joshua Castro[1], Trevor Steiner[3], Noemi Tagliavacche[4], Massimo Borghi[4], Lillian Thiel[1], Nick Lewis[1], Amalu Shimamura[1], John Bowers[1,3], Marco Liscidini[4], Galan Moody[1]; *[1]Electrical and Computer Engineering Department,*

Univ. of California Santa Barbara, USA; [2]Physics Department, Univ. of California Santa Barbara, USA; [3]Materials Department, Univ. of California Santa Barbara, USA; [4]Department of Physics, Universita degli Studi di Pavia, Italy. We report an AlGaAs microresonator array enabling dense multiplexing of high-rate 1550 nm entangled-pair sources. Quantum combs are offset by 12.5 GHz and pumped with an electro-optic comb producing up to 4 GHz/mW^2 pair rate per resonator.

LW6F.3 • 16:15
Quantum-Enhanced Two Photon Interactions Beyond the Photon Pairs Regime, Thomas C. Dickinson[1], Ivi Afxenti[2], G Astrauskaite[3], L Hirsch[2], S Nerneberg[3], O Jedrkiewicz[4], A Gatti[4], Daniele Faccio[3], Caroline Muellenbroich[3], Matteo Clerici[2,5], Lucia Caspani[1,5]; *[1]Univ. of Strathclyde, UK; [2]James Watt School of Engineering, Univ. of Glasgow, UK; [3]School of Physics and Astronomy, Univ. of Glasgow, UK; [4]Istituto di Fotonica e Nanotecnologie del CNR, Italy; [5]Dipartimento Di Scienze e Alta Tecnologia, Universit`a degli Studi dell'Insubria, Italy.* Quantum-enhanced two photon interactions driven by parametric down-conversion (PDC) were mainly investigated in the photon pairs regime. We report the observation of nonclassical effects in the stimulated PDC regime, beyond the standard one-photon-per-mode threshold.

LW6F.4 • 16:30
Single-Photon Source in Silicon Nitride Photonics for Quantum Key Distribution, Alexander Senichev[2], Zachariah O. Martin[1], Samuel Peana[1], Alexei S. Lagutchev[1], Alexandra Boltasseva[1], Vladimir Shalaev[1]; *[1]Purdue Univ., USA; [2]Purdue Univ., USA.* We present an evaluation of quantum emitters formed at the interface of nitrogen-rich silicon nitride and silicon dioxide, demonstrating their potential as single-photon sources for quantum photonic applications, focusing on polarization-based quantum key distribution.

LW6F.5 • 16:45
Bright InAs/GaAs Quantum Dot Single Photon Emitters Embedded in Tapered Nanobeam Cavity, Abhijit Biswas[1,2], Mohammad Habibur Rahaman[1,2], Allan S Bracker[3], Edo Waks[1,2]; *[1]The Inst. for Research in Electronics and Applied Physics, Univ. of Maryland, USA; [2]Department of Electrical and Computer Engineering, Univ. of Maryland, USA; [3]US Naval Research Laboratory, USA.* We report a nanobeam photonic crystal cavity coupled to charge tunable quantum dot for efficient spin-photon interface. We achieved coupling efficiency of ~32% and deterministically tuned the cavity resonance over ~9 nm range using gas tuning.

17:30 -- 19:00
Room: 3A
FW7A • Virtual Reality and Augmented Vision Theme: Systems Design
Presider: Sundeep Jolly; Apple

FW7A.1 • 17:30 (Invited)
Full-color 3D Holographic Augmented-Reality Displays with Metasurface Waveguides, Manu Gopakumar[1], Gun-Yeal Lee[1], Suyeon Choi[1], Brian Chao[1], Yifan Peng[3], Jonghyun Kim[2], Gordon Wetzstein[1]; *[1]Department of Electrical Engineering, Stanford Univ., USA; [2]NVIDIA Corp, USA; [3]Department of Electrical and Electronic Engineering, The Univ. of Hong Kong, Hong Kong.* We introduce a holographic augmented reality system using inverse-designed metasurface gratings and artificial-intelligence-driven holography algorithms. These elements

are jointly designed to enable high quality, full-color, 3D augmented reality from a compact device form factor.

FW7A.2 • 18:00 (Invited)
Instant 3D Worlds Through Split-Lohmann Displays, Yingsi Qin[1]; [1]*Carnegie Mellon Univ., USA.* We present a novel 3D display that can create high-quality 3D scenes in an instant. It can put individual pixel areas to different depths, fully supporting the native focusing ability of the human eye.

FW7A.3 • 18:30 (Invited)
VRAR Theme Speakers: Title to be Announced, Ilmars Osmanis[1]; [1]*Lightspace Labs, USA.* Abstract not available.

17:30 -- 19:00
Room: 3B
FW7B • Machine Learning Theme: Photonic Design Applications
Presider: Zhaocheng Liu; Meta Tech - Reality Labs Research, USA

FW7B.1 • 17:30 (Invited)
Photonics × Machine Learning, Keisuke Kojima[1], Toshiaki Koike-Akino[2]; [1]*Boston Quantum Photonics, USA;* [2]*Mitsubishi Electric Research Laboratories, USA.* We will present the recent progress of generative AI for the design of photonic devices, including variable autoencoders and diffusion models, and latent space optimization. We also review our non-traditional way of implementing optical neural networks using data re-uploading technique originally proposed for quantum computing.

FW7B.2 • 18:00 (Invited)
Reconfigurable Optical Random Neural Network for Large-Scale Optical Data Science, Fei Xia[1]; [1]*Centre National de la Recherche Scientifique, France.* We will discuss our recent progress on deep optical random neural network design using complex media capable of performing large-scale training and inference in situ.

FW7B.3 • 18:30 (Invited)
Optical Implementation of Denoising Diffusion Models for Efficient Image Generation, Ilker Oguz[1], Niyazi Ulas Dinc[1], Mustafa Yildirim[1], Junjie Ke[2], Innfarn Yoo[2], Qifei Wang[2], Feng Yang[2], Christophe Moser[1], Demetri Psaltis[1]; [1]*Inst. of Electrical and Microengineering, Ecole Polytechnique Federale de Lausanne, Switzerland;* [2]*Google LLC, USA.* Image generation with diffusion models requires many denoising steps, causing substantial latency in sampling on electronic hardware. To alleviate this problem, we demonstrate that passive modulation layers can perform image denoising and generation optically.

17:30 -- 19:00
Room: 3C
FW7C • Photonic Design and Quantum Optics
Presider: Alex Dikopoltsev; ETH Zurich, Switzerland

FW7C.1 • 17:30
Scalable and piezoelectrically tunable hybrid quantum photonic crystal cavities, Andrew Greenspon[1,2], Mark Dong[1,2], Anders Khaykin[1,2], Ian Christen[2], Gerald Gilbert[3], Matt Eichenfield[4], Dirk Englund[2]; *[1]The MITRE Corporation Bedford, USA; [2]Massachusetts Inst. of Technology Research Laboratory of Electronics, USA; [3]The MITRE Corporation Princeton, USA; [4]The Univ. of Arizona James C Wyant College of Optical Sciences, USA.* We report concepts of tunable hybrid quantum photonic crystal cavities composed of diamond and silicon nitride materials. This approach gives theoretical unloaded Q>10^6 with normalized mode volumes ~$1.2(\lambda/neff)^3$ and tunability of 760 GHz.

FW7C.2 • 17:45
On-chip coupling scheme for synchronization of distant quantum emitters using superradiant coupling channels, Roman Shugayev[1], Matt Eichenfield[1]; *[1]Sandia National Laboratories, USA.* Superradiance offers an efficient approach for coupling of discrete quantum emitters. In this work we propose a novel scheme for on-chip generation of synchronized superradiant spontaneous emission from distant solid state quantum sources

FW7C.3 • 18:00
Ultra Bright Silicon-on-insulator (SOI) Polarization Entangled Photon Source, Jinyi Du[1], Xingjian Zhang[1], Arya Chowdhury[1], George Chen[2], Hongwei Gao[2], Dawn T. Tan[2,3], Alexander Ling[1,4]; *[1]Centre for Quantum Technologies, Singapore; [2]Singapore Univ. of Technology and Design, Singapore; [3]Agency for Science, Technology and Research, Singapore; [4]National Univ. of Singapore, Singapore.* Polarization-entangled photon sources on silicon chips are useful for scalable quantum computing. By employing novel low-loss fiber-chip couplers and optimizing the entire system, we developed an ultra-bright polarization-entangled photon source with >97% (H/V); >94% (D/A) two photon interference visibility at 200,000 observed raw coincidence rate.

FW7C.4 • 18:15
Positioned Nanofabrication and Characterization of a Polarization Demultiplexer Based on GaAs-AlGaAs Quantum Dots, William G. Eshbaugh[1,2], Ashish Chanana[2,3], Junyeob Song[2,3], Emerson G. Melo[4], Edgar Perez[2,5], Sadhvikas Addamane[6], Cori Haws[7], Luca Sapienza[8], Saimon F. Covre da Silva[9], Armando Rastelli[9], Jin-Dong Song[10], Kartik Srinivasan[2,5], Edward Flagg[1], Marcelo Davanco[2]; *[1]West Virginia Univ., USA; [2]National Inst. of Standards and Technology, USA; [3]Theiss Research, USA; [4]Universidade de Sao Paulo, Brazil; [5]Joint Quantum Inst., USA; [6]Center for Integrated Nanotechnologies, USA; [7]Univ. of Southampton, UK; [8]Univ. of Cambridge, UK; [9]Johannes Kepler Universitat Linz, Austria; [10]Korea Inst. of Science and Technology, Korea (the Republic of).* We work toward a high-yield fabrication of an inversely-designed polarization demultiplexer around localized GaAs-AlGaAs quantum dots and experimentally characterize device performance. Preliminary results show coupling of QD dipole moments to separate waveguides.

FW7C.5 • 18:30 (Invited)
Quantum Photonics, Quantum Information Science and Technology, and Optics, Brian J. Smith[1]; [1]*Univ. of Oregon, USA.* Abstract not available.

• 19:00 (Invited)
Photonic and Electronic Design IP Beyond PDK Components for Scaling Up System Complexity, Matthew Streshinsky[1]; [1]*Enosemi, Inc., USA.* Standardization of open-market silicon photonic foundries enables significantly more complex photonic systems. Future photonic systems will be composed of reusable IP blocks in the same way that VLSI electronic ICs leverage a hierarchy of designs.

17:30 -- 19:00
Room: 3D
FW7D • Integrated Devices and Systems for Quantum Applications
Presider: Nathan Youngblood; Univ. of Pittsburgh, USA

FW7D.1 • 17:30 (Invited)
Sensing and Target Detection Using Quantum Inspired Systems, Amr S. Helmy[1]; [1]*Univ. of Toronto, Canada.* The system utilises using high power classical time-frequency correlation that is closely related to non-classical time-frequency entanglement and a novel frequency conversion technique to analyze such correlation with unprecedented efficiency and accuracy.

FW7D.2 • 18:00 (Invited)
Materials and Devices for Integrated Atomic Quantum Systems, Karan Mehta[1]; [1]*Cornell Univ., USA.* I will discuss a novel material platform for blue/UV integrated photonics, as well as high-purity passive generation of pure circularly polarized light leveraging vectorial waveguide mode structure, for application in integrated atomic quantum systems.

FW7D.3 • 18:30
On-chip Quantum Interference of Transverse Modes with Inverse Designed Structures, Jamika Roque[2], Daniel C. Peace[1], Simon White[3], Emanuele Polino[3], Sayantan Das[1], Sergei Slussarenko[3], Nora Tischler[3], Jacqui Romero[1]; [1]*School of Mathematics and Physics, The Univ. of Queensland, Australia;* [2]*Univ. of the Philippines System, Philippines;* [3]*Centre for Quantum Dynamics, Griffith Univ., Australia.* We demonstrate two photon Hong-Ou-Mandel interference between the different transverse modes in a multimode silicon photonic chip using a compact inverse designed beam splitter with up to 99.56 ± 0.64% interference visibility, highlighting the potential of inverse designed devices for quantum information processing with transverse spatial modes.

FW7D.4 • 18:45
A low-loss and broadband all-fiber acousto-optic circulator, Riccardo Pennetta[1], Martin Blaha[1], Arno Rauschenbeutel[1]; [1]*Humboldt-Universitat zu Berlin, Germany.* We demonstrate novel all-fiber and magnetic-field-free circulators based on Mach-Zehnder interferometers including so-called fiber null-couplers. Their low insertion loss makes them ideal tools for the transmission and processing of optically encoded quantum information.

17:30 -- 19:00
Room: 3E
FW7E • Optical Interactions and Resonators
Presider: Luat Vuong; Univ. of California at Riverside, USA

FW7E.1 • 17:30 (Invited)
Nanoscale Petahertz Electronics, P. Donald D. Keathley[1]; *[1]Massachussetts Inst. of Technology, USA.* This talk overviews developments in nanoscale petahertz electronics, including our work in the area using metallic nanoantennas. It will focus on how we are leveraging insights and tools from the electronics community in device development.

FW7E.2 • 18:00
Avalanche-enabled optical modulation with single-photon intensities, Demid Sychev[1], Peigang Chen[1], Morris Yang[1], Colton Fruhling[1], Alexei S. Lagutchev[1], Alexander Kildishev[1], Alexandra Boltasseva[1], Vladimir Shalaev[1]; *[1]ECE, Purdue Univ., USA.* We demonstrate all-optical modulation of 1550-nm wavelength beam of 10mW power controlled by a single-photon intensity signal in an avalanche photodiode.

FW7E.3 • 18:15
An Efficient Computational Algorithm for Modeling Slow Soliton Interactions in Microresonators, Sanzida Akter[1], Pradyoth H. Shandilya[1], Logan Courtright[1], Giuseppe D'Aguanno[1], Amir Leshem[2], Omri Gat[2], Curtis Menyuk[1]; *[1]Univ. of Maryland Baltimore County, USA; [2]Hebrew Univ. of Jerusalem Racah Inst. of Physics, Israel.* Standard simulations of microresonator waveforms are limited by the photon lifetime. We describe a computational method that enables simulations on a laboratory timescale and apply this approach to study two-soliton interactions.

FW7E.4 • 18:30 (Invited)
Optomechanical Sensing and Signal Processing with Fabry-Perot Microcavities, Jason J. Gorman[1]; *[1]NIST Boulder, USA.* Fabry-Perot microcavities can have exceptionally low loss and be integrated with micromechanical structures. This presentation will describe the opportunities and challenges of leveraging these microcavities and their application to optomechanical accelerometers and RF photonics.

17:30 -- 19:30
Room: 3F
LW7F • Metamaterials I
Presider: Justus Ndukaife; Vanderbilt Univ.; Sc of Engineering, USA

LW7F.1 • 17:30 (Invited)
Metasurfaces for Future Sensing and Imaging Technologies, Mark Brongersma[1]; *[1]Stanford Univ., USA.* I will discuss how metasurface functionalities can start to impact a variety of optical sensing and imaging technologies. I will explain how to make transparent sensors on glass substrates and how to achieve imaging of surface textures.

LW7F.2 • 18:00 (Invited)
Metasurfaces for Image Processing and Analog Computing, Andrea Alu[1]; [1]*CUNY Advanced Science Research Center, USA.* I discuss our recent progress in demonstrating ultrathin engineered surfaces that perform image processing and computing on optical signals and images, and the opportunities for photonic technologies.

LW7F.3 • 18:30
Polarized asymmetric transmission with passive all-dielectric metagratings, Stavroula Foteinopoulou[1]; [1]*Univ. of New Mexico, USA.* We present a mechanism to asymmetric transmission which neither requires breaking reciprocity nor does it require a polarization rotation. We demonstrate the phenomenon with an all-dielectric metagrating for both TE and TM light.

LW7F.4 • 18:45
Multiwavelength and Multiport Beam Splitting for the generation of NOON states through nonlocal metasurfaces, Yu Tian[1], Qi Liu[1], Zhaohua Tian[1], Qihuang Gong[1], Ying Gu[1]; [1]*Peking Univ., China.* We demonstrate that nonlocal geometric phase gradient metasurfaces can function as a series of multiport beam splitters with spectral-polarization-dependence, through which high-NOON states with four spatial modes can be prepared

LW7F.5 • 19:00 (Invited)
Moiré Photonic Crystals in Engineered Semiconductor Membranes, Evelyn Hu[1]; [1]*Harvard Univ., USA.* Moiré photonic structures have demonstrated exceptional promise and possibilities for tunable optical behavior. This paper will discuss the design, fabrication, and analysis of lasers formed from merged and bilayer moiré GaN heterostructures.

Thursday, 26 September

08:00 -- 09:00
Room: 3A
FTh1A • Machine Learning Theme: Biomedical Applications II
Presider: Fei Xia; CNRS, France

FTh1A.1 • 08:00 (Invited)
Fluorescence-based Diffraction Tomography using Explicit Neural Fields, Yi Xue[1]; *[1]Univ. of California, Davis, USA.* We developed a new deep-learning algorithm based on explicit neural radiance fields to quantitatively reconstruct the 3D refractive index of transparent biological samples from fluorescence microscopy images.

FTh1A.2 • 08:30 (Invited)
Deep Learning for Flat Optics in Biomedical Applications, Yuan Luo[1]; *[1]National Taiwan Univ., Taiwan.* Abstract not available.

08:00 -- 09:00
Room: 3B
FTh1B • Quantum Information Control
Presider: Haoning Tang; Harvard Univ., USA

FTh1B.1 • 08:00 (Invited)
Control of the quasiparticle density in a superconducting qubit using an infrared laser, Rodrigo da Silva Benevides[1]; *[1]ETH Zurich, Switzerland.* We introduce a new technique to control quasiparticle density in superconducting qubits using an infrared laser. It can be used for understanding the effects of high-energy radiation on superconducting circuits with different geometries and materials.

FTh1B.2 • 08:30
Entanglement Generation and Transport in Time-Multiplexed Two Photon Quantum Walks, Federico Pegoraro[1], Philip Held[1], Benjamin Brecht[1], Christine Silberhorn[1]; *[1]Paderborn Univ., Integrated Quantum Optics, Inst. for Photonic Quantum Systems (PhoQS), Germany.* We use a time-multiplexed photonic quantum walk to entangle the polarization states of two photons. Our scheme is capable of generating states with variable degree of entanglement and distributes them across a large evolution network.

FTh1B.3 • 08:45
Tuning of Quantum Correlations in Light Scattering around the Resonance of an Ensemble of Cold Two-Level Atoms, Gabriel C. Borges[1], Alexandre Almeida[1], Wellington Martins[1], Guilhermo Roque[1], Daniel Barbosa[1]; *[1]Number, Street, Brazil.* We report the statistics of photon pairs generated via spontaneous four-wave mixing from an ensemble of two-level cold atoms in a low detuning regime and, consequently, the influence of optical depth (OD) on this regime.

08:00 -- 09:00
Room: 3C
FTh1C • Interferometry and Frequency Combs
Presider: Florian Willomitzer; Univ of Arizona, Coll of Opt Sciences, USA

FTh1C.1 • 08:00
Mode-Resolved Measurement of the Frequency Comb Fixed Point Using Dual-Comb Interferometry, Daniel I. Herman[1], Mathieu Walsh[2], Jérôme Genest[2]; *[1]Electrical, Computer and Energy Engineering, Univ. of Colorado Boulder, USA; [2]Centre d'Optique, Photonique et Laser, Universite Laval, Canada.* Dual-comb interferometry locates the fixed point of a fiber frequency comb to within a single comb mode. This estimate is nearly 1000× more precise than previous methods. Sub-nanometer shifts of the fixed point are examined.

FTh1C.2 • 08:15
Demonstration of Enhancement in Sensitivity in Measuring Frequency Shift Using a Slow-light Augmented Unbalanced Interferometer, Ruoxi Zhu[1], Zifan Zhou[1], Jinyang Li[1], Jason Bonacum[2], David Smith[3], Selim Shahriar[1,2]; *[1]Northwestern Univ., USA; [2]Digital Optics Technologies, USA; [3]NASA Marshall Space Flight Center, USA.* Using a slow-light augmented unbalanced Mach-Zehnder Interferometer, we demonstrate an enhancement in sensitivity, by more than two orders of magnitude, of measuring the frequency shift of a laser when compared to the conventional heterodyning technique.

FTh1C.3 • 08:30 (Invited)
Highly Functional Imaging with Versatile Optical Phase Control Using Optical Frequency Comb, Kaoru Minoshima[1]; *[1]Univ. of Electro-Communications, Japan.* Highly functional imaging with optical signal processing using precise phase controllability of optical frequency comb is presented. Amplitude and phase of optical interference waveform are obtained real-time for ultrafast imaging from microscopic to large-scale objects.

08:00 -- 09:00
Room: 3D
FTh1D • Advanced Integration and Fabrication
Presider: Nathan Lin; AIM Photonics, USA

FTh1D.1 • 08:00
Photonic Ribbon Cables: CMOS-fabricated Devices for Scalable Chip-to-chip Optical and Electrical Interconnection, Matthew Saha[1], Andrew Leenheer[2], Genevieve Clark[1], Jack Damenti[2], Josh Montoya[2], Gerald Gilbert[3], Matt Eichenfield[4,2], Dirk Englund[5]; *[1]The MITRE Corporation Bedford, USA; [2]Sandia National Laboratories, USA; [3]The MITRE Corporation Princeton, USA; [4]The Univ. of Arizona James C Wyant College of Optical Sciences, USA; [5]Massachusetts Inst. of Technology Research Laboratory of Electronics, USA.* We demonstrate our novel CMOS-fabricated, scalable interconnects for photonic integrated systems. These low-loss, channel-dense devices can optically and electrically connect separate photonic chips or spatially isolated components from a single reticle.

FTh1D.2 • 08:15

Cryogenic Packaging for Scalable Hybrid Quantum PICs, Robert Bernson[2], Alex Witte[1], Genevieve Clark[1], Kamil Gradkowski[2], Matt Saha[1], Andrew Leenheer[3], Kevin Chen[4], Gerald Gilbert[1], Matt Eichenfield[3,5], Dirk Englund[4], Peter O'Brien[2]; *[1]The MITRE Corporation, USA; [2]Tyndall National Inst., Ireland; [3]Sandia National Laboratories, USA; [4]Massachusetts Inst. of Technology, USA; [5]The Univ. of Arizona James C Wyant College of Optical Sciences, USA.* We demonstrate a robust packaging method for PICs using surface grating couplers. We use this method to create diamond color center quantum memory modules with active photon routing, strain tuning, and operation to millikelvin temperatures.

FTh1D.3 • 08:30

Efficient Forward-Bias Microring Phase Shifters in 45nm Electronic-Photonic Foundry CMOS, Elam Day-Friedland[1], Danielius Kramnik[1], Vladimir Stojanovic[1]; *[1]Electrical Engineering and Computer Sciences, Univ. of California Berkeley, USA.* O-band optical phase shifters based on carrier injection into adiabatic microring resonators are fabricated and characterized in 45nm CMOS. We present a design methodology for optimizing their insertion loss given tuning voltage or power constraints.

FTh1D.4 • 08:45

RF-optical signal conversion via Dual Active-Cavity modulator in a Monolithic Electronic-Photonic SOI Platform, Manuj Singh[1], Xinchang Zhang[1], Deniz Onural[1], Ruocheng Wang[2], Bohan Zhang[1], Kenaish Alqubaisi[1], Vladimir Stojanovic[2], Milos Popovic[1]; *[1]Boston Univ., USA; [2]Univ. of California Berkeley, USA.* We demonstrate a Dual Active-Cavity RF modulator combining T-shaped spoked junction with a novel “half-rib” waveguide in a monolithic electronic-photonic platform. We measure a sideband efficiency of -52 dB at 66 GHz RF carrier frequency.

08:00 -- 09:00
Room: 3E
FTh1E • Ultrafast Lasers and Applications II
Presider: Isaac Nape; Univ. of the Witwatersrand

FTh1E.1 • 08:00

Resonance properties of highly nonlinear ultra-silicon-rich nitride Bragg gratings, Amdad Chowdury[1], Benjamin J. Eggleton[2], Dawn T. Tan[1,3]; *[1]Photonics Devices and Systems Group, Singapore Univ. of Technology and D, Singapore; [2]Inst. of Photonics and Optical Science, School of Physics, The Univ. of Sydney, Australia; [3]Inst. of Microelectronics, Agency for Science Technology and Research, Singapore.* We numerically reveal the regions where modulation instability-induced phase-matched frequencies are present in ultra-silicon-rich nitride Bragg gratings. We show that the Bragg grating has complex resonance frequency patterns close to the stop band.

FTh1E.2 • 08:15

1.5 TW High-Energy, Few-Cycle Beamline for Relativistic Laser-Matter Interactions, Alexander R. Meadows[1], Kiyoshi Yamamoto[1], Francisco Szlafsztein[2], Vladimir Chvykov[1], Carmen Menoni[1], Bruno Schmidt[3], Jorge Rocca[1]; *[1]Colorado State Univ., USA; [2]Universidad de Buenos Aires Facultad de Ciencias Exactas y Naturales, Argentina; [3]Few-Cycle, Canada.* We demonstrate the production of 1.5 terawatt, few-cycle laser pulses for irradiation of solid targets at relativistic intensities. Pulses of up to 25 mJ are spectrally broadened in a helium-filled hollow-core fiber and recompressed.

FTh1E.3 • 08:30
Ultra-low power optical tweezers for indentation of tissues, Krishangi Krishna[1], Joshua A. Burrow[1], Wenyu Liu[1], Shayaan Chaudhary[1], Kimani Toussaint[1]; *[1]Brown Univ., USA.* Traditional optical tweezers rely on the use of continuous-wave laser sources with moderate to high optical powers for indenting cells which can lead to unwanted thermal effects. Here, we demonstrate that a femtosecond laser can provide optical tweezing of microparticles to indent tissues using an average power as low as 1 mW.

FTh1E.4 • 08:45
Post-Compression of High-Energy Laser Pulses Broadened by Folded Beam Propagation in Air, Vladimir Savichev[1], Tarkan Takil[2], Yong Wang[1], Oscar Martinez[3], Jorge Rocca[1,2], Vladimir Chvykov[1], Federico Furch[4]; *[1]Electrical and Computer Engineering, Colorado State Univ., USA; [2]Physics, Colorado State Univ., USA; [3]Universidad de Buenos Aires, Argentina; [4]Max-Born-Institut fur Nichtlineare Optik und Kurzzeitspektroskopie im Forschungsverbund Berlin eV, Germany.* A proof-of-principle experiment demonstrates post-compression by a factor of ~six of 0.1 J-level Yb:YAG picosecond laser pulses spectrally broadened by free beam propagation in atmospheric air folded by flat mirrors.

08:00 -- 09:00
Room: 3F
LTh1F • Metamaterials II
Presider: Hadiseh Alaeian; Purdue Univ., USA

LTh1F.1 • 08:00 (Invited)
Manipulating Thermal Emission Using Bound States in the Continuum, Justus C. Ndukaife[1], Guodong Zhu[1], Ikjun Hong[1]; *[1]Vanderbilt Univ., USA.* We theoretically and experimentally demonstrate robust narrowband thermal emission using plasmonic quasi-BIC metasurfaces. Our wavelength-selective thermal emitters feature remarkable emission stability over a broad range of temperatures.

LTh1F.2 • 08:30
Nonreciprocal thermal emission from a planar structure in transmission mode, Michela Florinda Picardi[1], Vera I Moerbeek[1], Mariano Pascale[1], Georgia Papadakis[1]; *[1]Institut de Ciencies Fotoniques, Spain.* Approaching thermodynamic limits in light harvesting requires nonreciprocal thermal emission. Most of previous nonreciprocal emitters operate in reflection. We propose a pattern-free heterostructure operating in transmission mode, using a magneto-optical material embedded between two dielectrics.

LTh1F.3 • 08:45
Thermal Control of Bound States in the Continuum in Toroidal Metasurfaces, Fedor Kovalev[1], Andrey Miroshnichenko[2], Alexey Basharin[3], Hannes Toepfer[4], Ilya Shadrivov[1]; *[1]ARC Centre of Excellence for Transformative Meta-Optical Systems (TMOS), Research School of Physics, Australian National Univ., Australia; [2]School of Engineering and Technology, Univ. of New South Wales Canberra at ADFA, Australia; [3]Department of Physics and Mathematics,*

Center for Photonics Sciences, Ita-Suomen yliopisto, Finland; [4]Advanced Electromagnetics Group, Technische Universitat Ilmenau, Germany. We demonstrate significant progress in the tunability of toroidal metasurfaces by effectively controlling bound states in the continuum resonances in the terahertz range, achieved through the heating of integrated thin film patches of vanadium dioxide.

09:15 -- 10:00
Room: 3A
FTh2A • FiO Machine Learning Visionary Session
Presider: G. Groot Gregory; Synopsys, Inc, USA

FTh2A.1 • 09:15 (Visionary)
Compiling Machine Intelligence on Optoelectronic Systems, Dirk Englund[1]; *[1]Massachusetts Inst. of Technology, USA.* This work investigates the scalability and performance metrics—such as throughput, energy consumption, and latency—of various such architectures, with a focus on recently developed hardware error correction techniques, in-situ training methods, initial field trials, as well as extensions into DNN-based inference on quantum signals with reversible, quantum-coherent resources.

09:15 -- 10:00
Room: 3F
LTh2B • Laser Science Visionary Session III
Presider: David Reis; Stanford Univ., USA

LTh2B.1 • 09:15 (Visionary)
Imaging Charge Carrier, Heat, and Ion Transport at the Nanoscale, Naomi Ginsberg[1]; *[1]Univ. of California Berkeley, USA.* Naomi Ginsberg's vision is to detect and discern the spatiotemporal evolution of charge carriers, heat, and ions as they interconvert and explore emerging materials' structure and heterogeneity on multiple scales. She will share our development of stroboscopic optical scattering microscopy (stroboSCAT), whose contrast originates from how photoexcitations alter a material's refractive index with sub-picosecond and single-digit nanometer sensitivity.

10:30 -- 12:30
Room: 3A
FTh3A • Machine Learning Theme: Computational Imaging and Machine Learning
Presider: Simon Thibault; Université Laval, Canada

FTh3A.1 • 10:30 (Invited)
Computational Imaging with Randomness, Ryoichi Horisaki[1]; *[1]Tokyo Daigaku, Japan.* I will present our recent research efforts in computational imaging with randomness and scattering, including the use of machine learning techniques.

FTh3A.2 • 11:00 (Invited)
Computational Coded Imaging Systems Using Trained/Untrained Neural Networks, Tomoya Nakamura[1]; *[1]Osaka Daigaku, Japan.* Computational coded imaging systems employ

image-reconstruction algorithms to decode captured images. In this talk, I introduce lensless and super-resolution imaging systems utilizing trained/untrained neural networks for image reconstruction processing.

FTh3A.3 • 11:30 (Invited)
Neural Wavefront Shaping, Chris Metzler[1]; *[1]Univ. of Maryland at College Park, USA.* This talk introduces neural wavefront shaping (NeuWS), a guidestar-free approach for imaging through optical aberrations. NeuWS integrates maximum likelihood estimation, measurement modulation, and neural signal representations to reconstruct diffraction-limited images through static/dynamic scattering media.

FTh3A.4 • 12:00 (Invited)
Self-Supervised, Experiment-Free Neural Network for Hologram Reconstruction Using Physics Consistency, Luzhe Huang[1], Hanlong Chen[1], Tairan Liu[1], Aydogan Ozcan[1]; *[1]Univ. of California Los Angeles, USA.* We presented a self-supervised learning framework that leverages synthetic artificial training data and physics consistency loss, eliminating the need for capturing experimental data, and demonstrated its superior generalization to unseen real-world samples than competitive methods.

10:30 -- 12:30
Room: 3B
FTh3B • Novel Optical Fiber Design
Presider: Giovanni Milione; NEC Laboratories America Inc., USA

FTh3B.1 • 10:30 (Invited)
Low-Loss Fiber Bragg Grating Mode Scramblers Exploiting Propagation Constant Engineering, Anirudh Vijay[1], Oleksiy Krutko[1], Rebecca Refaee[1], Joseph M. Kahn[1]; *[1]Stanford Univ., USA.* Periodic scrambling in multimode fiber links minimizes accumulated modal dispersion and mode-dependent gain/loss, but existing scramblers are too lossy. In fiber Bragg grating scramblers, index profile optimization curtails coupling to unguided modes, yielding losses <0.1 dB over the C band.

FTh3B.2 • 11:00
Metasurfaces for Free-Space Coupling to Multicore Fibers, Jaewon Oh[1], Jun Yang[2], Louis A. Marra[2], Ahmed Dorrah[1], Alfonso Palmieri[1], Paulo Dainese[2], Federico Capasso[1]; *[1]Harvard John A Paulson School of Engineering and Applied Sciences, USA; [2]Corning Incorporated, USA.* Metasurface-based free-space couplers between a single-mode fiber array and a multicore fiber are demonstrated. Measured insertion loss and crosstalk are as low as 1.2 dB and up to -40.1 dB across the O-band, respectively.

FTh3B.3 • 11:15
Tapered Ring-Core Fiber with Flattened Negative Dispersion for Cylindrical Vector Modes, Wenpu Geng[1], Zhi Zeng[2], Weiwei Liu[1], 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 dual ring-cores is proposed to achieve broadband and flat negative dispersion for vortex modes. The dispersion curve of the HE_{21} mode features < ±1 ps/(nm●km) variation from 1449 to 1671 nm.

FTh3B.4 • 11:30
High loss reveals gaseous chlorine in antiresonant hollow core fibres, Kerrianne Harrington[1], Robbie Mears[1], James Stone[1], William Wadsworth[1], Jonathan Knight[1], Tim Birks[1]; *[1]Univ. of Bath, UK.* We observe unexpectedly high loss at ultraviolet wavelengths in freshly-drawn anti-resonant hollow core fibres. The loss matches the absorption spectrum of gaseous (molecular) chlorine, and dissipates over time.

FTh3B.5 • 11:45
Low loss multi-core anti-resonant hollow core fibre, Robbie Mears[1], Kerrianne Harrington[1], William Wadsworth[1], Jonathan Knight[1], James Stone[1], Tim Birks[1]; *[1]Univ. of Bath, UK.* We report a three-core hollow core optical fibre, with low loss guidance at visible and near-infrared wavelengths. Coupling between cores is very weak, while the breaking of rotational symmetry yields fabrication insights.

FTh3B.6 • 12:00
Highly multi-mode anti-resonant hollow core fibres, Robbie Mears[1], Kerrianne Harrington[1], William Wadsworth[1], Jonathan Knight[1], James Stone[1], Tim Birks[1]; *[1]Univ. of Bath, UK.* We report transmission capacity, propagation loss and bend loss of anti-resonant fibres with 7, 12 and 24 cladding tubes. The 24-tube fibre transmits ~50× more light than the 7-tube fibre for the same source.

FTh3B.7 • 12:15
Lensless Multicore Fiber Endoscope with Expanded Cores for Improved Light Collection, Kinga Zolnacz[1,2], Ronja Stephan[3], Jakob Dremel[1,4], Katharina Hausmann[3], Matthias Ließmann[3], Michael Steinke[3,6], Juergen W. Czarske[1,5], Robert Kuschmierz[1,5]; *[1]Technische Universitat Dresden, Germany; [2]Politechnika Wroclawska Wydzial Podstawowych Problemow Techniki, Poland; [3]Leibniz Universitat Hannover, Germany; [4]Else Kroner Fresenius Center for Digital Health, Technische Universitat Dresden, Germany; [5]BIOLAS, Competence Center for Biomedical Computational Laser Systems, Technische Universität Dresden, Germany; [6]Cluster of Excellence PhoenixD, Leibniz Univ. Hannover, Germany.* Multicore optical fibers are an innovative tool in lensless endoscopy. To overcome their main limitation, i.e., low light collection efficiency, thermal expansion of the cores was applied, resulting in improved image quality, contrast and signal-to-noise ratio.

10:30 -- 12:30
Room: 3C
FTh3C • Waveguides and Nanostructures
Presider: Lan Yang; Washington Univ. in St Louis, USA

FTh3C.1 • 10:30 (Invited)
Adiabaticity Engineering in Guided Wave Optics, Hung-Ching Chung[1], Chih-Hsien Chen[2,3], Yung-Jr Hung[2,3], Shuo-Yen Tseng[1,3]; *[1]Department of Photonics, National Cheng Kung Univ., Taiwan; [2]Department of Photonics, National Sun Yat-sen Univ., Taiwan; [3]Miniaturized Photonic Gyroscope Research Center, National Sun Yat-sen Univ., Taiwan.* Adiabatic mode evolution is an important concept in guided wave optics. We describe various approaches to engineer device adiabaticity, including fast quasiadiabatic dynamics, adiabaticity engineering, and adiabaticity map, leading to robust devices with small footprints.

FTh3C.2 • 11:00
Waveguide Undercut for Increased Efficiency in Integrated Optical Phased Arrays, Jacob N. Bouchard[1,2], Marcel W. Pruessner[1], Nathan F. Tyndall[1], Scott Holmstrom[1,3], Michael L. Fanto[4], Gerald Leake[5], Todd H. Stievater[1]; *[1]Optical Sciences Division, US Naval Research Laboratory, USA; [2]NRC Postdoctoral Scholar, USA; [3]Department of Physics & Engineering Physics, The Univ. of Tulsa, USA; [4]Air Force Research Laboratory Information Directorate, USA; [5]The Research Foundation for The State Univ. of New York, USA.* We demonstrate a new foundry process from AIM Photonics used to thermally isolate photonic devices. This process is demonstrated with optical phased arrays utilizing isolated silicon thermo-optic phase shifters which exhibit a 12x efficiency gain.

FTh3C.3 • 11:15
Resonant mode analysis and 2D projection via waveguide-on-cantilever ski jumps, Matthew Zimmermann[1], Matt Saha[1], Y. Henry Wen[1], Andrew Greenspon[1], Mark Dong[1,2], Andrew Leenheer[3], Gerald Gilbert[4], Matt Eichenfield[3,5]; *[1]The MITRE Corporation, USA; [2]Research Laboratory of Electronics, Massachusetts Inst. of Technology, USA; [3]Sandia National Laboratories, USA; [4]The MITRE Corporation Princeton, USA; [5]The Univ. of Arizona James C Wyant College of Optical Sciences, USA.* We characterize mechanically resonant modes of a broadband waveguide on a piezoelectrically-actuated cantilever with <0.1 mm^2 device size that is capable of projecting tens of thousands of beam spots via 2D resonant steering

FTh3C.4 • 11:30
Designing Broadband Dielectric Mirrors using 3D Periodic Nanolattices, Vijay Anirudh Premnath[1], Chih-Hao Chang[1]; *[1]The Univ. of Texas at Austin, USA.* This research involves designing and demonstrating broadband near-100% reflectance in multilayer 3D nanolattice reflectors with stacked layers of alternating high and low refractive indices by varying geometric properties like layer thickness and periodicities.

FTh3C.5 • 11:45
Fabrication of Sapphire Nanostructures with Anti-Glare, Dust-Mitigating, and Scratch Resistant Properties, Kun-Chieh Chien[1], Mehmet Kepenekci[1], Andrew Tunell[1], Chih-Hao Chang[1]; *[1]Univ. of Texas at Austin, USA.* This work reports sapphire nanostructures with broadband and omnidirectional antireflection properties. The structures also mitigate dust adhesion and has increased surface scratch resistance and can find applications in protective windows in extreme environment.

FTh3C.6 • 12:00
Stress-controlled, Low-Loss and Conformal Optical Coatings by High-Throughput Spatial ALD, Emanuele Sortino[1], Philipp Maydannik[2], John Rönn[2], Kalle Niiranen[2], Tommi Kääriäinen[1]; *[1]Beneq Inc, USA; [2]Beneq, Oy, Finland.* We present a new-generation Spatial ALD system that achieves oxide deposition rates of 2000 nm/h at ≤150°C, with tunable stress, refractive index, and low optical loss over conformal geometries.

FTh3C.7 • 12:15
Development of Highly Nonlinear Soft Glass Structured Optical Fibers Based on 3D Preform Printing with the Direct Molten Glass Deposition Method, Ryszard Buczynski[1,2], Pawel Wienclaw[3,1], Przemyslaw Golebiewski[2,1], Grzegorz Stepniewski[2], Pawel Socha[2], Dariusz

Pysz[2], Adam Filipkowski[2], Andrzej Burgs[3], Rafal Kasztelanic[1,2]; [1]*Uniwersytet Warszawski, Poland;* [2]*Siec Badawcza Lukasiewicz - Instytut Mikroelektroniki i Fotoniki, Poland;* [3]*Sygnis S.A., Poland.* The 3D glass printing system dedicated to the development of optical fiber preforms is reported. Line-by-line horizontal printing of microstructured fiber preform with heavy metal oxide glass is demonstrated. A proof-of-concept fiber was fabricated and used for near-infrared octave-spanning supercontinuum generation.

10:30 -- 12:30
Room: 3D
FTh3D • Integrated Devices on Silicon and SiN Platform
Presider: Tsung-Han Wu; Univ. of Colorado at Boulder, USA

FTh3D.1 • 10:30 (Invited)
Large-Scale Integrated Photonics on Silicon, Di Liang[1]; [1]*Univ. of Michigan, USA.* Silicon has proven to be a favorable platform for large-scale integration and production of photonics, both in monolithic and heterogeneous fashions. This talk attempts to review their latest breakthroughs for mainstream and emerging applications.

FTh3D.2 • 11:00
Optical switch trees with rapid adiabatic coupler on a CMOS platform, Xinchang Zhang[1], Manuj Singh[1], Dingning Li[1], Deniz Onural[1], Howard Dao[1], Shiva Raja[1], Milos Popovic[1]; [1]*Boston Univ., USA.* We present a compact optical switch with rapid adiabatic coupling, achieving high extinction ratios over a 75 nm wavelength in a 1-by-2 unit. A 1-by-8 switch tree driven by three inputs is also demonstrated.

FTh3D.3 • 11:15
A Vertical-Junction Carrier-Depletion Micro-Ring Modulator, Mohammad Rakib Uddin[1]; [1]*AIM Photonics, USA.* A vertical-junction, carrier-depletion, micro-ring modulator is demonstrated with an extinction ratio around 30 dB, a modulation efficiency ~40 pm, and works with drive voltages as low as 0.5 V

FTh3D.4 • 11:30
Inverse Design of Silicon Nitride Wavelength-division Multiplexers and Frequency-selective Resonators, Danxian Liu[1], Egemen Bostan[1], Tianyi Zeng[1], Aditya Paul[1,2], Kiyoul Yang[1]; [1]*Harvard John A Paulson School of Engineering and Applied Sciences, USA;* [2]*Department of Electrical Engineering and Computer Science, Massachusetts Inst. of Technology, USA.* We experimentally demonstrate inverse-designed 980/1530 nm and 1480/1530 nm wavelength-division multiplexers on an 800 nm-thick silicon nitride platform. The devices exhibit < 3 dB insertion loss and ≈ 9 dB crosstalk. Additionally, we showcase a frequency-selective resonator architecture utilizing the inverse-designed elements.

FTh3D.5 • 11:45
High-Speed Heterogenous Photodiodes on Silicon Nitride for Integrated Microwave Applications, Fatemehsadat Tabatabaei[1], Junyi Gao[1], Xiangwen Guo[1], Andreas Beling[1]; [1]*Univ. of Virginia, USA.* We demonstrate InGaAs/InAlGaAs/InP waveguide photodiodes on Si_3N_4 with

up to 81 GHz 3-dB bandwidth, 0.76 A/W responsivity, and -1.8 dBm and -9 dBm output RF power at 50 GHz and 100 GHz, respectively.

• 12:00

Hybrid Integration of Nonlinear Reflector and Semiconductor Optical Amplifier, Rui Jiang[1], Tianyi Zeng[1], Danxian Liu[1], Kiyoul Yang[1]; *[1]John A. Paulson School of Engineering and Applied Sciences, Harvard Univ., USA.* We demonstrate electrically pumped lasers in inverse-designed silicon photonic circuits, achieved through hybrid integration with a III-V semiconductor optical amplifier. Our laser exhibits both single-mode and multi-mode operations, and the inverse-designed structure demonstrates all-optical nonlinear reflection.

10:30 -- 12:30
Room: 3E
FTh3E • Complex States of Light
Presider: Luat Vuong; Univ. of California at Riverside, USA

FTh3E.1 • 10:30

Higher Order Bessel Beams Integrated In Time (HOBBIT) using Engineered Light Frequencies (ELFs), J. Keith Miller[1], Tyler Cramer[1], Matthew Reid[1], Evan Robertson[1], Jaxon Wiley[1], Eric Johnson[1,2]; *[1]Clemson Univ., USA; [2]CREOL, Univ. of Central Florida, USA.* This paper presents a scheme exploiting a frequency diverse array of optical beamlets to realize diffraction-less beams with unprecedented changes in Orbital Angular Momentum (OAM) at a rate of 20 ns per OAM.

FTh3E.2 • 10:45

A Wavefront Shaping Approach to Second Harmonic Generation Enhancement in WS2, Russell L. Berger[1], Alex Mavian[1], Edgar Dimitrov[2], Na Zhang[2], Nazifa Rumman[1], Pascal Bassène[1], Humberto Terrones[1], Peter Persans[1], Mauricio Terrones[2], Moussa N'Gom[1]; *[1]Rensselaer Polytechnic Inst., USA; [2]Department of Physics, The Pennsylvania State Univ., USA.* Using feedback based wavefront shaping (WFS), we enhance the weak second harmonic (SH) generation up to 10x in Transition Metal Dichalcogenide (TMD) crystals with nanometer scale interaction length probed by a femtosecond pulse.

FTh3E.3 • 11:00

The information aspect of optical metrology with topologically structured light, Thomas Grant[1], Anton Vetlugin[2], Eric Plum[1], Kevin F. MacDonald[1], Nikolay I. Zheludev[1,2]; *[1]ORC, Univ. of Southampton, UK; [2]CDPT, Nanyang Technological Univ., Singapore.* We provide a Fisher information theory analysis of the recently demonstrated picometre precision optical metrology of one-dimensional object with topologically structured light. Moreover, we demonstrate extension of this metrology to elementary imaging of complex objects

FTh3E.4 • 11:15

Ghost imaging of transparent objects using projective measurements, Isaac M. Nape[1], Chane Moodley[1], Bereneice Sephton[1], Andrew Forbes[1]; *[1]Univ. of Witwatersrand, South Africa.* We report on the imaging of transparent objects having spatially varying phases with Ghost Imaging. We use photons generated from spontaneous parametric down-conversion and exploit projective measurements constructed as superposition states of pixel/position-like states.

FTh3E.5 • 11:30

Invariant states of complex light through atmospheric turbulence, Cade R. Peters[1], Asher Klug[1], Andrew Forbes[1]; *[1]School of Physics, Univ. of the Witwatersrand Johannesburg Faculty of Science, South Africa.* Here we report on the theoretical development and numerical and experimental validation of eigenmodes of atmospheric turbulence for robust transport and reliable free space optical communication.

FTh3E.6 • 11:45 (Invited)

Spatiotemporal structuring of light, Antonio Ambrosio[1]; *[1]Istituto Italiano di Tecnologia, Italy.* Our approach innovatively employs specifically designed light manipulation tools, applied in both spatial and temporal dimensions, to create a plethora of space-time helical wavepackets with unprecedented functionalities.

FTh3E.7 • 12:15

Miniature Spectrometer Using a Rotated Chirped Volume Bragg Grating, Murat Yessenov[1], Oussama Mhibik[1], Ivan Divliansky[1], Ayman F. Abouraddy[1]; *[1]Univ. of Central Florida, CREOL, USA.* We introduce a miniature spectrometer based on a rotated chirped volume Bragg grating (r-CBG). We holographically record and characterize an r-CBG of 25x6x6 mm3 total volume, >90% diffraction efficiency, spectral bandwidth of up to 100 nm, and spectral resolution down to 0.5 nm.

10:30 -- 12:30
Room: 3F
LTh3F • Nanophotonics
Presider: Alexander Senichev; Purdue Univ., USA

LTh3F.1 • 10:30 (Invited)

Light-Matter Interactions in Photonic Time-Crystals, Mordechai Segev[1], Ohad Segal[1], Noa Konforty[1], Mark Lyubarov[1], Lior Bar-Hillel[1], Yonatan Plotnik[1]; *[1]Technion - Israel Inst. of Technology, Israel.* We discuss linear and nonlinear light-matter interactions in photonic time crystals, present theoretical results and recent experiments.

LTh3F.2 • 11:00

Quasi-Bound States in the Continuum and Enhanced Light-Matter Interactions in GaN/InGaN Epitaxial Metasurfaces, Yuan Xu[1], Jiangnan Liu[2], Anshuman Singh[3], Cheng-Chia Tsai[1], Stephanie Malek[1], Walter Jin Shin[2], Jiahao Wu[1], Zezheng Zhu[1], Qian Liu[1], Nanfang Yu[1], Zetian Mi[2], Moe Soltani[3]; *[1]Department of Applied Physics and Applied Mathematics, Columbia Univ., USA; [2]Department of Electrical Engineering and Computer Science, Univ. of Michigan, USA; [3]Raytheon BBN, USA.* We fabricated GaN metasurfaces doped with InGaN quantum dots by templated molecular beam epitaxy (MBE) that support tunable high Q-factor quasi-bound states in the continuum (q-BICs) and demonstrated efficient optical nonlinear conversion using this platform.

LTh3F.3 • 11:15

Quasi-phase-matched up- and down-conversion in periodically poled transition metal dichalcogenides, Chiara Trovatello[1,2], Carino Ferrante[3], Birui Yang[1], Josip Bajo[4], Benjamin

Braun[4], Zhi Hao Peng[1], Xinyi Xu[1], Philipp K. Jenke[4], Andrew Ye[5], Milan Delor[1], D. N. Basov[1], Jiwoong Park[5], Philip Walther[4], Lee A. Rozema[4], Cory Dean[1], Andrea Marini[3], Giulio Cerullo[2], P. James Schuck[1]; *[1]Columbia Univ., USA; [2]Politecnico di Milano, Italy; [3]Consiglio Nazionale delle Ricerche, Italy; [4]Universitat Wien, Austria; [5]Univ. of Chicago Division of the Physical Sciences, USA.* Here we demonstrate quasi-phase-matched up- and down-conversion in a periodically poled van der Waals semiconductor (3R-MoS2). This work opens the new and unexplored field of phase-matched nonlinear optics with microscopic van der Waals crystals.

LTh3F.4 • 11:30 (Invited)
Quantum Optics of Non-Markovian Systems and Strongly-Interacting Photons, Hadiseh Alaeian[1]; *[1]Purdue Univ., USA.* Waveguides enable efficient coupling of distant quantum emitters with engineered dispersion properties, allowing long-range interactions and non-Markovian dynamics. We explore collective behavior and its implications for quantum sensing, metrology, and networks.

JD4A • Joint Poster Session On Demand

JD4A.1
Colliding laser pulses for broadband terahertz wave generation from air plasma, Yuxuan Chen[1], Yuhang He[1], Liyuan Liu[1], Zhen Tian[1], Jianming Dai[1]; *[1]Tianjin Univ., China.* For the first time, we experimentally demonstrate broadband coherent terahertz radiation generation through the interaction of colliding laser pulses with gas plasma.

JD4A.2
Photocurrent Induced through Quantum Interference from MoS_2 under Two-color Light Excitation, Yuhang He[1], Yuxuan Chen[1], Xiangyu La[1], Chenyin Dai[1], Zhen Tian[1], Jianming Dai[1]; *[1]Tianjin Univ., China.* We demonstrate that quantum interference in the direct gap region induces the photocurrent in multilayer MoS_2, and find that it is a more effective mechanism to induce THz radiation compared to optical rectification.

JD4A.3
Ultracolor Multiplexing in QR Codes for Data Encryption and Transmission, Sara Ignacio Cerrato[1,3], David Pacios[2,3], José Miguel Ezquerro Rodríguez[1], José Luis Vázquez-Poletti[2], María Estefanía Avilés Mariño[5], Konstantinos Stravakakis[3], Alessio Di Iorio[3], Clemente Cesarano[4], Nikolaos Schetakis[6,7]; *[1]Optics Department, Universidad Complutense de Madrid, Spain; [2]Department of Computer Architecture and Automation, Universidad Complutense de Madrid, Spain; [3]Alma Sistemi Srl, Italy; [4]Mathematics, Universita Telematica Internazionale UNINETTUNO, Italy; [5]Departamento de Lingüística Aplicada a la Ciencia y a la Tecnología, Universidad Politécnica de Madrid, Spain; [6]Computational Mechanics and Optimization Laboratory, School of Production Engineering and Management, Polytechneio Kretes, Greece; [7]Quantum Innovation Pc, Greece.* This paper introduces an innovative encryption method using ultracolor codification via the Prism Algorithm, which effectively encodes large data volumes into images with base64 encoding, demonstrating practical reliability and potential for secure data transmission.

JD4A.4

Spectroscopic Detection of Heavy Metals Using Functionalized Gold Nanoparticles, Nishita Singh[1]; [1]*MAHE, India.* Incorporating nanotechnology in the optical detection techniques like colorimetric detection for heavy metals have greater advantage over conventional techniques. Functionalized nanoparticles can be made into simple nanosensors and detect heavy metals at low concentrations.

JD4A.5

Probing the Influence of Heavy Metals on Protein Topology by Autofluorescence Spectroscopy, Thoshna L B[1], Shaik Basha[2], Anjana Pithakumar[1], Shanmukha Sreeya Devarakonda[1], Darshan Chikkanayakanahalli Mukunda[2], Jackson Rodrigues[2], Subhash Chandra[2], Ameera K.[2], Shimul Biswas[2], Krishna K. Mahato[2]; [1]*Manipal Academy of Higher Education, India;* [2]*Department of Biophysics, Manipal Academy of Higher Education, India.* Heavy metals significantly impact the homeostasis of proteins. The current study investigates the influence of Zinc and Copper on protein structure alterations using autofluorescence spectroscopy. Further, modifications of proteins are validated by Thioflavin T assay.

JD4A.6

Investigation of Protein Thermal Aggregation Using Autofluorescence Spectroscopy, Shaik Basha[1], Shanmukha Sreeya Devarakonda[2], Darshan Chikkanayakanahalli Mukunda[1], Jackson Rodrigues[1], Subhash Chandra[1], Anjana Pithakumar[2], Thoshna L B[2], Ameera K.[1], Shimul Biswas[1], Krishna K. Mahato[1]; [1]*Biophysics, Manipal Academy of Higher Education, India;* [2]*Manipal Academy of Higher Education, India.* This study aims to investigate thermal transitions in BSA and HSA using autofluorescence spectroscopy upon thermal incubation, providing information on the corresponding unfolding and aggregation.

JD4A.7

Influence of Buffers on Intrinsically Disordered Proteins Using Autofluorescence Spectroscopy, Anjana Pithakumar[2], Shaik Basha[1], Shanmukha Sreeya Devarakonda[2], Thoshna L B[2], Darshan Chikkanayakanahalli Mukunda[1], Jackson Rodrigues[1], Subhash Chandra[1], Ameera K.[1], Shimul Biswas[1], Krishna K. Mahato[1]; [1]*Department of Biophysics, Manipal Academy of Higher Education, India;* [2]*Manipal Academy of Higher Education, India.* The current study employs Light Emitting Diode -Induced Autofluorescence (LED-IAF) spectroscopy to assess the influence of different pH buffers on intrinsically disordered proteins. Further, the action of buffers was validated by Thioflavin T assay.

JD4A.8

Multi-Slits-Qudits Working with Octal System, Decimal System, Duodecimal System, Hexadecimal System, respectively, Hui Peng[1]; [1]*James Peng Lab, USA.* We propose multi-slits-Qudits, which respectively formed by: (1) multi-single-slits; (2) multi-double-slits (multi-Qubits); (3) multi-triple-slits (multi-Qutrits). Multi-slits-Qudits may work with Octal System, Decimal System, Duodecimal System, Hexadecimal System, respectively, and reduce the components.

JD4A.9

Scattering loss analysis for in-situ characterization of optical micro/nano fibres, Bashaiah Elaganuru[1], Shashank Suman[1], Resmi M[1], Ramachandrarao Yalla[1]; [1]*Univ. of Hyderabad, India.*

We demonstrate an *in situ* optical characterization of micro/nano fibres, using scattering loss analysis. The measured results are qualitatively correlated with surface morphology results.

JD4A.10
All-Optical Shifting of a Narrow Gaussian Beam by Third-Order Diffraction in Nonlocal Nonlinear Media, Divya Yadav[1], Brajraj Singh[1], Soumendu Jana[3], Mohit Sharma[1], Manoj Mishra[2]; *[1]MUST, India; [2]SciSER, SK Somaiya College, Somaiya Vidyavihar Univ., India; [3]Physics, Thapar Inst. of Engineering and Technology (Deemed to be Univ.), India.* The article presents the impact of third-order diffraction (TD) on beam dynamics in nonlocal nonlinear media. TD induces a shift in the beam center that could be promising in all-optical-device fabrication, particularly switching devices.

JD4A.11
Excitation Transfer in a Pulsed Trimer of Qubits in a Young's Double-Slit Configuration, Abuenameh Aiyejina[1], Ethan A. Wyke[2], Roger Andrews[2], Andrew Greentree[3]; *[1]Science, Computing and Artificial Intelligence, The Univ. of the West Indies, Antigua and Barbuda; [2]Physics, The Univ. of the West Indies, Trinidad and Tobago; [3]RMIT Univ., Australia.* We investigate interfering amplitudes in a pulsed trimer system consisting of a pair of source qubits and one detector qubit. We have demonstrated that this system exhibits different interference properties from the Young's double-slit experiment.

JD4A.12
Normal and Anomalous Dispersion with Gain in Four Level System Coupled by Two Coherent Fields, Jyotish Kumar[2], Manoj Mishra[1], Shwetanshumala S[3]; *[1]SciSER, SKSC, Somaiya Vidyavihar Univ., India; [2]Physics, AN College, India; [3]Physics, Patliputra Univ., India.* The article explores the possibility of both subluminal and superluminal propagation in the same system. We find that the strength of the single coupling field and its detuning are like knobs to control propagation speed.

JD4A.13
Modulation Instability of Ultra-Narrow Gaussian Beams in Nonlocal Nonlinear Media with Higher Order Diffraction, Manoj Mishra[2], Divya Yadav[3], Brajraj Singh[3], Mohit Sharma[3], Soumendu Jana[1]; *[1]TIET, Patiala, India; [2]SciSER, SKSC, Somaiya Vidyavihar Univ., India; [3]Physics, Mody Univ. of Science and Technology School of Liberal Arts and Sciences, India.* This article presents the modulation instability of an ultra-narrow Gaussian beam in nonlocal nonlinear media with second- and fourth-order diffractions. It is found that fourth-order diffraction suppresses the growth rate of the modulation instability.

JD4A.14
**Nondispersing Multi-Electron Trojan-Like Wavepackets on Langmuir Type-(1) Multi-Layer ``Bulb Wire" Trajectories with Vacancy Defects,** Matt Kalinski[1]; *[1]Utah State Univ., USA.* Extension of the Trojan-like wave packets localized around the multilayer Langmuir ``Bulb Wire" Helium configurations is discovered with the electrons hopping between the vertices of regular polygons but not occupying all.

JD4A.15
Fabrication of Optical Nanofibers for Sensing Applications, Bashaiah Elaganuru[1], Shashank Suman[1], Resmi M[1], Ramachandrarao Yalla[1]; *[1]School of Physics, Univ. of Hyderabad,*

India. We demonstrate the fabrication of optical nanofibers with diameters of 570 nm and 480 nm using chemical etching and gas-flame techniques, respectively.

JD4A.16
Image Generation for Moina Classification using GAN-CNN and Digital Holography, Bunyarit Voochaiyaphum[1], Prathan Buranasiri[1], Witoon Yindeesuk[1]; *[1]Physics, King Mongkut's Inst. of Technology Ladkrabang, Thailand.* Moina are small aquatic organisms that cannot be differentiated by species with the naked eye. In this research, we employed the GAN-CNN technique to generate images of Moina from raw hologram data and to automatically classify the species. The experimental results demonstrate the effectiveness of species classification using the GAN-CNN technique.

JD4A.17
Holey meta-lens integrated with VCSEL to explore subwavelength beam focusing, Fahad M. Mujawar[1], Likhith R[1], Dheeraj M[1], Niranjana G[1], Rajat K. Sinha[2], Kaustav Bhowmick[1]; *[1]PES Univ., India; [2]Department of ECE,M5S 3G8, Univ. of Toronto, Canada.* This paper showcases the first-ever integration of Vertical-Cavity-Surface-Emitting-Lasers (VCSELs) and Holey meta-lens for sub-wavelength beam-focusing. Operating at 1310 nm with FWHM ~1 µm and ~66% efficiency, this novel approach promises future enhancements and easy fabrication.

JD4A.18
Fabrication of High-aspect Ratio Biopolymeric Microneedles for Biomedical Applications, Sweta Rani[1]; *[1]IITB-Monash Research Academy, India.* We report maskless fabrication of high-aspect ratio microneedles (MNs) in biopolymer-chitosan via femtosecond laser-assisted two-photon lithography and molding, enabling the fabrication of MNs up to 500 µm height while preserving its inherent chemical functionalities post-fabrication.

JD4A.19
One-step Fabrication of Fluorescent Photonic Crystals via Two-photon Lithography, Sweta Rani[1]; *[1]IITB-Monash Research Academy, India.* We report a one-step technique for fabricating fluorescent photonic crystal (FPC) via two-photon lithography. The FPCs exhibit strong, tunable photoluminescence under 405,488 and 561 nm laser excitation, which is promising for optoelectronics and sensing applications.

JD4A.20
A Hyperbola Framework for Scalar Diffraction Theory with Applications, Joseph I. Thomas[2,1]; *[1]MRC - Laboratory for Molecular Cell Biology, Univ. College London, UK; [2]School of Natural Sciences and Engineering, National Inst. of Advanced Studies, India.* A complete geometrization of the Huygens–Fresnel principle by means of a highly versatile hyperbola theorem is presented, alongside its applications. The unitary framework so developed can concurrently apprehend both optical interference and diffraction phenomena.

JD4A.21
Raman Spectroscopic Characterization of Indigenous Rice Germplasm from Costal Regions of Karnataka, Manikanth Karnati[1], Indira Govindaraju[1], Sudeeksha H C[2], Guan Y. Zuho[3], Nirmal Mazumder[1]; *[1]MANIPAL ACADEMY OF HIGHER EDUCATION, India; [2]Horiba Pvt Ltd, India; [3]China Medical Univ. Inst. of Translational Medicine and New Drug Development, Taiwan.* Rice grains represent a significant source of carbohydrates and contain trace amounts

of other essential nutritional components, including proteins and lipids. Raman spectroscopy is explored for the rapid analysis of intact rice kernels.

JD4A.22
Analysis of coconut oil adulteration by Raman Spectroscopy and Excitation Emission Matrix (EEM), Manikanth Karnati[1], Sudeeksha H. C.[2], Nirmal Mazumder[1]; *[1]Manipal Academy of Higher Education, India; [2]Horiba Pvt Ltd, India.* Oils, primarily triacylglycerol mixtures, are often adulterated with palm kernel oil, impacting quality and health. This study uses Raman spectroscopy and excitation emission matrix to analyze adulteration in oils which are commercially available in market.

JD4A.23
Spectroscopic and Microscopic Analysis of Rice Varieties: Physico-Chemical Characteristics, Nutraceutical Potential, and Impact on Gut Microbiome, Adline S. Rebello[1], Manikanth Karnati[1], Indira Govindaraju[1], Bharath Prasad[1], Nandana blal[1], Nirmal Mazumder[1]; *[1]Manipal Academy of Higher Education, India.* This study characterizes Karnataka rice varieties' amylose and resistant starch content followed by microscopy and spectroscopy analysis, selecting a rice variety for its high resistant starch for in vivo analysis on Sprague-Dawley rats' gut microbiota.

JD4A.24
Diffractive and imaging properties of chiral Fresnel zone plates, Nagi A. Buaossa[1], Monish R. Chatterjee[1]; *[1]Univ. of Dayton, USA.* A magnetic, chiral Fresnel zone plate is introduced via an analytic and numerical methodology for examining its imaging and tuning properties including effects of transverse defocusing of superposed waves due to the multiple foci. Such defocusing and its minimization via tuning of parameters and zone radii.

JD4A.25
Birefringence Measurements using Wavefront Shearing Generates Classical Bell's State, Shouvik Sadhukhan[1,2]; *[1]Department of Physics, Indian Inst. of Space Science and Technology, India; [2]Department of Physics, Indian Inst. of Technology Kharagpur, India.* Spatial-polarization entanglement was achieved through a folded Mach-Zehnder Interferometer, employing wavefront shearing to explore sample birefringence. Entanglement entropy and degrees of purity (DOP) were analyzed across four configurations, showing no distinguishable differences.

JD4A.26
Design of a Horizontal Chiral Thin Film Array for Optical Filter Applications in the Visible Range, Akram Muntaser[1], Monish R. Chatterjee[1]; *[1]Univ. of Dayton, USA.* In this study, we present a chiral thin film resonator array that may utilized to be used as an optical filter that gives high gain along with high Q and band reject with low gain.

JD4A.27
Optical sensing of Arsenic by β- D-glucose functionalized Gold nanoparticles, Sharmila SN[1], Nirmal Mazumder[1], Rajib Biswas[2], Krishna K. Mahato[1]; *[1]Manipal Academy of Higher Education, India; [2]Physics, Tezpur Univ., India.* Glucose- functionalized gold nanoparticle sensor was synthesized for optical detection of Arsenic in water. The absorbance obtained from UV- vis spectroscopy was used in the quantification of Arseni in solution.

JD4A.28

Anti-vortex soliton dynamics in systems modelled by a complex cubic-quintic Ginzburg-Landau vector equation, Marius Jeannot Nko'o Nko'o[3], Alain Djazet[2], Lucien Mandeng Mandeng[1], Serge Ibraid Fewo[3], Clément Tchawoua[3], Timoléon Crépin Kofané[4], David Tatchim Bemmo[3]; *[1]National Advanced School of Engineering, Cameroon; [2]Department of Petroleum Engineering, NAHPI-School of Engineering, Univ. of Bamenda, Cameroon; [3]Laboratory of Mechanics, Materials and Structures, Department of Physics, Faculty of Science, Univ. of Yaoundé I, Cameroon; [4]Botswana International Univ. of Science and Technology, Botswana.* Using the variational approach, we show that the anti-vortex vector solution is the best which can be managed using the coupling parameters of the system because it is more stable following its rapid soliton transformation.

JD4A.29

Influence of duration and peak power on Airy pulses supercontinuum spectra generated in a silicon-on-insulator waveguide including negative frequency Kerr effect and third-harmonic generation, Souang Kemedane Boukar[2,3], Lucien Mandeng Mandeng[1], Crépin Heuteu[2], Clément Tchawoua[2]; *[1]National Advanced School of Engineering, Cameroon; [2]Laboratory of Mechanics, Materials and Structures, Department of Physics, Univ. of Yaoundé I, Cameroon; [3]Department of Physics, Univ. of Adam Barka, Chad.* Reducing the pulse duration as well as the power is beneficial for the Airy pulses supercontinuum generation in the realistic case where nonlinear absorptions, third harmonic generation, negative frequency Kerr effect are taken into account.

JD4A.30

Analysis of Squeezed Light Generation via SFWM in a Si3N4 Microring Resonator, Masiha Rabiei[1], Hassan Kaatuzian[1], Mahmood Hasani[1], Atena Shircharandabi[1]; *[1]Photonics Research Lab., Dept. of Electrical Engineering, Amirkabir Univ. of Technology, Iran (the Islamic Republic of).* This work investigates the generation of squeezed light states through spontaneous four-wave mixing (SFWM) using a silicon nitride (Si3N4) waveguide coupled to a microring resonator which holds promise as a source for quantum technologies.

JD4A.31

Graded-index Double-ring-core Fiber with Four Zero-dispersion Wavelengths for Enhanced OAM Supercontinuum Generation, Qinru Peng[1], Wenpu Geng[3], Yongbo Dong[2], Zhongqi Pan[4], Yang Yue[1]; *[1]School of Information and Communications, China; [2]Xi'an Jiaotong Univ. School of Energy and Power Engineering, China; [3]Nankai Univ. Inst. of Modern Optics, China; [4]Department of Electrical & Computer Engineering, Univ. of Louisiana at Lafayette, USA.* We propose and design a graded-index double-ring core fiber, achieving a near-zero flat dispersion profile for $OAM_{1,1}$ mode, enabling a flat and broad 3599-nm supercontinuum generation from 662 nm to 4261 nm at -40 dB.

JD4A.32

Estimating the Absorption and Waveguiding in Porous Slabs from Multimodal Measurements, Navindra D. Singh[1], Luat Vuong[1]; *[1]Univ. of California at Riverside, USA.* We present relations and demonstrate a multimodal approach for estimating the light absorbed in porous paints and thin slabs, which is significant when the single-pass absorption the porous slab is more than a few percent.

JD4A.33

Lenslet Array Free Intensity detection based Wavefront Reconstruction, Shouvik Sadhukhan[1], Shirsendu Sarkar[2,3], Debabrata Bhadra[2,3]; *[1]Department of Physics, Indian Inst. of Space Science and Technology, India; [2]Department of Physics, West Bengal State Univ., India; [3]Department of Physics, Bhairab Ganguly College, India.* CCD based Wavefront Reconstruction algorithm has been established without using lenslet array in front of the CCD sensor. Absence of lenslet array increased the sensitivity and efficiency of the wavefront reconstruction and zernike decomposition.

JD4A.34

Laser Radiation and Mechanical Spectroscopy of SiO_2, Nanocomposites of Multiwalled Carbon Nanotubes and Polymers, Anatoliy P. Onanko[1]; *[1]physical faculty, department of physics functional materials, radiation physics laboratory, National Univ., Ukraine.* After stopping of laser radiation action of fusion solidification begun exactly from the surface, but the crater underbody is extended (molten) and created additional squeezing mechanical tension, that pull central part of crater surface.

JD4A.35

Anthocyanin-Incorporated Starch Bioplastic: Characterization Study, Shreya Shahapur[1], Pooja N[1], Tilottoma Kargupta[1], Nirmal Mazumder[1]; *[1]Manipal School of Life Sciences, India.* This study examines biopolymer films with anthocyanin extracts and silver nanoparticles, focusing on their morphology, structure, chemistry, and functionality. Findings show variations in film properties and effective ammonia vapor sensitivity for spoilage detection in food packaging.

JD4A.36

Spectroscopic Analysis of Curcumin-Infused Starch Biopolymers, Tilottoma Kargupta[1], Pooja N[1], Shreya Shahapur[1], Nirmal Mazumder[1]; *[1]Manipal School of Life Sciences, India.* This research shows that curcumin enhances starch-based biopolymers' properties, increasing moisture content and anti-bacterial activity while reducing water solubility. Characterization techniques like XRD, confirm curcumin's beneficial effects.

JD4A.37

Probing Cavity Polariton Relaxation using Angle-Resolved Photoluminescence Spectroscopy, Elizabeth O. Odewale[1], Sachithra T. Wanasinghe[1], Aaron S. Rury[1]; *[1]Chemistry, Wayne State Univ. College of Liberal Arts and Sciences, USA.* Cavity polaritons are hybrid light-matter states formed when molecular transitions are strongly coupled to a photon in an optical cavity. We probe the determinants of polariton relaxation using the luminescence of the molecular chromophores. Our results suggest that the cavity photon and molecular exciton competitively limit polaritonic relaxation.

JD4A.38

Effect of Pump Intensity on the Bell Parameter of the Polarization-Entangled Source, Sohan S. Bisht[1], Hemant K. Singh[1], Bhaskar Kanseri[1]; *[1]IIT DELHI, India.* We experimentally validate the effects of pump intensity and accidental coincidences on the Bell parameter (S) for a CW pumped polarization-entangled source, providing insights for effectively balancing these factors.

JD4A.39

Design and Simulation of Triple Quantum Well Vertical Cavity Transistor Laser for Technical Characteristics Investigation, Mahsa Mohaghegh[1]; *[1]Amirkabir Univ., Iran (the Islamic Republic of).* In this work, design and simulation of a triple quantum well vertical cavity transistor laser is investigated. The base and quantum wells width are 120nm and 12nm respectively. The optical power output, DC current gain, and threshold current are investigated in the new structure. The threshold current is estimated on the order of 3.5mA.

JD4A.40

Alloy Percentage Considerations for Technical Characteristics Improvement in Double Quantum Well Vertical Cavity Transistor Laser, Mahsa Mohaghegh[1]; *[1]Amirkabir Univ., Iran (the Islamic Republic of).* In this paper, we investigate the affection of Al content of $Al_zGa_{1-z}As$ material of the base region on the characteristics of DQW-VCTL. By increasing the Al mole fraction, it obtained increasing in optical output power, decreasing in the current gain and not considerable change in the threshold current (about 3mA).

JD4A.41

Angular Dependent Classification Accuracy of Hermite-Gaussian Speckle Field, Purnesh S. Badavath[1], Vijay Kumar[1]; *[1]NIT-Warangal, India.* The classification accuracy achieved by the custom-designed 1D CNN trained on 1D Hermite-Gaussian far-field speckle information is found to be angular dependent along the mapped 1D speckle information angle.

JD4A.42

Quantum Photonic Computer Challenges: Quantum Decoherence, Quantum Error Correction (QEC), and Scalability, Mehrdad Ghasemi[1]; *[1]Univ., Iran (the Islamic Republic of).* In this paper, the new promising algorithms have been discussed for employment in quantum photonic computers as robust and reliable computational tasks to define the best fidelity as a figure of merit in quantum error correction schemes. Furthermore, a parametric study has been done by adding noble metals to the Integrated Photonic Chip.

JD4A.43

Modified Spiral-Shaped PCF based SPR Biosensor with Circular Ring, Shweta Mittal[5], Akshat Agarwal[5], Nitesh Mudgal[1], Kamal Kishor Choure[2], Ankur Saharia[5], Santosh Kumar[3], Ghanshyam Singh[4], Manish Tiwari[5]; *[1]Poornima College of Engineering, India; [2]SRM Inst. of Science and Technology (Deemed to be Univ.), India; [3]KL Deemed to be Univ., India; [4]Malaviya National Inst. of Technology Jaipur, India; [5]Manipal Univ. Jaipur, India.* This work intended to present a spiral-shaped PCF-based SPR Biosensor with a circular ring. The Phase Matching Resonance condition is found at 820nm having a peak confinement loss of 1.002 dB/cm at analyte RI 1.40.

JD4A.44

Efficient Coupling of Single Photons using a Composite Nanostructure, Resmi M[1], Bashaiah Elaganuru[1], Shashank Suman[1], Ramachandrarao Yalla[1]; *[1]Univ. of Hyderabad, India.* We report the efficient coupling of single photons from a single dipole source into guided modes of a silica nanotip (SNT) using a composite nanostructure. Experimental realization towards it is also discussed.

JD4A.45

A Scalable and Simple Horizontal Sub-Wavelength Grating for Bio-Molecule Sensing using Fano-Resonance, Aditya Aravind[1], Aditya Ramesh[1], Anirudh Kashyap[1], Chandana Chandra[1], Rajat K. Sinha[2], Kaustav Bhowmick[1]; *[1]PESU RR Campus, India; [2]ECE, Univ. of Toronto, Canada.* The present works demonstrates a Fano resonating horizontal subwavelength grating structure in biomolecule sensing, with sensitivity ~ 40nm/RIU, FOM of ~ 12 RIU^{-1} and Q factor ~ 460, for refractive indices between 1.312 and 1.33.

JD4A.46

Exploring the Effect of Solvents in Liquid Phase Exfoliation of MoSe2: A Comparative Study, Shahnaz Shabnam[1], Gazi A. Ahmed[1]; *[1]TEZPUR Univ., India.* This work demonstrates the liquid phase exfoliation of a transition metal dichalcogenide material MoSe2 using various solvents, with subsequent characterization to analyze the structure, layer count, and morphology of the exfoliated nanosheet.

JD4A.47

A Star Shaped Nested PCF for OAM Mode Propagation, Sushma Punia[1], Jeevani Gudipati, Gudipati,[1], Ankur Saharia[1], Anton V. Bourdine[2], Yaseera Ismail[3], Ghanshyam Singh[4], Manish Tiwari[1]; *[1]Manipal Univ. Jaipur, India; [2]Povolzskij gosudarstvennyj universitet telekommunikacij i informatiki, Russian Federation; [3]Stellenbosch Univ., South Africa; [4]Malaviya National Inst. of Technology Jaipur, India.* This work demonstrates a star-shaped nested Photonic Crystal Fiber (PCF) capable of supporting Orbital Angular Momentum (OAM) modes. The proposed PCF can support 15 OAM modes at 1.55 µm, at the highest purity of 98%

JD4A.48

Effect of Storage Temperature on Carotenoid Content of Citrus Fruits by Portable Raman Spectrometer, Nidhi Dhillon[1]; *[1]Jawaharlal Nehru Univ., New Delhi, India.* A portable Raman Spectrometer has been used for analyzing the effect of storage temperature on citrus fruits. The results showed a significant change in the intensity of carotenoid Raman peaks with time.

JD4A.49

Design and Development of Microfluidic Device for High Throughput Dynamic Spheroid Generation Using 3D Printing and Soft Lithography Technology, Amol L. Salve[1], Oindrila Banik[1], Earu Banoth[1]; *[1]NIT ROURKELA, India.* Cell spheroids replicate in-vitro environments. Our AutoCAD-designed, COMSOL-simulated microfluidic device shows potential for high-throughput dynamic spheroid generation. Simulations and experiments confirm that a flow rate of ≤0.3 ml/hr achieves dynamic cell settling.

JD4A.50

Low-cost Dynamic Light Scattering to Detect Rotavirus Particles in Drinking Water, Anish Dahal[1], Shishir Gurung[1], Avash Kattel[1], Rijan Maharjan[1], Jack Radford[2], Philip Binner[2], Ilya Starshynov[2], Daniele Faccio[2], Ashim Dhakal[1]; *[1]Phutung Research Inst., Nepal; [2]Univ. of Glasgow College of Science and Engineering, UK.* We demonstrate a simple method that uses dynamic light scattering for the detection of rotavirus particles in water. Our method uses low-cost and reagent-free instrumentation and materials feasible for implementation in resource-limited settings.

JD4A.51

Enhanced NH_3 Gas Sensing in SHI-Irradiated MoS_2 Monolayers: A DFT Exploration, Aditya Kushwaha[2], Neeraj Goel[2], Sneha Singh[1]; *[1]The NorthCap Univ., India; [2]Netaji Subhas Univ. of Technology, India.* DFT calculations indicate SHI-irradiated 2D-MoS_2 monolayers ($V_{S\text{-}MoS2}$ and $V_{Mo\text{-}MoS2}$) show strong potential for NH_3 gas sensing, with $V_{S\text{-}MoS2}$ exhibiting higher adsorption energy, charge transfer, and sensitivity, suggesting excellent reversibility and selective detection.

JD4A.52

Study of temperature-dependent optical properties of L-Arginine Phosphate-monohydrate (LAP) for efficient THz generation, Naga Vamsi Krishna Reddy[3,1], Anil Kumar Chaudhary[1], Shymal Mondal[3], Brahadeeswaran S[2]; *[1]ACRHEM, Univ. of Hyderabad, India; [2]Department of Physics, Anna Univ. - Regional Office Tiruchirappalli, India; [3]Department of Physics, Defence Inst. of Advanced Technology Department of Applied Physics, India.* The paper reports temperature-dependent properties of aq-LAP crystal. The Refractive Index with values lying between 1.5-2.2 and the Figure of Merit lies between 0.065-0.275 as a function of frequency (0.3-2.7 THz) between 30°C and 70°C.

JD4A.53

Generation And Compression of High-Power fs Deep-Ultraviolet Laser Pulse in Noble Gas, Hao Li[1], Qian Dong Ran[1], Zunaied Ahmed Muhammad[1]; *[1]MIV/OIS, Singapore Inst. of Manufacturing Technology, Singapore.* A novel method to generate ultrafast high-power ultraviolet laser pulse 258 nm through 4^{th} harmonic generation pumped by a 1.2 ps 1030 nm Yb: YAG laser followed by compression of the pulse to sub-ps in noble gas is proposed. The proposed method is to rise the celling of fs DUV laser peak intensity and promote its adoption in industrial applications.

JD4A.54

Quantum-Photonic Treatment for Nano-Refraction, Mahdi Saberi[1], Sina Mahmoudi[1], Hassan Kaatuzian[1], Majid Shalchian[1]; *[1]Amirkabir Univ. of Technology Department of Electrical Engineering, Iran (the Islamic Republic of).* Nano Refraction involves the precise estimation and manipulation of photon/electron trajectories at the atomic scales. In this paper we have used Quantum Photonics for explaining Nano Refraction for an orthorhombic crystal lattice. Simulation results based on Monte Carlo modeling and simulation, follows the Snell's Law with less than 6% error.

JD4A.55

High-Power Laser Pulse Shape Optimization with Hybrid Stochastic Optimization Algorithms, Ishraq Md Anjum[2], Davorin Peceli[1], Francesco Capuano[1], Bedrich Rus[1]; *[1]ELI Beamlines, Czechia; [2]Univ. of Maryland Baltimore County, USA.* We evaluate five optimization algorithms for laser pulse temporal shape optimization, using a semi-physical model of a high-power laser. Hybrid algorithms combine Differential Evolution and Bayesian optimization algorithm exploration with Nelder-Mead exploitation, exhibiting superior performance.

JD4A.56

Terahertz Photocurrent Response from Ultrafast Optically Excited Atomically Thin WS_2, Neetesh Dhakar[1], Brijesh Kumar[2], Sunil Kumar[1]; *[1]Department of physics, Indian Inst. of Technology Delhi, India; [2]Department of physics, Univ. of Lucknow, India.* Femtosecond laser-

induced ultrafast photocurrent mediated THz emission from atomically thin WS_2 layers is presented here. The excitation-fluence, azimuth angle, and pump polarization dependent measurements elucidate the role of different microscopic mechanisms in the THz generation.

JD4A.57
A Portable Raman Spectrometer for the Rapid Detection of Biotic Stress in Spinach, Nidhi Dhillon[1]; *[1]Jawaharlal Nehru Univ., New Delhi, India.* A portable Raman Spectrometer has been used for the early detection of biotic stress in spinach. The significant change in the carotenoid peaks indicated the presence of bacterial infection within 48 hr.

JD4A.58
Investigation of Squeezed-State Generation Using SFWM in a SiO2 Microring Resonator, Atena Shircharandabi[1], Hassan Kaatuzian[1], Mahmood Hasani[1], Masiha Rabiei[1]; *[1]Photonics Research Lab., Dept. of Electrical Engineering, Amirkabir Univ. of Technology, Iran (the Islamic Republic of).* This study uses numerical simulation to investigate the generation of squeezed light via spontaneous four-wave mixing (SFWM) using a silicon dioxide (SiO2) waveguide coupled to a microring resonator as a possible source in photonic technologies.

JD4A.59
Self-Pulsation Dynamics of Single Section III-V/Si DFB Laser with Optical Injection, Loubna Benkoula[1,2], Youcef Driouche[1,2], Amin Souleiman[1,3], Joan Manel Ramirez[3], Kamel Merghem[1,2]; *[1]Services Repartis Architectures MOdelisation Validation Administration des Reseaux, France; [2]Institut Polytechnique de Paris, France; [3]III-V Lab, France.* We demonstrate self-pulsing in a single-section III-V-on-Silicon DFB laser, with a tunable pulsation frequency from 7 GHz to 2.38 GHz. Further investigation into the self-pulsation mechanism under controlled optical injection.

JD4A.60
Concurrence Modulation and Direct Detection Free-space Optical Communication Systems under General Stokes Detection Noise, Weijie Dai[1], Xiaoqian Liu[1], Xiaofeng Su[1], Xun Guan[1], Jian Song[1], Yuhan Dong[1]; *[1]Tsinghua Univ., China.* We summarize and extend concurrence modulation and direct detection free-space optical communication systems under general Stokes detection noise, and provide results constrained by natural environments to examine the roles of moderate turbulence and Stokes receivers.

JD4A.61
OAM Spectral Asymmetry Identification and Symbol-level Detection in Twisted Partially Coherent FSO Links, Weijie Dai[1], Xiaoqian Liu[1], Xiaofeng Su[1], Xun Guan[1], Jian Song[1], Yuhan Dong[1]; *[1]Tsinghua Univ., China.* To fully leverage the biased OAM spectra of twisted partially coherent fields, we propose a spectral asymmetry measurement method, and a symbol-level detection technique, enabling nine-fold capacity enhancements in FSO links.

JD4A.62
Predictive analysis of Future Optical Networks: An AI approach for OPM in Next Generation Optical Networks, Yugnanda Malhotra[1], Jolly Parikh[1], Rishit Singh[1], Rajneesh Talwar[2]; *[1]BVCOE, India; [2]Chitkara Univ., India.* Optical Performance Monitoring (OPM) for Next Generation Optical Networks is explored using Machine Learning. Accuracy level of 99% is

reported with the proposed approach which outperforms traditional OPM methods in terms of accuracy and computational efficiency under different modulation scenarios.

JD4A.63
Discrimination between normal and inflammatory blood serum samples based on reflection-enhanced laser-induced fluorescence, Rania M. Abdelazeem[1], Zienab Abdel-Salam[1], Mohamed Abdel-Harith[1]; [1]*Niles, Cairo Univ., Egypt.* Reflection-enhanced laser-induced fluorescence (RELIF) has been used to discriminate between normal and inflammatory blood serum samples. The tested samples were placed in a side-coated cuvette. The results from the well-known LIF and RELIF were compared.

JD4A.64
Design and Development of a Portable Raman Spectrometer for Early Diagnosis of Parkinson's Disease, Umesh C. Garnaik[1], Shilpi Agarwal[1]; [1]*School of Physical Sciences, Jawaharlal Nehru Univ., India.* Raman spectroscopy offers specific, highly sensitive, deliberate, and multiplex disease diagnosis. A portable Raman spectrometer is developed and optimized for the characterization and classification of Parkinson's Disease by salivary Raman fingerprint of individuals.

JD4A.65
Real-Time Synchronous Hyper Image and Scattered Light Acquisition using Portable Microcontroller from Continuous Flow of Sample, Sunit K. Sao[1], Satwik S. Sahoo[1], Abhinav Ajay Jha[1], Earu Banoth[1]; [1]*National Inst. of Technology Rourkela, India.* This work presents a new system for synchronized data collection in Multiphasic Microfluidics Imaging Flow-Cytometry (MIFC), combining flow cytometry and microfluidics imaging. This comprises simultaneous signal and image capture, live synchronization, and a tailored hardware interface.

JD4A.66
1130nm InGaAs/GaAs VCSELs for 3D Sensing and Industrial Applications, Amirhossein Ghods[1], Alexandar Behres[1], Simon Baumann[1], Aditya Prabaswara[1], Klein Johnson[1]; [1]*ams OSRAM, USA.* We report on development of 1130nm oxide VCSELs based on InGaAs/GaAs active material and AlGaAs distributed Bragg reflectors. To our knowledge, this is the first report on the development of multijunction VCSELs at this wavelength.

JD4A.67
Probing the Peroxynitrite-Induced Nitration of Proteins by Autofluorescence and FTIR Spectroscopy, Sreeya Devarakonda[1], Shaik Basha[2], Anjana Pithakumar[1], Thoshna L B[1], Darshan Chikkanayakanahalli Mukunda[2], Jackson Rodrigues[2], Vijay Kumar K. Joshi[2], Subhash Chandra[2], Ameera K.[2], Shimul Biswas[2], Krishna K. Mahato[2]; [1]*Manipal Academy of Higher Education, India;* [2]*Department of Biophysics, Manipal Academy of Higher Education, India.* Protein tyrosine nitration can cause alterations in protein structure and function, which can impact cell homeostasis. The current study investigates the structural alterations of proteins induced by Peroxynitrite *in vitro* using autofluorescence and FTIR spectroscopy.

JD4A.68
Investigating the Influence of Dielectric Barrier Discharge Plasma on the Physical Characteristics and Mechanical Properties of PVA/Aloe Vera/Chitosan Nanofibers, Kaushik K. Nath[1]; [1]*Tezpur Univ., India. The central idea is to fabricate PVA/ Aloe Vera/Chitosan*

nanofibers and subject them to plasma treatment to investigate alterations in their physical characteristics and physical properties. exploring its potential as wound dressing.

JD4A.69
Comparative Sizing of Silver and Gold Nanoparticles: Analysis with Microcontroller-Assisted Setup, NIKHIL K. DAIMARI[1], Upama Das[1], Protyasa P. Bhattacharyya[1], Rajib Biswas[1]; *[1]TEZPUR UNIV., India.* The present study employs an intensity interrogation based Arduino aided setup for estimation of relative size distribution of nanoparticles (silver and gold).

JD4A.70
Plasma treated Polyvinyl Alcohol/Honey Based Film: Preparation and Characterization, Rajib Biswas[1], Kaushik K. Nath[1]; *[1]Tezpur Univ., India.* The aim of this work is to fabricate PVA/Honey film and subject them to plasma treatment to investigate alterations in their physical properties. This research explores the potential of the mat as packaging film for its use in food packaging, with a focus on inhibition of bacterial growth.

JD4A.71
Theoretical upper bound of truncation threshold in TSVD-based multimode fiber single-pixel imaging, Yangyang Xiang[1], Le Yang[1], Junhui Li[1], Mingying Lan[1], Jianxin Ma[1], Li Gao[1]; *[1]Beijing Univ. of Posts and Telecommunications, China.* We propose a theoretical upper limit for truncation thresholds in TSVD-based MMF-SPI, revealing that incorporating the smaller singular values which were oft-overlooked not only aligns with the proposed bound but also enhances image recovery significantly.

JD4A.72
Integration of Optical Sensing and Machine Learning for Enhanced Glucose Concentration Monitoring, Nourhan Hany[2], Menatallah Elsayed[2], Omnia H. Abd El-Rahman Nematallah[1,2], Mohammed Abo-Zahhad[2]; *[1]Cairo Univ., Egypt; [2]Faculty of Electronics, Communications, and Computer Engineering, Egypt-Japan Univ. of Science and Technology (E-JUST), Egypt.* We propose an optical-based approach utilizing laser sources at different wavelengths (532nm&670nm) integrated with machine learning to enhance glucose detection in aqueous solutions to improve measurement precision and consistency.

JD4A.73
Classifying the Thermal Effect of Two UV-Laser Types Used For Corneal Ablation via a Convolutional Neural Network, Fatma Heikal[1], Omnia H. Abd El-Rahman Nematallah[1], Ibrahim Abdelhalim[1], Jala El-Azab[1], Tawfik Ismail[1]; *[1]Cairo Univ., Egypt.* This paper investigates the thermal effects of excimer and Nd:YAG lasers on ex vivo rabbit corneas. Thermal images were obtained and utilized to classify laser ablation using a CNN constructed with Python

JD4A.74
Time-Wavelength Interleaved Photonic Convolution Accelerator on TFLN platform, Lin Wang[1], Yang Gao[1], Lei Zhang[1], Kun Yin[1], Hui Yu[1]; *[1]Zhejiang Lab, China.* We demonstrate a time and wavelength interleaving convolutional accelerator based on TFLN platform, which demonstrates the potential for optimal computational speeds through parallelism and high-speed modulation.

JD4A.75

Dual Symmetric Bound States in the Continuum on Graphene-based Metasurface, Shuvajit Roy[1], Sweta Rani[1]; [1]*Electronics and Communication Engineering, Sister Nivedita Univ., India.* A dual symmetric bound state in the continuum (BIC) is proposed on a graphene metasurface. Access to quasi-BIC transmission radiation channels is obtained by perturbing the position and dimension of the etched circles on graphene.

JD4A.76

Machine Learning-Based Assessment of Optical Fiber Reflections for Motion Sensing, Ahmed Elnahal[2], Hazem Korayem[2], Mohamed Lela[2], Omnia H. Abd El-Rahman Nematallah[1], Maha Elsabrouty[2]; [1]*Cairo Univ., Egypt;* [2]*Department of Electronics and Communications Engineering, Egypt-Japan Univ. of Science and Technology (E-JUST), Egypt.* This paper presents a motion detection framework that is based on optical fiber reflections integrated with machine learning. The presented framework achieves accurate and cost-effective motion sensing by reliably identifying reflectance spectra enabling versatile applications.

JD4A.77

***AlGaAs MQW LED Light Source for Planar Integrated Circuits Optical Communications*,** Abdullah J. Zakariya[1]; [1]*Ministry of Interior Kuwait, USA.* An AlGaAs MQW structure is selectively intermixed to produce a monolithic LED emitting individually and independently controlled wavelengths of 795, 810, 825 and 855nm integrated with flexible optical waveguide for planar integrated circuits optical communications

JD4A.78

Sensitive Refractive Index Response based on Two Types of Valley Hall Topological Edge States, Huaqing Jiang[1], Yumiao Li[1], Xiaojun Ying[1], Kun Yin[1], Hui Yu[1], Wanshu Xiong[1]; [1]*Zhejiang Lab, China.* A novel topological insulator cavity utilizing two types of edge states is proposed. Due to the slow light effect, its transmission spectrum is anticipated to undergo significant changes depending on the pure medium occupying the cavity region. This innovation holds promise for applications in refractive index detection within the THz band.

JD4A.79

Graphene-based Tunable MD and MQD Enhanced Scattering Plasmonic Metasurface, Shuvajit Roy[1], Sweta Rani[1]; [1]*Electronics and Communication Engineering, Sister Nivedita Univ., India.* A tunable graphene-based plasmonic metasurface is proposed. It suppresses electric dipole (ED) scattering at resonance, enhancing magnetic dipole (MD) and magnetic quadrupole (MQD) scattering. It can be tuned by the chemical potential of the graphene.

JD4A.80

Design and Simulation of Clad-free Optical Fiber Evanescent Field Sensor, Arun Jaiswal[1]; [1]*School of Biomedical Engineering, The Univ. of Sydney, Australia.* We report design and theoretical evaluation of clad-free tapered optical fiber for development of evanescent field sensors with large evanescent fields exhibiting capabilities to sense media with refractive index varying from 1.2 to 1.4

JD4A.81

Combining Single and Two -photon Polymerization: An Approach to Generate Laminated Anticounterfeiting Tags, Arun Jaiswal[1]; [1]*School of Biomedical Engineering, The Univ. of Sydney, Australia.* Combination of single and two-photon polymerization have been exploited to generate laminated nanopatterned tags. A micro-QR code is fabricated using two-photon lithography, and the subsequent lamination is achieved via single-photon polymerization

JD4A.82

LED-based Rotation Speed Identification of Multi-opening Objects, ZHILIN ZHANG[1], Yiwen Zhang[2], Wenqian Zhao[1], Zhongqi Pan[3], Yang Yue[1]; [1]*School of Information and Communications Engineering, 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 low-cost detection system based on LED is designed, utilizing an attention mechanism to identify 10 different rotation speeds of multi-opening objects, achieving an average identification accuracy of 90.36% across 14 types of objects.

JD4A.83

Sensitivity Unveiled: Exploring Molecular Convection through Thermal Lens Spectroscopy, Aman Sharma[1], Sumit K. Gupta[1], Debabrata Goswami[1]; [1]*IIT KANPUR, India.* Thermal lens (TL) spectroscopy, an ultra-sensitive technique utilizing femtosecond lasers, probes molecular properties through nonlinear heating. Our TL experiments reveal the crucial role of convection and suggest optimizations to improve its sensitivity and design.

JD4A.84

Demystifying Biomolecular Changes in Osteosarcoma- Fourier Transform Infrared Micro-Spectroscopy Based Study, KARTIKEYA BHARTI[1], Saumitra Mahendra[2], VERTIKA SHARMA[2], Pranab Talukdar[1], POOJA LAHIRI[1], BASUDEV LAHIRI[1]; [1]*Indian Inst. of Technology Kharagpur, India;* [2]*PATHOLOGY, LPS Inst. of Cardiology, India.* We have used Fourier transform infrared (FTIR) micro-spectroscopy for exploring bio-molecular changes in human bone with osteoblastic type of high-grade osteosarcoma (OHOS). Our study gives an idea of ultrastructural changes during osteosarcoma.

JD4A.85

Reducing the data acquisition time in optical scanning holography based on data correlation, Jilu Duan[2], Yatao Luo[2], Yaping Zhang[2], Ting-Chung Poon[1]; [1]*Bradley Department of Electrical and Computer Engineering, Virginia Polytechnic Inst. and State Univ., USA;* [2]*Yunnan Provincial Key Laboratory of Modern Information Optics, Kunming Univ. of Science and Technology, China.* We use the mean square error (MSE) to evaluate the correlation of data that skips similar hologram lines in optical scanning holography. This approach has notably decreased the data acquisition duration in experimental settings.

JD4A.86

Phase correction algorithm for spherical structures in digital holography microscopy, Haining Dang[1], Qinghe Song[1], Haiting Xia[1], Rongbi Wu[1], Wenzhuang Shen[1]; [1]*Kunming Univ. of Science and Technology, China.* We propose an algorithm capable of eliminating the spherical structure introduced by the microscope objective in microscopic holography. The effectiveness of the algorithm has been verified through experiments.

JD4A.87

Single-exposure synthetic aperture micro digital holography achieving maximum resolution, Rongbi Wu[1], Qinghe Song[1], Haiting Xia[1], Haining Dang[1], Wenzhuang Shen[1]; [1]*Kunming Univ. of Science and Technology, China.* By calculating the frequency shift distance induced by oblique illumination, achieving equivalence with the system's cut-off frequency allows for the maximum enhancement of resolution. Simulation results indicate that this approach is effective.

JD4A.88

Auto-Focusing in Off-axis Digital Holography Using Gray Level Co-Occurrence Matrix, Zixin Gao[1], Yongan Zhang[1], Pei Liu[1], Ruijin Fu[1], Bing Zhang[1]; [1]*Kunming Univ. of Science and Technology, China.* We propose employing the gray level co-occurrence matrix (GLCM) to compute the contrast characteristics of holographic reconstructions for auto-focusing. Simulation results demonstrate that this method represents an effective approach for off-axis digital holographic auto-focusing.

JD4A.89

Enhanced Tukey Window Mask for Speckle Reduction in Digital Holography, Ruijin Fu[1], Yongan Zhang[1], Fei Ye[1], Zixin Gao[1], Pei Liu[1], Bing Zhang[1]; [1]*Kunming Univ. of Science and Technology, China.* To mitigate speckle noise in digitally reconstructed holographic images, we utilized an enhanced Tukey window function mask, thereby effectively circumventing the additional noise problems typically associated with the use of a rectangular window function mask.

JD4A.90

Channel Crosstalk Elimination of Color Digital Holography Based on Plane Wave Holographic Interference, Wenzhuang Shen[1], Qinghe Song[1], Haiting Xia[1], Haining Dang[1], Rongbi Wu[1]; [1]*Kunming Univ. of Science and Technology, China.* We propose a color CCD crosstalk elimination method based on the interference of plane waves. This method only requires capturing one hologram to determine the crosstalk matrix, and improving the calculation accuracy.

JD4A.91

Suppression of Defocused Images in Digital Holographic Reconstruction Based on Image Plane Filtering Technique, Pei Liu[1], Yongan Zhang[1], Zixin Gao[1], Ruijin Fu[1], Bing Zhang[1]; [1]*Kunming Univ of Sci. and Tech., China.* We use image plane filtering technique to filter out the focused light field in digital holographic reconstruction, which can reduce the defocusing effect of this part of the light field on reconstruction at other distances.

JD4A.92

Multi-wavelength Mode-locked Thulium-doped Fiber Laser Based on Mach-Zehnder Interferometer, Qian Zhang[1], Zheng H. Li[2], XinXin Jin[2]; [1]*Suzhou City Univ., China;* [2]*Beihang Univ., China.* We reported a multi-wavelength thulium-doped fiber laser using an all-fiber Mach–Zehnder interferometer, achieving single-wavelength pulse output with a 55.8 nm tunable range. Varying the pump power enabled mode-locked pulses with one to four wavelengths.

JD4A.93

Photopolymer chirped grating based on holographic interferometry, Hang Chen[1], Bing Zhang[1], Yaping Zhang[1], Yongwei Yao[1], Yongan Zhang[1]; *[1]Kunming Univ of Sci. and Tech., China.* We present a simple experiment to fabricate chirped gratings. The gratings are fabricated through interference exposure using photopolymer composed of methyl methacrylate (MMA), Irgacure784 (Ti), and Azodiisobutyronitrile (AIBN).

JD4A.94

Non-zero Dispersion Shifted Fiber with Multi-concentric-ring Cores for OAM Modes, Yuxiang Huang[1], Wenqian Zhao[1], Zhongqi Pan[2], Yang Yue[1]; *[1]Xi'an Jiaotong Univ., China; [2]Univ. of Louisiana at Lafayette, USA.* A multi-concentric-ring-core non-zero dispersion shifted fiber is proposed and designed to support 70 OAM modes while adhering to the ITU-T G.655.C standard. The corresponding nonlinear effects and confinement loss of the designed fiber are investigated.

JD4A.95

Measurement of the Temperature Coefficient of the Refractive Index for Silicon Nitride Thin Film in the Visible Range, Samer Idres[1], Hossein Hashemi[1]; *[1]Univ. of Southern California, USA.* We experimentally measure the temperature dependence of the refractive index for 400 nm thick LP-CVD Silicon Nitride layer in the visible range, finding a refractive index of ~2.03 and a temperature coefficient of $\sim -1.3\times10^{-4}$.

JD4A.96

Trench-assisted Seven-core Graded-index Ring Fiber for OAM Modes, Yuetian Wang[1], Yuanpeng Liu[2], Wenpu Geng[2], Wenqian Zhao[1], Zhongqi Pan[3], Yang Yue[1]; *[1]Xi'an Jiaotong Univ., China; [2]Nankai Univ., China; [3]Univ. of Louisiana at Lafayette, USA.* Trench-assisted seven-core graded-index ring fiber is proposed and designed to support 210 OAM modes in the C-band with > 99.27% purity. It features with < -90 dB crosstalk for the majority of the supported modes.

JD4A.97

Self-diffraction rings in organic materials with Gelite Bloom and Hibiscus Sabdariffa, Oscar Alberto Mejia Vega[1], Michel O. Chacon Carrero[1], Monica Trejo Duran[1], Miroslava Cano Laro[2], Edgar Alvarado Mendez[1]; *[1]Universidad de Guanajuato, Mexico; [2]Instituto Tecnologico Superior de Irapuato, Mexico.* An experimental study on hibiscus sabdariffa in gelite bloom using z-scan and variable power Ar laser revealed significant nonlinear absorption an self - phase modulation is presented.

JD4A.98

Spatial Impulse Response of Ultrasound Transducer Correction Using Deep Learning in Photoacoustic Tomography, Isha Munjal[1], Jaya Prakash[1]; *[1]Indian Inst. of Science, India.* Photoacoustic tomography (PAT) image quality is degraded by transducer-related distortions. This study employed conventional l1-norm based deconvolution and deep learning based deconvolution to compensate spatial impulse response, achieved 40/81% improvement in terms of SSIM/PSNR over backprojection reconstruction.

JD4A.99
Highly Efficient Nano-Optical Spot Generation in a Non-Metallic Tip, Weinan Feng[1], Makoto Tsubokawa[1]; [1]*Waseda Univ., Japan.* A near-field sub-nanometer optical field is generated by confining a radially polarized fiber mode at a non-metallic cone shaped nanotip that is connected to the output end of a nanofiber.

JD4A.100
Dynamics of ultrafast pulse propagation in amorphous materials via variational approach, Karabo K. Ndebele[1]; [1]*Physics and Astronomy, Botswana International Univ. of Science and Technology, Botswana.* The impact of saturable nonlinearity and dispersions on self-induced transparency amorphous materials through modulational instability of the optical beam propagating in the nonlinear system is made as well as investigating propagation characteristics of ultrafast pulses.

JD4A.101
Spectroscopic Assessment of an Edible Oil for Quality Determination, Hazel Mendonca[1]; [1]*Department of Biophysics, Manipal Academy of Higher Education, India.* Edible oils are vital to human nutrition and health. Photo-oxidation occurs when oil is exposed to light. Spectroscopy is one of the convenient methods that can examine the chemical characteristics and parameters of oil.

JD4A.102
Quantum-Photonic Treatment for Nano-Dispersion, Sina Mahmoudi[1], Mahdi Saberi[1], Hassan Kaatuzian[1], Majid Shalchian[1]; [1]*Amirkabir Univ. of Technology, Iran (the Islamic Republic of).* Nano-dispersion involves controlling light dispersion at the quantum atomic level within nanostructures on an atto-second time scale. This study uses Q.P. theory and MonteCarlo time domain modeling to simulate photon interactions, showing that N.D. aligns with Snell's law at large dimensions but provides more precise predictions at steeper angles.

JD4A.103
Inverse Design of Quantum Spin Hall Effect-based Photonic Topological Insulators, Wanshu Xiong[1], Huaqing Jiang[1], Yumiao Li[1], Kun Yin[1]; [1]*Zhejiang Lab, China.* A generalized deep learning method is proposed for fast and accurate inverse design of photonic topological insulators (PTIs) characterized based on the Quantum Spin Hall Effect. And the topological protection performance is verified.

JD4A.104
State field relative phase conditions for all-optical switching using two level systems, Aneesh Ramaswamy[1], Svetlana Malinovskaya[1]; [1]*Stevens Univ. of Technology, USA.* We demonstrate tunable transparency, with applications to all-optical switching, for a pulse propagating in a medium of two-level systems when the initial atomic coherence and field are in phase.

JD4A.105
Dirac mass induced by optical gain and loss, Letian Yu[1], Haoran Xue[2], Ruixiang Guo[1], Eng Aik Chan[1], Yun Yong Terh[1], Cesare Soci[1], Baile Zhang[1], Yidong Chong[1]; [1]*Nanyang Technological Univ., Singapore;* [2]*Physics, The Chinese Univ. of Hong Kong, China.* We show experimentally that Dirac masses can be generated via non-Hermiticity. We implement a

photonic synthetic lattice with gain and loss engineered to produce Dirac quasiparticles with real mass. We then explore how the space-time engineering of the gain/loss-induced Dirac mass affects the quasiparticles.

JD4A.106
Bridging the Gap: Towards Contextualised Optical Character Recognition using Large Language Models, Ananya Mudgal[2], Anshul Sharma[1], Yugnanda Malhotra[2]; *[1]Computer Science and Engineering, Manipal Univ. Jaipur, India; [2]Electronics and Communication Engineering, Bharati Vidyapeeth's College of Engineering New Delhi, India.* Optical Character Recognition is used to convert handwritten/printed text to digitised text, but it lacks refinement. We propose to integrate it with a Large Language Model, to create a context-driven word/sentence detection program.

JD4A.107
2D Nano Material Based Highly Sensitive SPR Biosensor for Wide Ranged Hemoglobin Concentration Measurement, Khandakar Mohammad Ishtiak[1], Safayat-Al Imam[1], Quazi D. Khosru[1]; *[1]BUET, Bangladesh.* We propose a 2D material-based wide-range surface plasmon resonance biosensor for hemoglobin concentration measurement and compared it to recent literature.

JD4A.108
Laser Induced Persistent Holographic Gratings Formed in Praseodymium Doped Zinc-Tellurite Glasses, Abdulatif Y. Hamad1, Nathan Kolb1, Eric Voss1; 1Southern Illinois University Edwardsvill, USA. Strong persistent gratings were formed in praseodymium doped zinc-tellurite glasses using the four-wave mixing technique. The gratings were written by an argon laser operating at 476.5 nm. The maximum change in the index of refraction was 0.00019.

JD4A.109
Tunable Gammadion-Structured Chiral Metamaterial Sensor with ZnO/Ag Layers for Enhanced Visible Region Detection, Hager F. Ali1, Abdelrahman M. Ghanim1,2, Ahmed Faramawy1,2, Mohamed A. Swillam1; 1American University in Cairo, Egypt; 2Physics, Ain Shams University, Egypt. The study uses a gammadion structure in the visible region, featuring a ZnO between two Ag layers for plasmonic enhancement. The structure induces strong chiral optical responses, with the ZnO layer modulating the sensor's properties.

JD4A.110
Broadband plasmonic graphene-dielectric absorber for MIR, karim m. atef1, Abdelrahman M. Ghanim1,2, Mohamed A. Swillam1; 1American University in Cairo, Egypt; 2Physics, Ain Shams University, Egypt. The optical absorber plays a pivotal role in achieving effective energy harvesting. This study presents a fractal mid-IR absorber that utilizes a SiO2 geometry resonator with fractal technology to achieve a wideband cross-fractal formation. The proposed structure demonstrates broad absorption capabilities spanning a wide range of IR wavelengths.

JD4A.111
Enhanced Light Harvesting in PTB7:PC71BM Organic Solar Cells Using Plasmonic Nanostructures, Shaimaa Sanad1, Abdelrahman M. Ghanim1,2, Mohamed A. Swillam1;

1American University in Cairo, Egypt; 2Physics, Ain Shams University, Egypt. The progress of organic solar cells has been achieved by modifying high performance to get the best results of power conversion efficiency (PCE). The material that will used is PTB7-PC71BM as an active layer in OSC and the light harvesting can be enhanced by adding different plasmonic nanoparticles (NPs) in the active layer.

JD4A.112

Ag-550 Nanocrystals for Enhanced Optical Manipulation and Wavelength-Dependent Optical Limiting, Amit K. Pradhan1, Suman Kumar2, Amiya Priyam3, Prasanta Kumar Datta1; 1Physics, Indian Institute of Technology Kharagpur, India; 2Chemistry, Central University of South Bihar, India. We report femtosecond laser-induced nonlinear absorption in Ag-550 nanocrystals, revealing their optical limiting potential under off-resonant excitation and an intriguing decrease in optical transparency with dilution, enhancing their applicability in photonic devices.

JD4A.113

Concentration-Based Study of Serotonin in Polyethylene by Terahertz Time Domain Spectroscopy (THz-TDS), Rajat Kumar1, Nitesh Kumar Pathak2, Jayanta Kumar Sarkar1, Shrabana Adak1, Umakanta Tripathy2, Prasanta Kumar Datta1; 1Department of Physics, Indian Institute of Technology Kharagpur, India; 2Department of Physics, Indian Institute of Technology (Indian School of Mines) Dhanbad, India. We report the concentration variation of serotonin in polyethylene medium using THz-TDS. The complex refractive index of serotonin is analyzed using Complex Refractive Index (CRI) model. The RI of serotonin varies linearly with the concentration.

JD4A.114

Third Harmonic Generation at THz Frequencies: A Frequency-Selective Metasurface Approach with Complementary Split Ring Resonators, Mitali Sahu1, Partha Roy Chaudhuri1; 1Physics, Indian Institute of Technology Kharagpur, India. We report here investigation on third harmonic generation (THG) in the terahertz (THz) regime using double resonant frequency selective metasurface composed of square shaped periodic complementary single split ring resonators

JD4A.115

Tunable Generation of Vector Vortex Beams using an Optically Active Material, Ankita Karmakar1, Maruthi M. Brundavanam1; 1Indian Institute of Technology Kharagpur, India. We have proposed and demonstrated a tunable and common-path technique for the generation of optical vector vortex beams using an optically active material.

JD4A.116

Tuning the Degree of Classical Non-Separability of a Vector Vortex Beam, Bibek K. Patra1, Maruthi M. Brundavanam1; 1Indian Institute of Technology Kharagpur, India. A vector vortex beam is generated using a common-path technique. The degree of the classical non-separability of the generated beam is tuned by the reflection of the beam using a simple N-BK7 prism.

JD4A.117

Plasmonics Assisted Self-Assembly of a Biologically Active Specimen, Anand D. Ranjan1, Sucharita Bhowmick2, Amirul I. Mallick2, Ayan I. Banerjee1; 1Physics, Indian Institute of Science Education and Research Kolkata, India; 2Biology, Indian Institute of Science Education and Research Kolkata, India. Developing diagnostic tools necessitates patterning biologically active biomolecules. We present a technique for patterning biospecimens using self-assembly mediated by plasmonic microbubbles. We also successfully demonstrate a protocol for immobilising diverse biospecimens on transparent substrates for potential biosensing applications.

FD1 • On-Demand Oral Session

FD1.1 • 09:00
Scalable Incoherent Optical Tensor Core Based on Thin-film Lithium Niobate Platform, Lin Wang[1], Xinyu Huang[1], Lei Zhang[1], Kun Yin[1], Hui Yu[1]; *[1]Zhejiang Lab, China.* We introduce and fabricate a scalable incoherent optical tensor core based on the thin-film lithium niobate platform, and demonstrated image convolution tasks in such a scenario.

FD1.2 • 09:00
Third-order nonlinearity in AuNP-GeSe Heterostructure, Vinod Kumar[1], K. V. Adarsh[1]; *[1]IISER Bhopal, India.* We demonstrate ultrafast third-order nonlinear behavior in gold nanoparticle (AuNP)/amorphous GeSe heterostructure. Enhanced nonlinearity is attributed to the charge transfer and verified through Raman spectroscopy and transient absorption, paving the way for saturable absorber applications.

FD1.3 • 09:00
High-speed Photonic Tensor Core Utilizing Lithium Niobate Modulator Array, Wenting Jiao[1], Yang Gao[1], Lei Zhang[1], Kun Yin[1], Hui Yu[1]; *[1]Zhejiang LAB, China.* We present a photonic tensor core for convolution computation utilizing modulator arrays on lithium niobate platform, enabling significant enhancements in computational speed and integration capabilities.

FD1.4 • 09:00
Variational Inference Using High Speed Photonic Neural Networks, James M. Garofolo[1], Taichu Shi[1], Paul Prucnal[2], Ben Wu[1]; *[1]Department of Electrical and Computer Engineering, Rowan Univ., USA; [2]Department of Electrical and Computer Engineering, Princeton Univ., USA.* We propose a method of performing variational inference using high speed photonic neural accelerators. This method incurs no slowdown compared to deterministic photonic inference, affecting only the power consumption of existing accelerator architectures.

FD1.5 • 09:00
Extended Imaging Depth via Long-wavelength Conjugate Spectral-domain OCT, Gauri Arora[1], Santosh Balakrishnan[1], Steven Graham Adie[1]; *[1]Meinig School of Biomedical Engineering, Cornell Univ., USA.* This article presents ultra-deep imaging in spectral domain OCT based on a combination of long-wavelength super-continuum source and conjugate configuration. Using this technique, we demonstrate deep tissue imaging up to 5.1mm optical depth in chicken breast tissue.

FD1.6 • 09:00
Robust SOP-Based Vibration Sensing Integrated in DSCM System Based on Frequency-Domain Pilot Tones, Bang Yang[1,2], Jianwei Tang[1,2], Quhao Zhuo[2], Yaguang Hao[1,2], Linsheng Fan[1], Shangyi Wang[2], Shuang Gao[2], Junpeng Liang[1], Weisheng Hu[1], Yong Yao[2], Jinlong Wei[1], Yanfu Yang[1,2]; *[1]Peng Cheng Laboratory, China; [2]School of Electronics and Information Engineering, Harbin Inst. of Technology, Shenzhen, China.* Integrated optical fiber communication and 100kHz-level vibration sensing in DSCM system is demonstrated with frequency-domain pilot tones used for simultaneous carrier phase tracking, polarization demultiplexing and SOP-based vibration sensing.

FD1.7 • 09:00
Low-Cost and DSP-Free SOP-Based Fiber Sensing Integrated in Optical Communication Systems, Bang Yang[1], Quhao Zhuo[1], Jianwei Tang[1], Shangyi Wang[1], Jiaxin Chen[1], Mingfu Xu[1], Shuang Gao[1], Guodong Gao[1], Kuntian Dai[1], Yong Yao[1], Yanfu Yang[1]; *[1]School of Electronics and Information Engineering, Harbin Inst. of Technology, Shenzhen, China.* A low-cost integrated communication and DSP-free sensing solution is demonstrated across scenarios including robot intrusion and gimbal shake, offering versatile and robust performance for real-world applications.

FD1.8 • 09:00
Interference Sensing based on Wireless Sensors Synchronized with Optical Fiber Link, Taichu Shi[1], James M. Garofolo[1], Ben Wu[1]; *[1]Rowan Univ., USA.* We proposed and demonstrated interference sensing method to accurately measure the location of interference source. The wireless sensors are synchronized with optical links for high resolution time difference of arrival measurement.

FD1.9 • 09:00
Integrated All-Optically Controlled FIR Filter and Data Sequence Detector Using WDM Laser Signals, Samer Idres[1], Hossein Hashemi[1], Jonathan Habif[1]; *[1]Univ. of Southern California, USA.* We experimentally demonstrate an integrated all-optically controlled two-tap FIR filter and sequence detector. A 1.25 Gbps OOK optical data was used to test the performance. The design is fabricated in a commercial silicon photonics process.