Optica Nonlinear Optics Session Guide

Disclaimer: this guide is limited to technical program with abstracts and author blocks as of 21 July. For updated and complete information with special events, reference the online schedule or mobile app.

Monday, 4 August

08:00 -- 10:00
Room: Alohilani Ballroom 1
M1A • Nonlinear Processes in Waveguide Systems
Presider: Anna Peacock; Univ. of Southampton, UK

M1A.1 • 08:00 (Invited)
Progress in Brillouin Integrated Photonics: Heterogeneous Integration, Surface Acoustic Wave Engineering, and Lasing Inhibition, Benjamin J. Eggleton[1]; [1]*Univ. of Sydney, Australia.* Recent breakthroughs in Brillouin integrated photonics—including heterogeneous integration, surface acoustic wave excitation, and post-fabrication engineering—are enabling new functionalities in signal processing, sensing, and light generation within compact, hybrid photonic-acoustic circuits.

M1A.2 • 08:30
Visible to Mid-IR Supercontinuum Initiated by Quasistatic SHG in Thin-Film Lithium Niobate on Sapphire, Noah Flemens[1], Christopher Phillips[1], Marc Jankowski[1,3], Marin Hamrouni[2,1], Alex Hwang[1], Jatadhari Mishra[1], Carsten Langrock[1], Amir Safavi-Naeini[1], Thomas Südmeyer[2], Hideo Mabuchi[1], Martin Fejer[1]; [1]*Stanford Univ., USA;* [2]*Université de Neuchâtel, Switzerland;* [3]*NTT Research, USA.* We demonstrate multi-octave supercontinuum generation with f-2f self-referencing, utilizing the extended transparency window of TFLN on sapphire. Broadening is induced by quasistatic SHG in infrared and extended to the visible by cascaded higher harmonic generation.

M1A.3 • 08:45
Ultrabroadband Supercontinuum Spectroscopy of X-cut Thin-Film Lithium Niobate Waveguides, Sagar P. Doshi[1], Dodd J. Gray[2], Jason Plant[2], Teddy Hsieh[1], Gavin N. West[1], Robert McConnell[2], William Loh[2], Rajeev J. Ram[1]; [1]*Massachusetts Inst. of Technology, USA;* [2]*Massachusetts Inst. of Technology Lincoln Laboratory, USA.* Using supercontinuum spectroscopy, we rapidly identify phase matching conditions in etched x-cut thin-film lithium niobate waveguides. Visible and NIR losses are attributed to polaron absorption enhanced by fabrication-induced defects. These losses can be mitigated by annealing waveguides at 500C.

M1A.4 • 09:00 (Invited)
Sounds Waves Harness Photonic Neuromorphic Computing and Quantum Signal Processing, Birgit Stiller[1,2]; [1]*Inst. of Photonics, Leibniz Univ. Hannover, Germany;* [2]*Max Planck Inst. for the Science of Light, Max Planck Inst. for the Science of Light, Germany.* We experimentally enhance photonic neural networks with acoustic functionality, e.g. an optoacoustic recurrent operator and optoacoustic activation functions. We demonstrate phonon cooling and the conditions for photon-phonon entanglement leading to new quantum signal processing schemes.

M1A.5 • 09:30
Tunable Megawatt Pulses by Soliton Self-Frequency Shift in Nitrogen-Filled Hollow Fiber, Yishai Eisenberg[1], Wenchao Wang[1], Yi-Hao Chen[1], Enrique Antonio-Lopez[2], Rodrigo Amezcua-Correa[2], Chris Xu[1], Frank W. Wise[1]; [1]*Cornell Univ., USA;* [2]*Univ. of Central Florida, USA.* Soliton formation and soliton self-frequency shift are investigated in hollow-core fiber filled with nitrogen. Solitons with peak power above 5 MW are generated between 1100 and 1300

nm.

M1A.6 • 09:45
Integrating Linear Pulse Compression Inside ANDi Fibers for Broadband Coherent Supercontinuum Generation, Andrea Arduin[1], Shreesha Rao D.S.[1], Andreas Baltzer Skov[1], Ole Bang[1,2]; *[1]Department of Electrical and Photonics Engineering, Technical Univ. of Denmark, Denmark; [2]NKT Photonics A/S, Denmark.* We integrate a short section of anomalous dispersion fiber inside an All-Normal Dispersion (ANDi) fiber and demonstrate that this integrated all-fiber linear pulse-compressor more than doubles the spectral width of a coherent ANDi supercontinuum.

08:00 – 09:30
Room: Alohilani Ballroom 2
M1B • Unconventional Dynamics and Metasurfaces
Presider: Zhigang Chen; Nankai Univ., China

M1B.1 • 08:00 (Invited)
Space-Time Image Processing in Nonlinear and Nonlocal Metasurfaces, Costantino De Angelis[1]; *[1]Dept. of Information Engineering, Universita degli Studi di Brescia, Italy.* In this work, I will present our recent findings on the use of nonlocal and nonlinear metasurfaces for image processing in space and time.

M1B.2 • 08:30
Quantum non-Demolishing Dynamics as a Physics Behind Exceptional Points in Multimode Squeezing, Evgeny Moiseev[1], Kai Wang[1]; *[1]McGill Univ., Canada.* We establish the connection between quantum non-demolition (QND) dynamics for linear quadrature operators and Hermitian and exceptional degeneracies in multimode bosonic quadratic Hamiltonians. We show how different QND operators are related
to different degeneracies.

M1B.3 • 08:45
Prethermalization and Thermal Processes in a Topological Su-Schrieffer-Heeger Lattice, Guowen Yang[1], Jiale Wang[1], Yichuan Chen[1], Limin Song[1], Shiqi Xia[1], Daohong Song[1], Zhigang Chen[1], Nikolaos K. Efremidis[2,3]; *[1]Nankai Univ., China; [2]Department of Mathematics and Applied Mathematics, Univ. of Crete, Greece; [3]Inst. of Applied and Computational Mathematics, FORTH, Greece.* We study the processes associated with the prethermalization and thermalization dynamics in 1D Su-Schrieffer-Heeger lattices, both in the topologically trivial and nontrivial regimes, unveiling the role played by the topological edge state and bandgap.

M1B.4 • 09:00 (Invited)
Synthetic non-Abelian Gauge Fields for Photons, Yi Yang[1]; *[1]The Univ. of Hong Kong, Hong Kong.* I will present the recent study of photonic synthetic non-Abelian gauge fields in my group in both Hermitian and non-Hermitian regimes, particularly their creation and manipulation via nonlinear modulation in the synthetic frequency dimensions.

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10:30 -- 12:30
Room: Alohilani Ballroom 1
M2A • Integrated Cavity Sources
Presider: Frank Wise; Cornell Univ., USA

M2A.1 • 10:30 (Invited)
Achieving the Schawlow-Townes Linewidth and Beyond in Nonlinear Photonic Oscillators, Alexander L. Gaeta[1]; [1]*Columbia Univ., USA.* We analyze theoretically the quantum-noise properties of various configurations of optical parametric oscillators. Under suitable conditions, it is possible to surpass the equivalent Swallow-Townes linewidth.

M2A.2 • 11:00
High-Energy Mode-Locked Pulses From a Photonic Integrated Mamyshev Oscillator, Zheru Qiu[1,2], Zhongshu Liu[1,2], Xuan Yang[1,2], Jianqi Hu[1,2], Yichi Zhang[1,2], Jiale Sun[1,2], Xinru Ji[1,2], Grigorii Likhachev[1,2], Xurong Li[1,2], Zihan Li[1,2], Ulrich Kentsch[3], Tobias Kippenberg[1,2]; [1]*Swiss Federal Inst. of Technology Lausanne (EPFL), Switzerland;* [2]*Inst. of Electrical and Micro Engineering, EPFL, Switzerland;* [3]*Helmholtz-Zentrum Dresden-Rossendorf (HZDR), Germany.* We present the first photonic integrated circuit-based Mamyshev oscillator modelocked laser on an erbium-doped silicon nitride photonic chip, delivering stable 161 pJ pulses at a repetition rate of 184.9 MHz.

M2A.3 • 11:15
Integrated Mode-Locked Laser at C-Band on a Poly-Silicon Extension to a Commercial SiN Platform, Tom Reep[1], Dongbo Wang[1], Stijn Poelman[1], Thi Ngoc Lam Tran[1], Jose Carreira[2], Camiel Op de Beeck[2], Stijn Cuyvers[2], Michael Geiselmann[2], Dries Van Thourhout[1], Bart Kuyken[1]; [1]*Ghent Univ. - imec, Belgium;* [2]*LIGENTEC SA, Switzerland.* A fully integrated mode-locked laser with a 4.3 GHz repetition rate is demonstrated on a commercial SiN platform with an added p-Si layer. The p-Si layer simplifies manufacturing by reducing micro-transfer printing and EBL steps.

M2A.4 • 11:30
Towards Efficient Optical Parametric Amplification on Chip by Second Harmonic Resonance, Devin J. Dean[1], Taewon Park[1], Hubert Stokowski[1], Luke Qi[1], Sam Robison[1], Alex Hwang[1], Jason Herrmann[1], Martin Fejer[1], Amir Safavi-Naeini[1]; [1]*Stanford Univ., USA.* We demonstrate efficient and broadband optical parametric amplification in a thin-film lithium niobate device that resonates the second harmonic of the 1550 nm pump but is single-pass for the signal and idler.

M2A.5 • 11:45
Integrated Optical Parametric Oscillator Squeezer on Thin-Film Lithium Niobate, Taewon Park[1], Sam Robison[1], Devin J. Dean[1], Luke Qi[1], Oguz T. Celik[1], Hubert Stokowski[1], Martin Fejer[1], Amir Safavi-Naeini[1]; [1]*Stanford Univ., USA.* We present our latest results on the development of an efficient squeezed-light generator and optical circuitry using an integrated optical parametric oscillator on a thinfilm lithium niobate platform.

M2A.6 • 12:00 (Invited)
Quadratic Dark Solitons in on-Chip Degenerate Optical Parametric Oscillators, Nicolas Englebert[1]; [1]*California Inst. of Technology, USA.* We theoretically describe and experimentally demonstrate dark soliton formation in a quadratic nonlinear resonator in lithium niobate

nanophotonic. The dark pulses have a temporal duration of 40 fs and form a 120-nm-wide coherent frequency comb.

10:30 -- 12:30
Room: Alohilani Ballroom 2
M2B • Novel Integrated Materials and Nonlinear Applications
Presider: Costantino De Angelis; Universita degli Studi di Brescia, Italy

M2B.1 • 10:30
Advanced Material Solutions for Frequency Conversion in the MLWIR, Shivashankar Vangala[1], Samuel Linser[2], Duane Brinegar[2], Valentin Petrov[3], Vladimir Tassev[1]; *[1]Air Force Research Laboratory, USA; [2]KBR, USA; [3]Max Born Inst., Germany.* 600 µm thick orientation-patterned quasi-phase matching GaAsP was grown by hydride vapor phase epitaxy on OP-GaAs templates. Frequency conversion in the MLWIR exceeding 19% conversion efficiency was demonstrated via second harmonic generation > 5µm.

M2B.2 • 10:30
Ultrafast Carrier Dynamics in Undoped InSb Driven by Intense THz Pulses, Carlos M. Garcia-Rosas[1], Xavier Ropagnol[1], Vineet Gupta[2], Abhishek Gupta[2], Jozsef Fulop[2], Francois Blanchard[3], Tsuneyuki Ozaki[1]; *[1]INRS, Canada; [2]ELI-ALPS Research Inst., Hungary; [3]Département de Génie Électrique,, École de Technologie Supérieure (ÉTS), Canada.* Using three intense THz sources, we demonstrate the balance between intervalley scattering and impact ionization in an undoped InSb semiconductor, showing how pulse frequency and field strength affect carrier dynamics and conductivity.

M2B.3 • 10:30 (Invited)
Nonlinear Properties of Si Rich SiN and its Applications, Shaya Fainman[1]; *[1]Univ. of California San Diego, USA.* Higher content of Si in silicon-rich nitride results in higher refractive index thus magnifying its nonlinear properties. We use four-wave mixing characterization in SRN waveguides for a range of refractive indices between 2.5 and 3.2.

M2B.4 • 10:30
Fabrication of Quasi-Phase-Matched Multiple-Plate Stacks of GaP and ZnSe by Use of Room-Temperature Bonding, Ichiro Shoji[1], Tokifumi Otani[1], Yuta Kuramoto[1], Aoi Sato[2], Satoshi Ashihara[2]; *[1]Chuo Univ., Japan; [2]Inst. of Industrial Science, The Univ. of Tokyo, Japan.* Quasi-phase-matched multiple-plate-stacked GaP and ZnSe with low scattering loss at the bonded interfaces were fabricated by room-temperature bonding. We observed broadband generation around 9 µm by the intra-pulse difference-frequency generation of a 2 µm fs laser.

M2B.5 • 10:30
Nonlinear Four-Wave Mixing in Niobia-Titania Micro-Ring Resonators, Aaron M. Gibbs[1], Aaron Schreyer-Miller[1], David Irvine[1], Ikechi Ndamati[1], Aiden Tomov[1], Mark A. Foster[1], William D. Houck[2], Amy C. Foster[1]; *[1]Johns Hopkins, USA; [2]VIAVI Solutions Inc., USA.* We demonstrate four-wave mixing using dispersion-engineered niobia-titania micro-ring resonators. Niobia-titania is a novel material platform for nonlinear integrated photonics with high index, nonlinearity and stability.

M2B.6 • 10:30 (Invited)
SiGe Based Integrated Optics for mid-IR Nonlinear Applications, Christelle Monat[1,4], Adam Bieganski[1,2], Marko Perestjuk[1,2], Remi Armand[1,3], Ujjal Chettri[1,4], Alberto Della torre[4], Shahaz Hameed[1,6], lamine ferhat[4,1], vincent reboud[3], Jean-Michel Hartmann[3], Andreas Boes[5], arnan mitchell[2], Jiayang Wu[6], David Moss[6], Thach Nguyen[2], Sebastien Cueff[4,1], Christian Grillet[4,1]; *[1]Ecole Centrale de Lyon, France; [2]RMIT, Australia; [3]CEA-Leti, France; [4]INL, France; [5]Univ. of Adelaide, Australia; [6]Swinburne Univ., Australia.* CMOS compatible highly nonlinear SiGe-on-Si platforms enable low-loss mid-IR integrated photonics, and supercontinuum generation thanks to dispersion engineering. I will present our recent advances towards the creation of tunable chip-based broadband sources and frequency combs.

14:00 -- 16:00
Room: Alohilani Ballroom 1
M3A • Integrated Systems for Quantum Optics
Presider: Birgit Stiller; Max-Planck-Inst Physik des Lichts, Germany

M3A.1 • 14:00 (Invited)
Ultrafast Quantum and Classical Nonlinear Nanophotonic Circuits, Alireza Marandi[1]; *[1]California Inst. of Technology, USA.* I will overview the progress on utilizing few-optical-cycle pulses in lithium niobate nanophotonics towards ultrafast quantum and clasiscal information processors. I will present recent results on generation and measurement of squeezed states in nanophotonics and the ongoing efforts towards non-Gaussian states and large-scale quantum nanophotonic circuits and photonic computing.

M3A.2 • 14:30
High-Gain Effects in Pulsed Squeezed Light Generation From a Silicon Nitride Microresonator, Massimo Borghi[1], Emanuele Brusaschi[1], Marco Liscidini[1], Matteo Galli[1], Daniele Bajoni[2]; *[1]Universita degli Studi di Pavia, Italy; [2]Dipartimento di Ingegneria Industriale e dell'Informazione, Univ. of Pavia, Italy.* We experimentally generate pulsed squeezed light from a silicon nitride microresonator up to 16 average photons per pulse. By tuning pump frequency and pulse duration, we maximize the generation rate while ensuring nearly single temporal mode emission.

M3A.3 • 14:45
on-Chip Integration of OPAs and High-Extinction-Ratio Low-Loss Pump/Signal Multiplexer for Ultrafast Quantum Computation, asuka inoue[1], Takahiro Kashiwazaki[1], Taichi Yamashima[1], Takeshi Umeki[1], Mamoru Endo[2], Akira Furusawa[2,3]; *[1]NTT, Japan; [2]The Univ. of Tokyo, Japan; [3]RIKEN Center for Quantum Computing, Japan.* We developed a periodically poled lithium niobate integration chip of optical parametric amplifiers and pump/signal multiplexer with 30-dB extinction ratio and 0.2 dB-insertion loss using multi-mode interferometer. Over 3-dB squeezing is observed at telecom wavelength.

M3A.4 • 15:00 (Invited)
Scaling up Integrated Quantum Photonic Circuits, Jianwei Wang[1]; *[1]Peking Univ., China.* In this talk, we present key approaches to scaling up integrated quantum photonic devices and circuits, including large-scale integration, deterministic entanglement, and multi-chip interconnection, and highlight their role in advancing quantum computing and quantum networking.

M3A.5 • 15:30
Graph Similarity With Bipartite Gaussian Boson Sampling in Time-Frequency Modes, Massimo Borghi[1], Emanuele Brusaschi[1], Marco Liscidini[1], Matteo Galli[1], Daniele Bajoni[2]; *[1]Universita degli Studi di Pavia, Italy; [2]Dipartimento di Ingegneria Industriale e dell'Informazione, Univ. of Pavia, Italy.* We demonstrate a bipartite gaussian boson sampling experiment with four photons in six frequency-time bin modes, using the device to assess similarity between different graph families of six vertices.

M3A.6 • 15:45
Quantum-Enhanced Second Harmonic Generation Pumped by Parametric Down Conversion Beyond the Photon Pairs Regime, Thomas Dickinson[1,2], Ivi Afxenti[3], Giedre Astrauskaite[4], Lennart Hirsch[3], Samuel Nerenberg[4], Ottavia Jedrkiewicz[1,5], Daniele Faccio[4], Caroline Müllenbroich[4], Alessandra Gatti[5], Matteo Clerici[1,3], Lucia Caspani[1,2]; *[1]Como Lake Inst. of Photonics, Dipartimento di Scienza e Alta Tecnologia, Università dell'Insubria, Italy; [2]Inst. of Photonics, Department of Physics, Univ. of Strathclyde, UK; [3]James Watt School of Engineering, Univ. of Glasgow, UK; [4]School of Physics and Astronomy, Univ. of Glasgow, UK; [5]Istituto di Fotonica e Nanotecnologie, CNR, Italy.* We demonstrate quantum-enhanced second harmonic generation driven by highly multimode parametric down conversion radiation, showing efficiency exceeding that of classical illumination up to intensities ten times the traditional quantum-classical boundary.

14:00 -- 16:00
Room: Alohilani Ballroom 2
M3B • Novel Nonlinear Effects and Structured Light
Presider: Guixin Li; Southern Univ of Science & Technology, China

M3B.1 • 14:00
Nonlinear Characterization of $Ca_5(BO_3)_3F$ (CBF) for Third Harmonic Generation at 355 nm, Florent Cassouret[1], Slimane Raissi[2], Pascal Loiseau[2], Jerome Debray[3], Patricia Segonds[3], Takunori Taira[4,1], Gerard Aka[2]; *[1]Division of Research, Innovation and Collaboration, Inst. for Molecular Science, Japan; [2]Institut de Recherche de Chimie Paris, Chimie ParisTech - PSL, France; [3]Neel Inst., Grenoble Alpes Univ. - CNRS, France; [4]Laser-Driven Electron-Acceleration Technology group, Riken SPring-8 Center, Japan.* Angular and temperature acceptances of CBF crystals cut along phase matching directions in the XY and YZ planes were investigated. YZ direction exhibits 6 times the temperature acceptance of LBO for 355 nm UV generation.

M3B.2 • 14:15
Enhancing Nonlinear Optics in the Mesoscopic Regime With Ultra-Thin Crystalline Silver Films, Philipp K. Jenke[1,2], Saad Abdullad[3], Andrew Weber[3], Álvaro Rodríguez Echarri[4,5], Fadil Iyikanat[3], Vahagn Mkhitaryan[3], Frederik Schiller[6,7], Enrique Ortega[6,7], Philip Walther[1,8], Javier García de Abajo[3,9], Lee A. Rozema[1]; *[1]Faculty of Physics, Vienna Center for Quantum Science and Technology (VCQ), Univ. of Vienna, Austria; [2]Vienna Doctoral School in Physics, Univ. of Vienna, Austria; [3]ICFO-Institut de Ciencies Fotoniques, Spain; [4]Max-Born-Institut im Forschungsverbund Berlin e.V., Germany; [5]Center for Nanophotonics, Netherlands; [6]Centro de Física de Materials CSIC/UPV-EHU-Materials Physics Center, Spain; [7]Donostia International Physics Center (DIPC), Spain; [8]Research Platform for Testing the Quantum and Gravity Interface (TURIS), Univ. of Vienna, Austria; [9]ICREA-Institucio Catalana de Recerca i Estudis*

Avancats, Spain. We demonstrate that reducing the thickness of few-atom-thick crystalline silver films enhances second-harmonic generation. This effect, mediated by quantum-confined electronic states, enables strong nonlinearities in microscopic interaction volumes, challenging classical predictions.

M3B.3 • 14:30 (Invited)
Structured-Light-Matter Interaction: From Motion Sensing to Quantum Cryptography, Eileen Otte[1]; [1]*Univ. of Rochester, USA.* When light interacts with media down to the nanoscale, it becomes spatially structured in various properties. We explore how this interaction enables encoding and decoding of information within structured light facilitating various applications.

M3B.4 • 15:00 (Invited)
Self-Localized Beams for Deep Volumetric Nonlinear Imaging, Sixian You[1]; [1]*Massachusetts Inst of Technology, USA.* Abstract not available.

M3B.5 • 15:30
Photonic Realization of Spin-Orbit Coupling and non-Abelian Electric Fields in Synthetic Dimensions, Shu Yang[1], Bengy Tsz Tsun Wong[1], Yi Yang[1]; [1]*The Univ. of Hong Kong, Hong Kong.* We experimentally demonstrate spin-orbit interaction from equal Rashba and Dresselhaus coupling and the resulting non-Abelian electric fields using a polarization-multiplexed, time-modulated fiber ring resonator in photonic synthetic dimensions.

M3B.6 • 15:45
Structured Light Enabled Measurement of Highly Nonlocal Nonlinear Responses, Pengbo Jia[2,1], Shiqiang Xia[2]; [1]*Nankai Univ., China;* [2]*Henan Normal Univ., China.* We report an approach to measuring highly nonlocal nonlinear responses using circular Airy beams. The nonlinear beam profile exhibits a linear dependence on input power, providing a direct way to characterize the nonlocal responses.

16:30 -- 18:30
Room: Alohilani Ballroom 1
M4A • Novel Waveguide Systems and Applications
Presider: Lucia Caspani; Universita dell'Insubria, Italy

M4A.1 • 16:30 (Invited)
Quantum Metrology With Optical Frequency Combs, Scott A. Diddams[1]; [1]*ECEE Department, Univ. of Colorado Boulder, USA.* We discuss the role of optical frequency combs in quantum metrology, including Kerr squeezing and electric-field-correlation spectroscopy. Experiments demonstrating quantum-enhanced spectroscopy and prospects for long baseline interferometry will be presented.

M4A.2 • 17:00
Efficient Frequency Translation of Broadband Photons by Bragg-Scattering Four-Wave Mixing, Ramy Tannous[1], Philip J. Bustard[1], Duncan England[1], Frederic Bouchard[1], Guillaume Thekkadath[1], Benjamin J. Sussman[1,2]; [1]*National Research Council Canada, Canada;* [2]*Physics, Univ. of Ottawa, Canada.* We demonstrate frequency translation of heralded single photons by Bragg scattering four-wave mixing, driven by orthogonally polarized pump pulses in a

birefringent fiber. We achieve efficiencies >97% and a noise floor of ≈10^{-4} per cycle.

M4A.3 • 17:15
20 GHz Mid-Infrared Frequency Combs Spanning 3.8 - 5.2 µm, Pooja Sekhar[1,2], Tsung-Han Wu[1], Qing-Xin Ji[3], Peter Chang[1,2], Anatoliy Savchenkov[4], Vladimir Iltchenko[4], Andrey Matsko[4], Kerry Vahala[3], Scott A. Diddams[1,2]; *[1]Electrical, Computer and Energy Engineering, Univ. of Colorado Boulder, USA; [2]Physics, Univ. of Colorado Boulder, USA; [3]T. J. Watson Laboratory of Applied Physics, Caltech, USA; [4]Jet Propulsion Laboratory, Caltech, USA.* We generate mid-infrared frequency combs spanning 3.8 - 5.2 µm in periodically poled lithium niobate waveguides, using both 20 GHz electro-optic combs and soliton microcombs pumped at 1550 nm.

M4A.4 • 17:30 (Invited)
Integrated Nonlinear Photonics with Solid-State Gain and Computational Optimization, Kiyoul Yang[1]; *[1]School of Engineering & Applied Sciences, Harvard Univ., USA.* This presentation will discuss computational optimization using integrated nonlinear photonics.

M4A.5 • 18:00
Optical Solitons in Topological SSH Waveguides, Ju Won Choi[1], Byoung-Uk Sohn[1], Hongwei Gao[1], George F. Chen[1], Jia Sheng Goh[2], Doris K. Ng[2], Dawn T. Tan[1,2]; *[1]Photonics Devices and System Group, Singapore Univ. of Technology & Design, Singapore; [2]Inst. of Microelectronics, Agency for Science Technology and Research (A*STAR), Singapore.* We demonstrate optical temporal solitons using topological Su-Schrieffer-Heeger waveguides implemented on ultra-silicon-rich nitride with high Kerr nonlinearity and negligible nonlinear loss at a wavelength of 1550nm, achieving 2x temporal compression of 0.97ps pulses.

M4A.6 • 18:15
Nonlinear Vortex Generation in Kagome-Based Topological Disclination , Zhichan Hu[1], Domenico Bongiovanni[1,2], Ziteng Wang[1], Xiangdong Wang[1], Ruoqi Cheng[1], Daohong Song[1], Roberto Morandotti[2], Hrvoje Buljan[1,3], Zhigang Chen[1]; *[1]Nankai Univ., China; [2]INRS, Canada; [3]Univ. of Zagreb, Croatia.* **We demonstrate nonlinearity-induced orbital coupling and superposition that leads to vortex OAM generation and robust transport through Kagome-based disclination, thanks to the large bandgap and two-fold topological protection gifted by the structure.**

16:30 -- 18:15
Room: Alohilani Ballroom 2
M4B • Plasmas I
Presider: Jens Osterhoff; Lawrence Berkeley National Laboratory, USA

M4B.1 • 16:30 (Invited)
Controlling Laser-Produced THz Radiation in Air With Flying Focus, Silin Fu[1,2], Yi Liu[3], André Mysyrowicz[1], Vladimir Tikhonchuk[4], Aurelien Houard[1]; *[1]Laboratoire d'Optique Appliquée, Ecole Polytechnique, France; [2]School of Nuclear Science and Technology,, Lanzhou Univ., China; [3]USST, China; [4]Centre Lasers Intenses et Applications, Universite de Bordeaux, France.* We show that THz radiation emitted by a short femtosecond laser filament in air can be tuned in any direction using the flying focus technique, which determines the speed and

direction of the ionization front.

M4B.2 • 17:00
Phase-Matched Second Harmonic Generation in Strongly Magnetized Plasma, Sida Cao[1], Matthew Edwards[1]; *[1]Stanford Univ., USA.* We show that phase-matched harmonic generation can be achieved in strongly magnetized plasma in a manner analogous to Type I and Type II harmonic generation in crystals, increasing conversion efficiency by orders of magnitude.

M4B.3 • 17:15
Indirect Ultraviolet Pulse Manipulation Through Upconversion in Noble gas Medium, Lin-Shan Sun[1,2], Hao Zhang[1,3], Cameron Leary[1], Connor Lim[1], Chad Pennington[1], Gia Azcoitia[1], Sergio Carbajo[1,3]; *[1]Univ. of California, Los Angeles., USA; [2]California NanoSystems Inst., USA; [3]SLAC National Accelerator Laboratory, USA.* **We demonstrate an anti-symmetric dispersion transfer from near-infrared femtosecond laser pulses to ultraviolet light through chirped-four-wave-mixing in hollow-capillary fiber with a conversion of over 13%. This technique expands the possibilities for indirectly shaping ultrafast pulses.**

M4B.4 • 17:30 (Invited)
Recent Study on Second Harmonic Generation With Dual-Laser-Induced Air Plasma, Shing Yiu Fu[1], Daopeng Yuan[1,2], Xi-Cheng Zhang[1]; *[1]Univ. of Rochester, USA; [2]Taishan College, Shandong Univ., China.* We experimentally characterize the second harmonic emission from dual-laser-induced air plasma, which is shown to be facilitated by the action of plasma grating under the interference of two laser beams.

M4B.5 • 18:00
Frequency Conversion in a Plasma for Intense, Narrowband Terahertz Pulses, Minsup Hur[1], Jaeho Lee[1], Manoj Kumar[1], Inhyuk Nam[1]; *[1]Physics, Ulsan National Inst of Science & Tech, Korea (the Republic of).* A narrowband terahertz pulse with several GV/m field strength can be generated with almost 1% efficiency when a density gradient plasma is driven by a bi-frequency laser pulse.

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Tuesday, 5 August

08:30 -- 10:00
Room: Alohilani Ballroom 1
Tu1A • Nonlinear Phenomena and Diagnostics
Presider: Nicolas Englebert; California Inst. of Technology, USA

Tu1A.1 • 08:30
Femtosecond Dissipative Quadratic Soliton From a Continuous Wave Pumped Nonlinear Enhancement Cavity, Jonathan Musgrave[1], Mingming Nie[2], Shu-Wei Huang[1]; *[1]Univ. of Colorado Boulder, USA; [2]Univ. of Electronic Science and Technology of China, China.* We demonstrate bichromatic femtosecond dissipative quadratic soliton (DQS) generation from a continuous wave pumped nonlinear enhancement cavity. This novel light source architecture eliminates the need of femtosecond pump and synchronization optoelectronics.

Tu1A.2 • 08:45
Optical Bistability in Mid-Infrared High Quality Factor Silicon-Germanium Resonators, Marko Perestjuk[1,3], Remi Armand[1], Miguel Gerardo Sandoval Campos[1], Ujjal Chettri[1], lamine ferhat[2], Jean-Michel Hartmann[4], vincent mathieu[4], Guanghui Ren[3], Andreas Boes[5], arnan mitchell[3], nicolas Bresson[4], vincent reboud[4], Christelle Monat[1], Christian Grillet[2,1]; *[1]Ecole Centrale de Lyon, France; [2]CNRS, France; [3]RMIT, Australia; [4]CEA-LETI, France; [5]The Univ. of Adelaide, Australia.* We report Optical bistability in high-Q Silicon Germanium (SiGe) Ring Resonators in the Mid-Infrared (MIR) wavelength range between 3.5 - 4.6 μm. We numerically show that the high Q factor in combination with the observed nonlinearities is sufficient to generate soliton-based frequency comb

Tu1A.3 • 09:00
Ultrafast Measurement of Resonant Microcavity Modes by Intracavity Optical Gating, Ouri Karni[1], Etienne Lorchat[1], Chirag Vaswani[1], Thibault Chervy[1]; *[1]Physics & Informatics Laboratories, NTT-Research Inc., USA.* We utilize second-order nonlinearity embedded within high-quality microcavities to instantaneously measure the resonant optical fields through optical gating. This will be useful for coherent and efficient measurement of intracavity fields in polariton and quantum-optics systems.

Tu1A.4 • 09:15
Ultrafast Pulse Retrieval From Partial FROG Traces Using Implicit Diffusion Models, Abhimanyu Borthakur[1], Jack Hirschman[2,3], Sergio Carbajo[4,5]; *[1]Electrical and Computer Engineering, Univ. of California, Los Angeles, USA; [2]Applied Physics, Stanford Univ., USA; [3]SLAC National Accelerator Laboratory, USA; [4]Physics and Astronomy, Univ. of California Los Angeles, USA; [5]California NanoSystems Inst., USA.* We present a novel generative diffusion model to automate the recovery of ultrafast pulses from highly incomplete Frequency Resolved Optical Gating traces resulting in a precise, fast and advanced deep learning algorithm.

Tu1A.5 • 09:30 (Invited)
Ultralow-Loss Microcomb Integrated Photonics, Junqiu Liu[1]; *[1]Univ. of Science and Technology of China, China.* Abstract not available.

Optica Nonlinear Optics Session Guide

Disclaimer: this guide is limited to technical program with abstracts and author blocks as of 21 July. For updated and complete information with special events, reference the online schedule or mobile app.

08:30 -- 10:00
Room: Alohilani Ballroom 2
Tu1B • Plasmas II
Presider: Félicie Albert; Lawrence Livermore National Laboratory, USA

Tu1B.1 • 08:30 (Invited)
Laser-Plasma Accelerator R&D at the BELLA Center: Compact, Ultrafast Sources of Electrons, Muons, and Photons, Jens Osterhoff[1]; *[1]1 Cyclotron Rd, Lawrence Berkeley National Laboratory, USA.* Relativistically intense laser pulses enable the acceleration of charged particle beams in plasma with >10 GV/m fields for broad applications. This presentation summarizes recent progress in this field at the BELLA Center at LBNL.

Tu1B.2 • 09:00
Longitudinal Controllable Density Profile Using Segmented Capillary gas-Cell for Laser Wakefield Acceleration, Inhyuk Nam[1], Minsup Hur[1]; *[1]Physics, UNIST, Korea (the Republic of).* We demonstrated that a segmented capillary gas cell can be used to tailor the longitudinal plasma density gradient, with the aim of controlling electron injection in laser wakefield acceleration (LWFA) and effectively reducing the electron beam energy spread.

Tu1B.3 • 09:15
Optimization of High-Damage-Threshold Transient gas Optics for High-Power Lasers, Ke Ou[1], Victor Perez-Ramirez[1], Sida Cao[1], Taekeun Yoon[1], Harsha Rajesh[1], Debolina Chakraborty[1], Devdigvijay Singh[1], Caleb Redshaw[1], Pelin Dedeler[1], Albertine Oudin[2], Eugene Kur[2], Khaled Younes[1], Matthias Ihme[1], Livia Lancia[4], Caterina Riconda[3], Pierre Michel[2], Matthew Edwards[1]; *[1]Stanford Univ., USA; [2]Lawrence Livermore National Laboratory, USA; [3]LULI, Sorbonne Université, CNRS, Ecole Polytechnique, CEA, France; [4]LULI, CNRS, CEA, Sorbonne Université, Ecole Polytechnique, Institut Polytechnique de Paris, France.* We create efficient diffraction gratings in an ozone-doped gas flow. These high-damage-threshold optics are suitable for high-power lasers and can support studies of extremely nonlinear optics. An optimization scheme is developed to optimize their performance.

Tu1B.4 • 09:45
Laser Shaping via Nonlinear Optics in Homogeneous Waveguides for High-Brightness Ultrashort Electron and X-ray Sources, Hao Zhang[1,2], Randy Lemons[2], Frederick Cropp[2], Jack Hirschman[2], Linshan Sun[1], Auralee Edelen[2], Sergio Carbajo[1,2]; *[1]Univ. of California, Los Angeles, USA; [2]Laser Science, SLAC National Accelerator Laboratory, USA.* We are exploring techniques to control both spatial and temporal beam profiles by leveraging spectral phase transfer through four-wave mixing within homogeneous waveguides. This method is intended for use in generating and modulating on-demand, attosecond-level electron and X-ray beams with high brightness and power.

Optica Nonlinear Optics Session Guide

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10:30 -- 12:30
Room: Alohilani Ballroom 1
Tu2A • Plenary Session

Tu2A.1 (Plenary)
Next Generation Nonlinear Photonic Devices, Michal Lipson[1]; [1]*Columbia Univ., USA.* Silicon nitride has proven to be a near-ideal integrated platform for high-performance nonlinear photonic devices and lasers. Such devices will have broad applications in data communications, metrology, sensing, quantum technology and healthcare.

Tu2A.2 (Plenary)
Spatiotemporal Optical Vortices: From Linear to Relativistic Intensities, Howard Milchberg[1]; [1]*Univ. of Maryland, USA.* I will introduce the new area of spatiotemporal optical vortices (STOVs), showing that they are necessary and ubiquitous structures in ultrashort pulse optics, and play a major role in intense laser-matter interactions.

Optica Nonlinear Optics Session Guide

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Wednesday, 6 August

08:15 -- 10:00
Room: Alohilani Ballroom 1
W1A • Lithium Niobate and Advanced Applications
Presider: Jianwei Wang; Peking Univ., China

W1A.1 • 08:15
Backward Stimulated Brillouin Scattering in Thin-Film Lithium Niobate Waveguides, Lisa-Sophie Haerteis[1], Yan Gao[3], Mikolaj Schmidt[2], Jochen Schroeder[3], Michael J. Steel[2], Andreas Boes[1]; *[1]Univ. of Adelaide, Australia; [2]Macquarie Univ., Australia; [3]Chalmers Univ., Sweden.* We report experimental demonstration of backward intra-modal stimulated Brillouin scattering in Z-cut lithium niobate on insulator waveguides, yielding a resonance at 8.88 GHz with a gain of 56 /m/W and a linewidth of 42.5 MHz.

W1A.2 • 08:30
High-Frequency Optical Phonon Mode Decay in Non-Stoichiometric Lithium Niobate, Helani Achintha Singhapura Singhapurage[1], Dinusha Senarathna[1], Feruz Ganikhanov[1]; *[1]Department of Physics, Univ. of Rhode Island, USA.* We report on ultrafast decay of lattice vibration modes in congruent $LiNbO_3$ traced by time-resolved Coherent Anti-Stokes Raman Scattering. We found phonon lifetimes for high frequency modes (26-38 THz) varying within 0.38-1.16 ps.

W1A.3 • 08:45
Cubic Nonlinear Susceptibility Tensor in Lithium Niobate, Roland Schiek[1]; *[1]Fachhochschule Regensburg, Germany.* Cubic nonlinear susceptibility tensor elements for polarization along the primary crystallographic axis in lithium niobate were measured. Results from self-phase modulation at extreme power and nonlinear wave propagation in coupled waveguides confirm the results.

W1A.4 • 09:00 (Invited)
Integrated Nonlinear Lithium Niobate Photonic Circuits: Towards Ultrafast, Low-Power, and Scalable Light–Matter Interfaces, Mengjie Yu[1]; *[1]110 Sproul Hall, Univ. of California Berkeley, USA.* In this talk, I will review our recent developments of 1) Fully integrated nonlinear photonic circuit for ultrashort pulse generation down to a few optical cycles 2) Ultrabroadband optical frequency combs as a path way towards an scalable optical atomic clock 3) microwave to optical transduction via thin-film-LN-based electro-optic modulators and optomechanical resonators 4) temporal and spectral shaping of light with sub-ps resolution and > 10 THz bandwidth. Lastly, I will discuss the potential of integrated nonlinear photonic platform for scaling up and accelerating classical and quantum technologies in sensing and communication networks.

W1A.5 • 09:30 (Invited)
Advances in Nonlinear Integrated Photonics Based on Thin-Film Lithium Niobate, Sasan Fathpour[1]; *[1]Univ. of Central Florida, CREOL, USA.* Thin-film lithium niobate has made significant strides in the last several years, maturing into a promising integrated photonic platform for nonlinear applications. This presentation reviews the background, current, and future directions of the emerging technology.

Optica Nonlinear Optics Session Guide

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10:30 -- 12:30
Room: Alohilani Ballroom 1
W2A • Nonlinear Quantum Systems
Presider: Sasan Fathpour; Univ. of Central Florida, CREOL, USA

W2A.1 • 10:30
Optimization for Femtosecond Regime Single Photon Detection via Frequency Up-Conversion, Yuta Kochi[1,2], Maximilian Hornauer[1,2], Sunao Kurimura[3], Junko Ishi-Hayase[1,2]; *[1]Keio Univ., Japan; [2]Center for Spintronics Research Network, Japan; [3]National Inst. for Materials Science, Japan.* We proposed an optimization method for beam diameter and crystal length in femtosecond-regime sum-frequency generation for single-photon detection. As a result, we achieved 25% up-conversion efficiency with a 2-mm-long crystal and 100 mW pump power.

W2A.2 • 10:45
Nonlinear Interferometry Enables two-Photon Detection With a Single-Photon Detector, Saleem Iqbal[1], Robert W. Boyd[1,2]; *[1]Univ. of Rochester, USA; [2]Univ. of Ottawa, Canada.* We explain how to measure a two-photon state, following propagation through an optical system and interaction with a sample, using only single-photon detection. We anticipate that this technique will be invaluable for emerging quantum technologies.

W2A.3 • 11:00 (Invited)
Twin Beams for Sensitivity Enhancement in Time-Domain Spectroscopy, Dionysis Adamou[2], Lennart Hirsch[2], Taylor Shields[2], Seungjin Yoon[2], Adetunmise C. Dada[3], Jonathan M. Weaver[2], Daniele Faccio[3], Marco Peccianti[4], Lucia Caspani[5,1], Matteo Clerici[1,2]; *[1]Como Lake Inst. of Photonics, Department of Science and High Technology, Universita dell'Insubria, Italy; [2]James Watt School of Engineering, Univ. of Glasgow, UK; [3]School of Physics and Astronomy, Univ. of Glasgow, UK; [4]Emergent Photonics Research Centre, Department of Physics, Loughborough Univ., UK; [5]Inst. of Photonics, Department of Physics, Univ. of Strathclyde, UK.* We show that quantum correlations in ultrafast twin beams suppress noise and double the sensitivity of time-resolved THz field detection. Our results highlight the potential of quantum resources to enhance time-domain spectroscopy via electro-optic sampling

W2A.4 • 11:30
Observation of Subnatural-Linewidth Biphotons in a Two-Level Atomic Ensemble, JyunKai Lin[2], Tzu-Hsiang Chien[2], Chin-Te Wu[2], Ravikumar Chinnarasu[2], Shengwang Du[1], Ite Yu[2], Chih-Sung Chuu[2]; *[1]Elmore Family School of Electrical and Computer Engineering, and Department of Physics and Astronomy, Purdue Univ., USA; [2]Department of Physics and Center for Quantum Science and Technology, National Tsing Hua Univ., Taiwan.* We demonstrate an innovative experimental approach to generate the biphotons in a two-level atomic ensemble with a bandwidth of 0.36 MHz, a record spectral brightness of 2.28×10^7~${\rm s}^{-1}{\rm mW}^{-1}{\rm MHz}^{-1}$, and a temporally symmetric wave-packet.

W2A.5 • 11:45
Entangled Photon-Pair Generation in Layered Semiconductors at Room and Cryogenic Temperatures, Josip Bajo[1,2], Benjamin Braun[1,2], Birui Yang[6], Zhi Hao Peng[4], Cory R. Dean[6], Peter James Schuck[4], Philip Walther[1,5], Chiara Trovatello[3,4], Lee A. Rozema[1]; *[1]Universitat Wien,*

Austria; [2]Vienna Doctoral School in Physics (VDSP), Austria; [3]Politecnico di Milano, Italy; [4]Department of Mechanical Engineering, Columbia Univ., USA; [5]Univ. of Vienna, Research Platform for Testing the Quantum and Gravity Interface (TURIS), Austria; [6]Department of Physics, Columbia Univ., USA. We demonstrate an ultra-thin source of down-converted photon pairs using periodically poled non-centrosymmetric layered semiconductors at room and cryogenic temperatures. The unique crystal symmetry enables realization of maximally entangled states over ultra compact path lengths.

W2A.6 • 12:00 (Invited)
Optical Quantum Computer with 101 Inputs in RIKEN, Shota Yokohama[1]; *[1]RIKEN, Japan.* We developed a full-stack analog optical quantum computer utilizing continuous variables and time-domain-multiplexed two-dimensional entanglement. The system achieves 101 analog inputs at an operating clock frequency of 100MHz, enabling scalable and accessible quantum computation.

14:00 -- 16:00
Room: Alohilani Ballroom 1
W3A • Microcombs
Presider: Junqiu Liu; Univ. of Science and Technology of China, China

W3A.1 • 14:00
Integrated Ultra-Broadband Soliton Microcombs, Xinrui Luo[1], Kaixuan Zhu[1], Yuanlei Wang[1], Ze Wang[1], Tianyu Xu[1], Du Qian[1], Yinke Cheng[1], Junqi Wang[1], Haoyang Luo[1], Yanwu Liu[1], Xing Jin[1], Xin Zhou[2], Min Wang[2], Jian-Fei Liu[2], Xuening Cao[2], Ting Wang[2], Qihuang Gong[1], Bei-Bei Li[2], Qi-Fan Yang[1]; *[1]Peking Univ., China; [2]Chinese Academy of Sciences Inst. of Physics, China.* A hybrid-integrated soliton microcombs with ultra-broadband span is demonstrated, where the pump power is enhanced using a resonant coupler.

W3A.2 • 14:15
Fully-Integrated Soliton Microcombs at Microwave Rates Based on Compact Microresonators, Yuanlei Wang[1,2], Ze Wang[1], Chenghao Lao[1,2], Tianyu Xu[1], Yinke Cheng[1,2], Zhenyu Xie[1], Junqi Wang[1], Haoyang Luo[1], Xin Zhou[2], Bo Ni[1,3], Kaixuan Zhu[1], Yanwu Liu[1], Xing Jin[1], Min Wang[2], Jian-Fei Liu[2], Xuening Cao[2], Ting Wang[2], Qihuang Gong[1,3], Bei-Bei Li[2], Fangxing Zhang[3], Yun-Feng Xiao[1,3], Qi-Fan Yang[1,3]; *[1]Peking Univ., China; [2]Chinese Academy of Sciences, China; [3]Peking Univ. Yangtze Delta Inst. of Optoelectronics, China.* Compact silicon nitride microresonators on 4-inch wafers are designed and fabricated, maintaining intrinsic quality factors over 10 M. These devices facilitate turnkey soliton microcombs with repetition rates down to 10 GHz.

W3A.3 • 14:30 (Invited)
High-Efficiency Microcombs Revisited, Xiaoxiao Xue[1]; *[1]Electronic Engineering, Tsinghua Univ., China.* Microcombs hold great promise for a wide range of applications. We introduce the principle and scheme of microcombs that can achieve high conversion efficiency both in the normal- and anomalous-dispersion regions.

W3A.4 • 15:00
Optical Frequency Division With an Integrated PZT-Controlled Soliton Microcomb, Ruxuan Liu[1], Mark W. Harrington[2], Fatemehsadat Tabatabaei[1], Samin Hinifi[1],

Shuman Sun[1], Kaikai Liu[2], Jiawei Wang[2], Jesse S. Morgan[1], Zijiao Yang[1,3], Beichen Wang[1], Ryan Rudy[4], Steve M. Bowers[1], Paul A. Morton[5], Karl D. Nelson[6], Andreas Beling[1], Daniel J. 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]U.S. Army Research Laboratory, USA; [5]Morton Photonics, USA; [6]Honeywell International, USA.*

We demonstrated an integrated optical frequency division using a SiN-based reference and a PZT-controlled microcomb for stable mmWave generation. 110 GHz signal is generated with a phase noise of -114 dBc/Hz at 10 kHz offset.

W3A.5 • 15:15

Spiral Resonator Referenced on-Chip low Noise Microwave Generation, Long Cheng[1], Mengdi Zhao[1], Yang He[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]T. J. Watson Laboratory of Applied Physics, California Inst. of Technology, USA.*

Dual lasers are co-locked to a spiral resonator and their relative phase noise is frequency-divided down to the microwave domain via an integrated electro-optic frequency comb. Record-low phase noise is achieved for chip-based oscillators.

W3A.6 • 15:30

Broadband Soliton Microcomb Laser, Qili Hu[1], Raymond Lopez-Rios[1], Jingwei Ling[1], Zhengdong Gao[1], shixin xue[1], Jeremy C. Staffa[1], Qiang Lin[1]; *[1]Univ. of Rochester, USA.*

We demonstrate a mode-locked soliton microcomb laser with a repetition rate of up to 2.75 THz, optical bandwidth of 140 nm and an optical intrinsic linewidth of 300 Hz.

W3A.7 • 15:45

Actively Mode-Locked OPO Microcomb on Integrated Lithium Niobate, Jeremy C. Staffa[1], Raymond Lopez-Rios[1], Qili Hu[1], Shixin Xue[1], Zhengdong Gao[1], Austin Graf[1], Qiang Lin[1]; *[1]Univ. of Rochester, USA.*

We demonstrate the first active mode-locking of broadband optical parametric oscillation in an integrated lithium niobate resonator, generating a microcomb spanning $>$100nm through simultaneous broadband down-conversion and electro-optic modulation.

16:00 -- 17:30
Alohilani Foyer
W4A • Poster Session

W4A.1

Stabilizing 2D Cavity Soliton With External Potential in Nonlinear Microresonator, Anjali Saini[1], Soumendu Jana[1]; *[1]Department of Physics and Material Science, Thapar Inst. of Engineering and Technology, India.*

An external potential, e.g., egg-carton potential, may broaden the stable region of two-dimensional cavity soliton in nonlinear microcavity. Variational method is applied to vertical cavity surface emitting laser with graphene saturable absorber and frequency-selective feedback

W4A.2

Optical Sensing Technique Based on Aymmetric Fabry-Perot Resonator, Dong-Geun Yang[1,3], Jaehyun Lee[1], Jihoo Kim[1,3], Davin Jeong[2], Soonwook Hong[2], Dae Hee Kim[4], Young-Jin

Kim[4], Young-Sik Ghim[1,3]; *[1]Korea Res. Inst of Standards and Science, Korea (the Republic of); [2]Chonnam National Univ., Korea (the Republic of); [3]Univ. of Science and Technology, Korea (the Republic of); [4]Korea Advanced Inst. of Science and Technology, Korea (the Republic of).* This paper presents a high-sensitivity optical sensor combining an asymmetric Fabry-Perot resonator with micro-ellipsometry, enabling precise detection of environmental or material state changes, with applications in bio-sensing, environmental monitoring, and chemical sensing.

W4A.3

Microcombs in Si3N4 Microresonators Fabricated via Metal Lift-off: Demonstration of Octave Bandwidth, Dual Dispersive Waves, and Solitons, Gabriel M. Colacion[1], Lala Rukh[1], Franco Buck[1], Tara E. Drake[1]; *[1]UNM Center for High Tech Materials, USA.* We develop thin metal masks via metal lift-off to fabricate Kerr-microring resonators in thick SiN. Nanoscale dimensional accuracy for precise dispersion control is demonstrated by generating octave-spanning frequency combs with dual dispersive waves and solitons.

W4A.4

A Universal Loss Characterization Method for Integrated Photonic Circuits, Haoran Chen[1], Ruxuan Liu[1], Gedalia Y. Koehler[1], Shuman Sun[1], Zijiao Yang[1,2], Beichen Wang[1], Xu Yi[1,2]; *[1]Department of Electrical and Computer Engineering, Univ. of Virginia, USA; [2]Department of Physics, Univ. of Virginia, USA.* We report a universal method to characterize loss/gain for integrated photonic circuits. The loss of each component in a circuit, including fiber-chip coupling facets, can be identified in non-demolition manner without compromising circuit functionality.

W4A.5

Evolution of the Ablation Threshold in Human Lung Epithelial Cancer Cells Irradiated by a two-Wave Mixing , Carlos Torres-Torres[1], Blanca E. García-Pérez[1], Hilario Martines-Arano[2]; *[1]Instituto Politecnico Nacional, Mexico; [2]Escuela Superior Tepeji del Río, Universidad Autónoma del Estado de Hidalgo, Mexico.* Herein is reported the modification of the ablation threshold exhibited by A549 cells in monolayer form irradiated by the superposition nanosecond pulses at 532 nm wavelength in a vectorial two-wave mixing experiment.

W4A.6

Orientation Patterned GaAsP for Frequency Conversion in the Infrared, Shivashankar R. Vangala[1,2], Vladimir Tassev[1], Samuel Linser[1,2], Duane Brinegar[1,2]; *[1]Air Force Research Laboratory, USA; [2]KBR, USA.* Heteroepitaxial growth of orientation patterned GaAsP quasi-phase matching structures with a thickness exceeding 600 mm was demonstrated. The ternary GaAsP can be an excellent alternative to OP-GaAs structures for frequency conversion in the infrared.

W4A.7

Ionization Dynamics in Matter With Resonant Nanoantennas Irradiated by Intense Laser Shots, Konstantin Zhukovsky[1]; *[1]Wigner Research Center for Physics, Hungary.* We explore numerically ionization dynamics of media doped with gold nanoantennas of various shapes under intense laser radiation. We study the energies of produced ions and identify best conditions for the maximum energies of protons.

W4A.8

Thermo-Optic Control of a Topological Zero Mode, Byoung-uk Sohn[1], Hongwei Gao[1], Xavier x. chia[1], Ju Won Choi[1], Doris K. Ng[2], Dawn T. Tan[1]; *[1]SUTD, Singapore; [2]A*star, Singapore.* We explore the thermo-optic-induced delocalization of a topological mode in a Su-Schrieffer-Heeger (SSH) system featuring a domain wall, and demonstrate modulation of the idler signal generated via nonlinear parametric wavelength conversion, governed by thermo-optic effects.

W4A.9
Spatial Mapping of Optical Nonlinear Responses in Periodic Structures, Pengbo Jia[2,1], Shiqiang Xia[2]; *[1]Nankai Univ., China; [2]Henan Normal Univ., China.* We demonstrate both theoretically and experimentally an approach to detect the nonlinear response function of photonic lattices through spatial mapping. The nonlinearly-reshaped beam profiles of the input Airy beams enable characterization of the nonlinear response.

W4A.10
Optical Parametric Oscillation via Quasi-Phase Matching in Exfoliated Gallium Selenide Stacks, Jacob D. Silver[1], Woraprach Kusolthossakul[1], Dmitrii Konnov[1], Konstantin L. Vodopyanov[1]; *[1]UCF CREOL, USA.* Gallium selenide (GaSe) is quasi-phase matched by exfoliating layers and stacking them in alternating orientations. Efficiency in optical parametric oscillation is compared between a single layer and stacks of two, three, and four layers.

W4A.11
Simultaneous Nonlinear Frequency Conversion and Spectral Phase Transfer in Gas-Filled Fibers, Hao Zhang[1,2], Linshan Sun[1], Jack Hirschman[2], Federico Belli[3], Sergio Carbajo[1,2]; *[1]Univ. of California, Los Angeles, USA; [2]SLAC National Accelerator Laboratory, USA; [3]School of Engineering and Physical Sciences, Heriot-Watt Univ., UK.* We investigate the optimization of spectral phase transfer efficiency and spectral phase mapping through four-wave mixing in gas-filled hollow-core fibers, targeting applications in high-power programmable lightwave shaping.

W4A.12
A Substrate Transition Scheme for Visible to Near Infrared Heterogeneous Photonic Circuits Over Broad Temperature Ranges, Mobin Motaharifar[1], Yaser M. Banad[1], Sarah Sharif[1]; *[1]Univ. of Oklahoma, USA.* We propose a novel graded-index substrate transition structure for minimizing photon loss between Indium Phosphide and Silicon Dioxide substrates in heterogeneous photonic integrated circuits.

W4A.13
SiGe PIC Sensor, Vittoria Urso[1]; *[1]Department of physics, Italy.* The goal of our project is to design a photonic chip for MIR sensing, consisting of SiGe epitaxial layers grown on a Si substrate, realizing the integration of WG (waveguide) and quantum well infrared photodetector.

W4A.14
Time Ordering Effects in Third-Order Nonlinear Processes Implemented in Integrated Waveguides, Ferney Castro Simanca[1], Francisco A. Domínguez Serna[2], Wencel De la Cruz Hernandez[3], Karina Garay Palmett[1]; *[1]Centro de Investigación Científica y de Educación Superior de Ensenada, Mexico; [2]SECIHTI- Centro de Investigación Científica y de Educación Superior de Ensenada, Mexico; [3]Centro de Nanociencias y Nanotecnología, UNAM, Mexico.* We study time-ordering effects in third-order nonlinear waveguide processes via the Magnus expansion, demonstrating their significant impact on the joint spectral amplitude at high

efficiencies and potential enhancement of biphoton state separability.

W4A.15
Frequency Conversion Through Wave-Mixing in Rydberg States, Erik Brekke[1], Cordell Umland[1]; [1]*St. Norbert College, USA.* We examine frequency conversion through the 30d Rydberg state in rubidium vapor using four-wave mixing, resulting in a generated beam at 480 nm. The dependence of this process on laser frequency and intensity is explored.

W4A.16
Discovery of the Exact 3D One-way Wave Equation, Kosmas Tsakmakidis[1], Maria Barlou[1], Tomasz P. Stefanski[2]; [1]*National and Kapodistrian Univ of Athens, Greece;* [2]*Gdansk Univ. of Technology, Poland.* We report the discovery of the exact one-way wave equation in three dimensions. Surprisingly, we find that this equation necessarily has a topological nature, giving rise to strong, transverse spin-orbit coupling and locking in isotropic inhomogeneous media, and non-vanishing (integer) Chern numbers.

Optica Nonlinear Optics Session Guide

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Thursday, 7 August

08:00 -- 10:00
Room: Alohilani Ballroom 1
Th1A • Nonlinear Applications
Presider: Karolina Stefanska; Sapienza Università di Roma, Italy

Th1A.1 • 08:00 (Invited)
Optical Quantum Control of Electron Transfer in Biology, Dongping Zhong[1]; [1]*Shanghai Jiao Tong Univ., China.* Abstract not available.

Th1A.2 • 08:30
Nonlinear Optics: the Underlying Mechanism for Photonic Quantum Technologies, Robert W. Boyd[1,3], Saleem Iqbal[1], Long D. Nguyen[2]; [1]*The Inst. of Optics, Univ. of Rochester, USA;* [2]*Department of Physics, Univ. of Rochester, USA;* [3]*Department of Physics, Univ. of Ottawa, Canada.* Nonlinear optics plays a fundamental role in generating quantum light, which has led to photon-based quantum information. We use the entangled photons created by the nonlinear optical SPDC to construct a quantum-enhanced microscope for biology.

Th1A.3 • 08:45
Hollow-Core Fiber Source of Tunable Megawatt Pulses for Multiphoton Microscopy, Yishai Eisenberg[1], Wenchao Wang[1], Shitong Zhao[1], Eric Hebert[1], Yi-Hao Chen[1], Dimitre Ouzounov[1], Hazuki Takahashi[1], Anna Gruzdeva[1], Aaron LaViolette[1], Moshe Labaz[2], Pavel Sidorenko[2], Enrique Antonio-Lopez[3], Rodrigo Amezcua-Correa[3], NIlay Yapici[1], Chris Xu[1], Frank W. Wise[1]; [1]*Cornell Univ., USA;* [2]*Technion, Israel;* [3]*Univ. of Central Florida, USA.* Using spectral broadening in argon-filled fiber, femtosecond pulses with multi-megawatt peak power are generated between 850 and 1700 nm. Images of neurons deep in mouse brain are obtained with the pulses at 1300 nm.

Th1A.4 • 09:00
Distance-Dependent Photon Entanglement Through Turbulence, Luchang Niu[1], Yang Xu[1], Saleem Iqbal[1], Robert Boyd[1,2]; [1]*Univ. of Rochester, USA;* [2]*Univ. of Ottawa, Canada.* Using the extended Huygens-Fresnel principle, we study the propagation of entangled photon pairs through turbulence. We discover the entanglement redistribution in the angle–OAM bases and identify a special region of maximal entanglement.

Th1A.5 • 09:15
Visible Dual-Comb Spectroscopy Across 100 THz With Lithium Niobate Nanophotonic Waveguides, Carter R. Mashburn[3,5], Kristina F. Chang[3,4], Tsung-Han Wu[3], Mathieu Walsh[1], Daniel I. Herman[3], Nazanin Hoghooghi[4], Ryoto Sekine[2], Luiz Ledzma[2], Alireza Marandi[2], Jérôme Genest[1], Scott A. Diddams[3,5]; [1]*Electrical and Computer Engineering, Universite Laval, Canada;* [2]*Electrical Engineering, California Inst. of Technology, USA;* [3]*Electrical, Computer and Energy Engineering, CU Boulder, USA;* [4]*Time and Frequency, National Inst. of Standards and Technology, USA;* [5]*Physics, CU Boulder, USA.* We employ nonlinear lithium niobate nanophotonic waveguides for visible frequency comb generation spanning over 100 THz. This enables spectroscopy of molecular iodine with 10^6 modes and 100 MHz resolution.

Th1A.6 • 09:30
Low Vpi, Low Frequency Phase Modulator, Luke Qi[1], Ali Khalatpour[1], Oguz T. Celik[1], Jason Herrmann[1], Kevin Multani[1], Samuel Gyger[1], Amir Safavi-Naeini[1]; *[1]Stanford Univ., USA.* We report a novel electro-optic phase modulator in thin-film lithium niobate with sub-volt Vpi at sub-GHz frequencies. We fabricate a 25 cm-long meander waveguide and measure up to eight sidebands with a 2 Vpp drive.

Th1A.7 • 09:45
Nonlinear Upconversion Frequency Comb Spectroscopy at Low Mid-Infrared Powers, Matthew Heyrich[1], Alexander Lind[1], Scott A. Diddams[1]; *[1]CU Boulder, USA.* We demonstrate a simple, tunable, and highly sensitive nonlinear upconversion mid-infrared spectroscopy instrument with 100 MHz spectral resolution. We conduct spectroscopy on ambient carbon dioxide using a mid-infrared comb with under 100 μW of power.

10:30 -- 12:30
Room: Alohilani Ballroom 1
Th2A • Nonlinear Effects in Novel Materials and Waveguides
Presider: Frank Wise; Cornell Univ., USA

Th2A.1 • 10:30 (Invited)
Robust Multidimensional Solitary States in Hollow-Core Fibers for Ultrafast Light Source Applications, Reza Safaei[1]; *[1]INRS, Canada.* We demonstrate multidimensional solitary states (MDSS) in Raman-active gas-filled hollow-core fibers, driven by picosecond pulses compressed to tens of femtoseconds, emphasizing their multimode nature, resilience to spatiotemporal instabilities, and application potential.

Th2A.2 • 11:00 (Invited)
Spatial Beam Freezing in a Few-Mode Optical Fiber, Karolina Stefanska[1], Mario Ferraro[2], Fabio Mangini[1,3], Wasyhun A. Gemechu[1], Stefan Wabnitz[1]; *[1]Department of Information Engineering, Electronics and Telecommunications, Sapienza Università di Roma, Italy; [2]Physics Department, Univ. of Alabria, Italy; [3]Department of Engineering, Niccolò Cusano Univ., Italy.* We demonstrate a transition from positive to negative temperature of optical gas revealed by inversion of modal distribution as a power of femtosecond pulse carried by the fundamental fiber mode approaches a highly nonlinear regime

Th2A.3 • 11:30
Nanoscale THz Nonlinearity Driven by Femtosecond Laser Filamentation, Weiwei Liu[1]; *[1]Nankai Univ., China.* We achieve efficient THz third harmonics generation from the Cd_3As_2 film in near field by constructing an intense THz s-SNOM system that combines high peak power THz pulses emitted from two-color femtosecond laser filaments with a tapping mode AFM system. Additionally, the near-field third harmonic imaging with resolution of 200 nm is demonstrated.

Th2A.4 • 11:45
Optical Switching of $\chi^{(2)}$ in Diamond Photonics, Sigurd Flågan[1], Joe Itoi[1], Prasoon K. Shandilya[1], Vinaya K. Kavatamane[1], Matthew Mitchell[1,2], David P. Lake[1,3], Paul E. Barclay[1]; *[1]Univ. of Calgary, Canada; [2]Dream Photonics Inc., Canada; [3]California Inst. of*

Technology, USA. Photoinduced modification of second-harmonic generation in a diamond cavity is observed. Excitation of nitrogen-vacancy centres quenches the second-harmonic, and is attributed to modification of $\chi^{(2)}$ by photoionisation from the negative to neutral charge states.

Th2A.5 • 12:00
Non-Reciprocal Nonlinear Interactions of Optical Beams in Atomic Vapors, Juan Wu[1], Yi Hu[1], Qing Guo[1,3], Sandan Wang[3,2], Wei Gao[3,2], Jinpeng Yuan[3,2], Jingjun Xu[1], Lirong Wang[3], Lian Tuan Xiao[3], Suotang Jia[3]; *[1]Nankai Univ., China; [2]Inst. of Laser Spectroscopy, China; [3]Shanxi Univ., China.* We demonstrate non-reciprocal light interactions in atomic vapors. Driving by competing nonlinearities, two optical beams exhibit chase-and-escape motion akin to predator-prey dynamics merely upon their mutual interactions, in contrast to opposite deflections in reciprocal configurations.

Th2A.6 • 12:15
Non-Volatile Photorefractive Frequency Tuning in a Diamond Photonic Crystal Cavity, Sigurd Flågan[1], Joe Itoi[1], Elham Zohari[1,2], Waleed El-Sayed[1], Nicholas J. Sorensen[1], Paul E. Barclay[1]; *[1]Univ. of Calgary, Canada; [2]Univ. of Alberta, Canada.* We demonstrate cavity-enhanced third-harmonic generation and novel non-volatile, photorefractive blue-shifting of the resonant frequency in a diamond photonic crystal cavity with Q/V~10^5. The total frequency shifts, which exceeds the cold cavity linewidth, amounts to 2π×20.9GHz.

14:00 – 15:00
Room: Alohilani Ballroom 1
Th3A • Emerging Photonic Materials and Nonlinear Phenomena
Presider: Weiwei Liu; Nankai Univ., China

Th3A.1 • 14:00 (Invited)
Nonlinear Frequency Conversion Using Metasurfaces: Scaling and Limits, Moe Soltani[1]; *[1]Raytheon BBN Technologies, USA.* Abstract not available.

Th3A.2 • 14:30
High-Fidelity Spatial Information Transfer Through Scattering Media by an Epsilon-Near-Zero Time Gate, Yang Xu[2], Saumya Choudhary[3], Long D. Nguyen[2], Matthew Klein[4], Shivashankar Vangala[4], J. K. Miller[5], Eric G. Johnson[5], Joshua R. Hendrickson[4], Zahirul Alam[1], Robert W. Boyd[3,1]; *[1]Department of Physics, Univ. of Ottawa, Canada; [2]Department of Physics and Astronomy, Univ. of Rochester, USA; [3]The Inst. of Optics, Univ. of Rochester, USA; [4]Sensors Directorate, Air Force Research Laboratory, USA; [5]The Holcombe Department of Electrical and Computer Engineering, Clemson Center for Optical Materials Science and Engineering Technologies, USA.* We use a femtosecond four-wave mixing on ITO as a time gate to image objects through scattering media. The selected ballistic photons give an orders-of-magnitude improvement of the signal-to-noise ratio in the presence of strong optical scattering.

Th3A.3 • 14:45
Ultrafast Optical Nonlinearity and Carrier Dynamics in Anisotropic Silver Nanoparticles, Prasanta K. Datta[1], Amit K. Pradhan[1], Ayon Jyoti Karmakar[1], Suman Kumar[2], Amiya Priyam[2]; *[1]Indian Inst. of Technology Kharagpur, India; [2]Chemistry, Central Univ. of South Bihar, India.* **:** Apart from saturation of two-photon absorption, we report observation of two

distinct, prominent vibrational modes of different quality factors in silver nanoparticles (AgNPs-550) of localized surface plasmon resonance at 550 nm by femtosecond transient absorption spectroscopy.