

2024 IEEE Research and Applications of Photonics in Defense Conference (RAPID 2024)

**Miramar Beach, Florida, USA
14-16 August 2024**



**IEEE Catalog Number: CFP24N87-POD
ISBN: 979-8-3503-7310-3**

**Copyright © 2024 by the Institute of Electrical and Electronics Engineers, Inc.
All Rights Reserved**

Copyright and Reprint Permissions: Abstracting is permitted with credit to the source. Libraries are permitted to photocopy beyond the limit of U.S. copyright law for private use of patrons those articles in this volume that carry a code at the bottom of the first page, provided the per-copy fee indicated in the code is paid through Copyright Clearance Center, 222 Rosewood Drive, Danvers, MA 01923.

For other copying, reprint or republication permission, write to IEEE Copyrights Manager, IEEE Service Center, 445 Hoes Lane, Piscataway, NJ 08854. All rights reserved.

****** This is a print representation of what appears in the IEEE Digital Library. Some format issues inherent in the e-media version may also appear in this print version.***

IEEE Catalog Number:	CFP24N87-POD
ISBN (Print-On-Demand):	979-8-3503-7310-3
ISBN (Online):	979-8-3503-7309-7
ISSN:	2836-6824

Additional Copies of This Publication Are Available From:

Curran Associates, Inc
57 Morehouse Lane
Red Hook, NY 12571 USA
Phone: (845) 758-0400
Fax: (845) 758-2633
E-mail: curran@proceedings.com
Web: www.proceedings.com

CURRAN ASSOCIATES INC.
proceedings
.com

TABLE OF CONTENTS

POSTER SESSION

Fast Optical Reconfigurable Intelligent Surfaces	1
<i>Waabee Geshow, Jeffery Allen, Monica Allen, Weidong Zhou</i>	

THA1: ULTRAFAST AND NONLINEAR NANOPHOTONICS

PW IR Sensing with MEMS Coupled to Metasurfaces	3
<i>M. E. Gulseren, M. Bensen, Z. Lin, R. Parker, J. S. Gomez-Diaz</i>	

THC1: HUMAN STATE MEASUREMENT

Deep Reinforcement Learning Control of an Avatar and Exoskeleton.....	5
<i>R. Dizor, A. Raj, B. Gonzalez</i>	
Higher Harmonic Spectra of Radio Frequency Biomarker Responses Enable Label-Free Biosensing.....	7
<i>Tate Fisher, Dharmakeerthi Nawarathna</i>	
Human Task Performance on Detecting Distant Targets Under Cluttered Background in NIR and LWIR.....	9
<i>L. Zhang, M. Martino, Orges Furshi, E. Jacobs, R. Driggers, C. K. Renshaw</i>	

THE1: TERAHERTZ PHOTONICS

Terahertz Imaging Through Dust.....	11
<i>Zachary R. Spencer, Daniel Heligman, Rajind Mendis</i>	

THA2: EMERGING MATERIAL PLATFORMS FOR NANOPHOTONICS

Gain-Shaped Terahertz Quantum Cascade Laser Frequency Combs.....	13
<i>Mithun Roy, Zhenyang Xiao, Sadhvikas Addamane, David Burghoff</i>	

THC2: HUMAN STATE MEASUREMENT

Controlled Concentration of Short DNA Molecules on the Electrodes Using AC Electric Fields and Capillary Flow	15
<i>Akila Wijesinghe, Ridhanya Sree Balamurugan, Umamaheswara Rao Tida, Dharmakeerthi Nawarathna</i>	
Plasmonic Biosensors for Real-Time Monitoring of Harmful Pathogens and Biomolecules.....	17
<i>F. Petronella, M. L. Sforza, F. Zaccagnini, A. Masi, D. De Biase, E. De Marinis, C. Nervi, A. D'Alessandro, L. De Sio</i>	
Real-Time Hydration Biomarker Monitoring Via Optical Sensor Microneedle Arrays	19
<i>Lawrence A. Renna, Kyle Brubaker, Eric Kroon, Paul Dicarmine, Megan Sax Van Der Weyden, Shane Caswell, Joel Martin, Andrew Koch</i>	

THA3: ACTIVE PLASMONICS AND NANOPHOTONICS

Epsilon-Near-Zero Photonics in Planar and Optical Fiber Platform	21
<i>Quynh Dang, David Dang, Aleksei Anopchenko, Christopher M. Gonzalez, S. Love, C. Effarah, S. Kunnavakkam, Yu-Hsun Chen, W. Yang, J. Wright, A. Hou, Howard Ho Wai Lee</i>	

THB3: INTEGRATED QUANTUM PHOTONICS

Characterization of Hot-Carrier Enhanced Pixels for Out-Of-Band CMOS Camera	22
<i>Matthew E. Spotnitz, Zachary Piontkowski, Raktim Sarma, Nickolas J. Karl, Mason J. Risley, Deanna M. Campbell, Evan M. Anderson, D. Bruce Burckel</i>	
Low Size, Weight, and Power Frequency Comb Modules for Deployed Optical Clocks, Radar Systems, and Quantum Sensors	24
<i>H. Timmers, A. Attar, B. Sodergren, N. Phillips, K. Vogel, K. Knabe</i>	

THC3: SEMICONDUCTOR MATERIALS AND QUANTUM NANOSCIENCE

Exploring AlGaInP for Use in Si Photomultiplier Analogs	26
<i>Evan M. Anderson, Andrew M. Armstrong, Lisa A. Caravello, Eduardo Garcia, Joseph P. Klesko, Samuel D. Hawkins, John F. Klem, Eric A. Shaner, Aaron J. Muhowski</i>	

THD4: TWO-DIMENSIONAL MATERIALS & TOPOLOGICAL PHOTONICS

Intercalated Graphene and Colloidal Quantum Dots as a Novel Architecture for UV/Vis/NIR Multispectral Photodetection	28
<i>J. Y. Shang, S. Ahn, J. Y. Shang, O. Vazquez Mena</i>	
Topological Insulator Based Polarization Sensitive Detection	30
<i>E. Y. Paik, O. A. Vail, P. J. Taylor, G. J. De Coster, B. C. Connelly</i>	

THE3: UV OPTOELECTRONICS

Development of High Power UVC LED Devices	32
<i>R. Randive, L. Fecteau, P. Aigeldinger</i>	

THC4: SCALABLE MANUFACTURING AND RAPID PROTOTYPING FOR PHOTONICS

THz-Frequency Free-Standing Bi-Layer Wire Grid Polarizers Fabricated by Stereolithography	34
<i>Dustin Louisos, Micheal McLamb, Glenn D. Boreman, Jincheng Zhang, Andrew Willis, Tino Hofmann, Jimmy E. Tuma</i>	

THD5: MODELING AND SIMULATION FOR ADVANCED PHOTONICS

Circuit Theory for Anomalies in Light Scattering	36
<i>Deepanshu Trivedi, Arjuna Madanayake, Alex Krasnok</i>	
A Modular Electromagnetic Model Framework: Concept and Example	38
<i>M. Schmitt, J. Keiper, M. Lear, J. Tuma</i>	

Enhancing the MEMS Gyroscope Physical Assurance Using Quantum Sensing.....	40
<i>Himanandhan Reddy Kottur, Aslam A. Khan, Nitin Varshney, Liton Kumar Biswas, Hamed Dalir, Navid Asadizanjani</i>	

FC1: RF AND OPTICAL TARGET IMAGING, IDENTIFICATION, AND PATTERN RECOGNITION

Improvements in Target Detection Using Machine Learning.....	42
<i>S. P. Bragdon, V. H. Truong, J. L. Clausen, M. I. Bishop</i>	
Data-Driven Reduced Order Models for Radar Imaging in Multi-Scattering Environments	44
<i>M. Zaslavsky, S. Moskow, V. Druskin</i>	
Using Hybrid Optical-Electronic Neural Network for Demultiplexing Multiplexed Orbital Angular Momentum Beams	46
<i>Jiachi Ye, Haoyan Kang, Belal Jahannia, Chandraman Patil, Hao Wang, Elham Heidari, Navid Asadizanjani, Hamed Dalir</i>	
Compact Photonic Microwave System for RADAR and EW Applications	48
<i>M. Giunta, B. Rauf, I. Baldoni, R. Zeltner, S. Peschl, J. Schulz, J. Schorer, J. Reeves, M. Fischer, R. Holzwarth</i>	
An Equivalent Currents Approach to Generating Simulated Training Data for RF Image Classifiers.....	50
<i>Matthew J. Burfeindt, Hatim F. Alqadah</i>	

FD1: RESONANT PHOTONIC LATTICES: PRINCIPLES AND APPLICATIONS

Photonic Lattice Physics: Singular States, Rytov Solutions, and Effect of Defects	52
<i>Fairooz Abdullah Simlan, Yeong Hwan Ko, Kyu Jin Lee, Robert Magnusson</i>	
Dual-Stacked Photonic Crystal for Transmissive Filtering Fabricated by Two-Photon Polymerization.....	54
<i>V. Paige Stinson, Micheal McLamb, Nuren Shuchi, Dustin Louisos, Glenn D. Boreman, Tino Hofmann</i>	
Tunable Long-Wave Infrared Filters Based on a Dense Array of Resonance Cavities and Phase-Change Materials.....	56
<i>Matthew Klein, Shivashankar R. Vangala, Joshua R. Hendrickson, Dylan Morden, Ivan Avrutsky</i>	

FE1: PHOTONICS AND FUTURE WARFIGHTER OPERATIONAL CONCEPTS

Flexible Thermochromic Coatings for Thermal Management.....	58
<i>Andrew P. Warren, James Ginn</i>	
Progress Toward Production Grade Infrared LED Scene Projector Systems	60
<i>F. Kiamilev, H. Ahmed, R. McGee, A. Deputy, J. Singh, T. Browning, B. Steenkamer, T. Lassitter, M. Greenlee, M. Joyce, L. Kiamilev</i>	
High Gain Low Noise InGaAs Avalanche Photodiode.....	63
<i>A. Patadia, R. S. Kim</i>	

FF1: NOVEL MATERIALS FOR PHOTONICS

- Modifying Thermal Signatures with the Plasmonic Phase-Change Material In_3SbTe_2 65
L. Conrads, T. Taubner
- Light Absorption Enhancement in a Textured Subwavelength Mercury Cadmium Telluride Layer 67
Md. Sojib, V. Sheremet, M. F. Rabbe, S. Ganguly, N. K. Dhar

FB2: ADVANCES IN CHIP-SCALE UV, VISIBLE AND NEAR-IR OPTOELECTRONICS AND PHOTONICS

- Sub-Nanosecond Periodic Pulsing Via Gain Switching in a Large Array of Semiconductor Blue Lasers 69
Olivier Spitz, Parashu Nyaupane, Yehuda Braiman

FC2: SPECTRAL, POLARIMETRIC, AND MULTIMODAL IMAGING

- A Scientific Approach for Unidentified Anomalous Phenomena Study 71
Randall L. Bostick
- Occlusion-Aided 3D Non-Line-Of-Sight Imaging Without Time-Resolved Measurements 73
Fadlullah Raji, John Murray-Bruce
- Cloud-Edge Framework for Multi-Vehicle Deployment Control Using Spiking Neural Networks 75
Yaser Mike Banad, Sarah Safura Sharif
- Multiband Strain Balanced Superlattice Material System for Third Generation Infrared Detectors 77
Arash Dehzangi

FD2: OPTICAL METAMATERIALS BASED DEVICES AND APPLICATIONS

- Exploiting Quasi-Optics and Near-Field Trajectory Engineering for THz Communications 79
Hichem Guerboukha
- Nonlocal Dielectric Metalens for Long-Wavelength Infrared Imaging 81
S. Guddala, F. De Luca, A. C. Overvig, J. Touma, A. Alù
- A Dual-Band Leaky Wave Antenna Design for K-Band and W-Band 83
Andrew Willis, Jincheng Zhang, Dustin Louisos, Tino Hofmann, Jimmy E. Touma
- Wide-Field-Of-View Multi-Wavelength Metalens 85
F. De Luca, A. C. Overvig, M. Lucente, J. Touma, A. Alù
- Nanostructured Films for Advancing Meta-Optics and Surface Processing 87
Md Sakibul Islam, Neal Raney, Dominic Bosomtvi, Vahid Karimi, Viktoriia E. Babicheva
- Control of Light in Three Dimensions Using Spatially Variant Photonic Crystals 89
A. Volk, A. Rai, Z. Bolatbek, I. Agha, R. Gnawali, J. E. Touma

FE2: EO/IR/LADAR

Radiance Field Sampling for Unresolved Specular Object Classification.....	91
<i>G. Nero, G. Hageman, A. Alghamdi, D. Brady</i>	

FF2: OPTICAL METASURFACES AND APPLICATIONS

Periodic Multipolar Arrangement for Photodetector and Tailored Emissivity Metasurfaces	94
<i>Vahid Karimi, Md Sakibul Islam, Viktoriia E. Babicheva</i>	
Exploring Curved Metasurface Optics	96
<i>D. Bruce Burckel, William C. Sweatt, Charles M. Reinke</i>	
Controlling Light with Optical Metasurfaces and Chiral Liquid Crystals.....	98
<i>L. De Sio, F. Zaccagnini, F. Petronella, J. Slagle, T. Bunning</i>	
Infrared Absorption Studies on BSA-Templated Gold Nanocrystals on Silicon Metasurface Supporting Quasi Bound-State-In-Continuum Resonance	100
<i>Urmila Bag, A. S. Lal Krishna, Karima J. Perry, Shashi P. Karna, Varun Raghunathan</i>	

FB3: MICROWAVE OPTICS AND RF PHOTONICS

Super-Bandwidth Detection Using a Real-Time, Gapless Broadband Photonics Spectrogram with High Frequency Resolution.....	102
<i>Connor Rowe, Benjamin Crockett, Xinyi Zhu, José Azaña</i>	
Time-Varying Microwave Photonic Filter Over 46-GHz Bandwidth with High Tuning Speed.....	104
<i>Xinyi Zhu, Benjamin Crockett, Connor M. L. Rowe, Hao Sun, José Azaña</i>	

FC3: OPTICAL DETECTORS/SENSORS

Hybrid Photonic-Plasmonic Littrow Retroreflectors.....	106
<i>Grant W. Bidney, Igor Anisimov, Dennis E. Walker, Gamini Ariyawansa, Vasily N. Astratov</i>	

FD3: COMPLEX NANOMATERIALS WITH TUNABLE CHIRALITY AND/OR NONLINEARITY

Nanomaterials for Ultrafast and Chiral Plasmonics	108
<i>Anton Bykov, Yuanyang Xie, Jingyi Wu, Vittorio Aita, Anastasia Zaleska, Anatoly V. Zayats</i>	

FE3: DEVICES AND SYSTEMS FOR SENSORS

Silicon Photonics Under Siege: Unveiling Security Vulnerabilities Against SAW	110
<i>Liton Kumar Biswas, Rouhan Noor, H. Reddy Kottur, Aslam A. Khan, Nitin Varshney, Hamed Dalir, Navid Asadizanjani</i>	
Advancing PCB Assurance Towards Netlist Extraction with the Integration of X-Ray Imaging and Semi-Supervised Learning Techniques	112
<i>Patrick Craig, Antika Roy, Nitin Varshney, Navid Asadizanjani</i>	

Optical Signal Transport on Aerospace Platforms: ADC-Defined Limits on Digital Link Implementation.....	114
<i>M. Hoff, S. Ralph, R. Stevens</i>	
Characterization of Partially Diffuse Objects with Photonic Lanterns.....	116
<i>W. D. Larson, C. J. Matamoros, D. Leaird, C. Keyser</i>	
Manipulating Self-Collimation to Guide and Multiplex Light Using Photonic Crystals	118
<i>A. Volk, E. Vantilburg, A. Rai, Z. Bolatbek, I. Agha, R. Gnawali, J. E. Tuma</i>	
Revolutionizing Infrared Detection in Defense Applications: A Nanophotonic Approach Leveraging 2D Materials for Enhanced Mid-IR Absorption	120
<i>Sarah S. Sharif, Yaser Mike Banad</i>	

FF3: SPECIALTY OPTICAL FIBERS

Inhibited-Coupled Multi-Mode Hollow-Core Anti-Resonant Fibers for High Power Applications.....	122
<i>Mohammad Al Mahfuz, Yiqing Dong, Md Selim Habib</i>	
Low-Loss near-UV Light Transmission Through Anti-Resonant Hollow-Core Fiber	124
<i>Md Abu Sufian, Stephanos Yerolatsitis, Ameen Alhalemi, Joseph Wahlen, Mohammad Al Mahfuz, Md Selim Habib, Daniel Cruz-Delgado, J. E. Antonio-Lopez, Rodrigo Amecua-Correa, Axel Schülzgen</i>	
Nested Anti-Resonant Hollow-Core Fiber for Low-Loss Multi-Mode Guidance	126
<i>Md Abu Sufian, Stephanos Yerolatsitis, Ameen Alhalemi, Joseph Wahlen, Mohammad Al Mahfuz, Md Selim Habib, J. E. Antonio-Lopez, Rodrigo Amecua-Correa, Axel Schülzgen</i>	
Stimulated Raman Scattering in Oxygen-Filled Fiber for Atmospheric Transmission Optimized LiDAR.....	128
<i>Trevor L. Courtney, Micah Raab, Cesar Lopez-Zelaya, Daniel Leaird, Rodrigo Amecua-Correa, Christian Keyser</i>	
Measurement of Raman Gain Coefficients for Liquid-Filled Fiber Multispectral Lasers	130
<i>Cesar Lopez-Zelaya, Debasmita Banerjee, Ryan Woodward, Trevor L. Courtney, Alfons Schulte, Christian K. Keyser</i>	

FC4: OPTICAL DETECTORS/SENSORS

Polarization-Dependent Absorption in GaSb-Based Quantum Cascade Detectors	132
<i>M. Giparakis, S. Isceri, A. Windischhofer, W. Schrenk, B. Schwarz, G. Strasser, A. M. Andrews</i>	
Ge-On-Si APD with Diagonal Dual Injection in 45nm SOI SiPh Process	134
<i>Md Nabil Shehtab Dhrubo, Robert F. Karlicek, Mona M. Hella</i>	

Author Index