Explanation of Session Codes

M1C.4

Day Of The Week
S = Sunday
M=Monday
T=Tuesday
W=Wednesday
Th=Thursday

Series Number
1 = First series of sessions in day
2 = Second series of sessions in day

Session Designation
(alphabetically)

Number
(Presentation order within the session)

The first letter of the code denotes the day of the week (Sunday=Sunday, Monday=M, Tuesday=Tu, Wednesday=W, Th=Thursday). The second element indicates the session series in that day (for instance, 1 would denote the first parallel sessions in that day). Each day begins with the letter A in the third element and continues alphabetically through a series of parallel sessions. The lettering then restarts with each new series. The number on the end of the code (separated from the session code with a period) signals the position of the talk within the session (first, second, third, etc.). For example, a presentation coded M1C.4 indicates that this paper is being presented on Monday (M) in the first series of sessions (1), and is the third parallel session (C) in that series and the fourth paper (4) presented in that session.

The information in this program is as of 27 February 2025. All times reflect Pacific Daylight Time (PDT, UTC-07:00). Please consult the conference app for the latest changes.

Technical Registrants: Download digest papers by visiting ofcconference.org and clicking on the "Download Technical Digest Papers" from the right column navigation on the home page.

Recorded sessions are also available 24 hours after the session by navigating to the Schedule tab. Select a session and click the "Watch Recorded Session" button.

Agenda of Sessions — Sunday, 30 March

	Rooms 201-202	Rooms 203-204	Rooms 205-206	Rooms 209-210	Rooms 211-212	Rooms 213-214	Room 215
07:00–19:00	**Registration Open,** *South Lobby, Moscone Center*						
08:30–12:30	**SC105, SC203, SC395, SC432, SC463, SC469, SC470***						
09:00–12:00	**SC177, SC359, SC459***						
13:00–15:30	**S1A • What Will Future Subsea Systems Look Like: Secured and Resilient Networks, Pluggable vs Multicore Interfaces, Solid Vs Hollow Core Fiber?**	**S1B • Networks of the Future and Next-Generation Production**	**S1C • How to Get More Out of Fiber Access Networks?**	**S1D • Linear Algebra Optics: Applications and Commercial Perspectives**	**S1E • Telecom and Sensing Living Together: Is it a Healthy Relationship?**	**S1F • Is Coherent DSP Solved? Are we Running Out of Innovation?**	**S1G • High Power and Multi-Wavelength Laser Light Sources: How Can They Address the Needs of AI/ML Interconnect?**
13:00–16:00	**SC408, SC485, SC512***						
13:00–17:00	**SC267, SC514***						
13:30–17:30	**SC216, SC384***						
15:30–16:00	**Coffee Break,** *Level 2 Corridors*						
16:00–18:30	**S2A • Are we Ready for Hollow Core Fiber Networks?**	**S2B • How do Co-Packaged Optics Become Manufacturable?**	**S2C • Watts the Limit? Powering Optical Network Growth**	**S2D • Unifying Control and Management of Disaggregated Networks with Pluggable Transponders - Who Controls the Pluggables?**	**S2E • Short and Sweet: How Do We Cost-Optimize a 10 Meter Link for Scaling Up Machine Learning Clusters?**	**S2F • Towards 400G/λ IM-DD: How to Pick up the Next Factor of 2?**	
19:00–21:00	**Hack Your Research! Tools and Tricks for Today's Telecommunications Techies,** *Room 303*						

*Short Courses are an excellent training opportunity to learn about new products, cutting-edge technology and vital information at the forefront of communications. They are offered Sunday and Monday and require an additional fee. Go to ofcconference.org/shortcourse for a list of available short courses and the format in which they will be offered or go to pages 2-3.

Agenda of Sessions — Monday, 31 March

	Rooms 201-202	Rooms 203-204	Rooms 205-206	Room 207	Room 208
07:00–18:30	**Registration Open,** *South Lobby, Moscone Center*				
08:00–18:00	**Optica Executive Forum,** *Lower B2 Level, Marriott Marquis (separate registration required)*				
08:00–10:00	**M1A • The Year of Quantum: Applications, Architectures and Enabling Technologies for Quantum Communication and Computing I**	**M1B • Submarine Transmission**	**M1C • Sensing Applications I**	**M1D • Multi-Mode and Polarization-Dependent Devices**	**M1E • System Characterization and Monitoring**
08:30–12:30	**SC369, SC393, SC443, SC444, SC448, SC452, SC453A, SC454, SC461, SC473, SC483, SC487, SC513, SC525, SC527***				
09:00–12:00	**SC114, SC465***				
10:00–10:30	**Coffee Break,** *Level 2 Corridors*				
10:30–12:30	**M2A • The Year of Quantum: Applications, Architectures and Enabling Technologies for Quantum Communication and Computing II**	**M2B • Next-Generation Intra-Data Center Connectivity for the AI Era: Meeting Hyperscale Demands with Advanced Technologies**	**M2C • Sensing Applications II**	**M2D • Applications of Passive Photonics**	**M2E • Digital Signal Processing, Machine Learning and Electrically-Enhanced Phase Noise**
12:45–13:45	**Optica Panel Discussion on Women at the Forefront of Optical Communication** *(RSVP requested), Rooms 203-204*				
13:30–16:30	**SC217, SC261, SC447, SC526***				
13:30–17:30	**SC160, SC325, SC327, SC357, SC431 SC433 SC451, SC453B, SC528***				
14:00–16:00	**M3A • Generative AI in Networking: From Proof of Concept to Production I**	**M3B • Open Optical Networks for 6G: Do we take the O-RAN path or blaze new trails?**	**M3C • High Symbol Rates Transceivers**	**M3D • Satellite and THz Communications**	**M3E • Integration and Devices for Quantum Systems**
14:00–16:00	**M3Z • Demo Zone,** *Room 303*				
16:00–16:30	**Coffee Break,** *Level 2 Corridors*				
16:30–18:30	**M4A • Generative AI in Networking: From Proof of Concept to Production II**	**M4B • Beyond Telecom: Illuminating Opportunities in Network-Scale Fiber Sensing**	**M4C • Datacenter Interconnect**	**M4D • Optical and Microwave Signal Processing**	**M4E • Quantum Entanglement and Computing (ends at 18:45)**
19:00–21:00	**Student Party,** *Lucky Strike Bowling*				

*Short Courses are an excellent training opportunity to learn about new products, cutting-edge technology and vital information at the forefront of communications. They are offered Sunday and Monday and require an additional fee. Go to ofcconference.org/shortcourse for a list of available short courses and the format in which they will be offered or go to pages 2-3.

Rooms 209-210	Rooms 211-212	Rooms 213-214	Room 215	Room 301	Room 304
Registration Open, *South Lobby, Moscone Center*					
Optica Executive Forum, *Lower B2 Level, Marriott Marquis (separate registration required)*					
M1F • Hollow and Solid Core Ultra Low Loss Fibers	**M1G • Datacenter IM/DD I**	**M1H • Space-Division Multiplexing and Hollow-Core Fiber Transmission**	**M1I • Optical X-Haul and In-Door Architectures**	**M1J • Intelligent and Autonomous Network Management**	**M1K • Light-Source and Integration I**
SC369, SC393, SC443, SC444, SC448, SC452, SC453A, SC454, SC461, SC473, SC483, SC487, SC513, SC525, SC527*					
SC114, SC465*					
Coffee Break, *Level 2 Corridors*					
M2F • Hollow-Core Fiber Characterizations and Applications	**M2G • Datacenter IM/DD II**	**M2H • Optical Transceiver Technologies**	**M2I • Coherent Access Networks**	**M2J • LiDAR, Ranging and Urban Demonstrations**	**M2K • Light Source and Integration II**
Optica Panel Discussion on Women at the Forefront of Optical Communication *(RSVP requested)*, *Rooms 203-204*					
SC217, SC261, SC447, SC526*					
SC160, SC325, SC327, SC357, SC431 SC433 SC451, SC453B, SC528*					
M3F • Multicore, Hollow Core, and Fiber-Based Networking	**M3G • Novel Materials, Metamaterial and Reconfigurable Devices**	**M3H • Sensing and Monitoring for Network Control and Management**	**M3I • Optical Switches for Datacenters**	**M3J • Lasers and Ranging**	**M3K • Modulators with Silicon and Alternative Materials**
M3Z • Demo Zone, *Room 303*					
Coffee Break, *Level 2 Corridors*					
M4F • Advanced Fibers and Applications	**M4G • Free Space Optical Communications (FSOC) (ends at 18:45)**	**M4H • Networks with Optical Circuit Switching**	**M4I • Access Network Coexistence and Convergence**	**M4J • Fiber and Chip Coupling Interfaces**	**M4K • Advancement of Integrated PD and APD**
Student Party, *Lucky Strike Bowling*					

Agenda of Sessions — Tuesday, 01 April

	Rooms 201-202	Rooms 203-204	Rooms 205-206	Room 207	Room 208	Rooms 209-210	Rooms 211-212
07:00–18:30	**Registration Open,** *South Lobby, Moscone Center*						
07:30–08:00	**Joint Plenary Session Coffee Break,** *Outside of Esplanade Ballroom*						
08:00–10:00	**Tu1A • Plenary Session,** *Esplanade Ballroom*						
10:00–17:00	**Exhibition,** *Halls A-F* (concessions available)						
10:00–14:00	**Unopposed Exhibit-only Time,** *Exhibition Halls A-F* (coffee service 10:00–10:30)						
10:30–12:00	**The Art of Writing the Perfect OFC Paper,** *Room 104*						
12:30–14:00	**OFC and Co-Sponsors Awards Ceremony and Luncheon,** *Separate registration required. Salon 9, Marriott Marquis Hotel*						
14:00–16:00	**Tu2A • Hybrid Satellite/ Terrestrial Networks: Where Does the Fiber End, and Satellite Take Over? I**	**Tu2B • Open-Access Design Platforms for PICs: Driving Sustainable Innovation**	**Tu2C • Summit on Optics for AI Datacenters**	**Tu2D • Quantum and Classical Security**	**Tu2E • Doped Fiber Lasers and Amplifiers I**	**Tu2F • Modulation and Coding**	**Tu2G • Filters, Multiplexers and Resonators**
16:00–16:30	**Coffee Break,** *Level 2 Corridors and Exhibition Halls A-F*						
16:30–18:30	**Tu3A • Hybrid Satellite/ Terrestrial Networks: Where Does the Fiber End, and Satellite Take Over? II**	**Tu3B • Crafting Fiber Access Networks for Service Excellence Assurance**	**Tu3C • Novel Subsystem Concepts**	**Tu3D • Practical Quantum Networks and Coexistence**	**Tu3E • Doped Fiber Lasers and Amplifiers II**	**Tu3F • Optical AI Evaluation and Sensing**	**Tu3G • Optical Interconnect Technologies**
17:15–18:15	**Exhibitor Happy Hour,** *Esplanade Ballroom, Mezzanine*						
18:30–20:00	**Conference Reception,** *Salons 7-9, Lower B2 Level, Marriott Marquis Hotel*						
19:30–21:00	**Rump Session: If a Global Disaster Struck and all the Optical Infrastructure was Wiped Out, Would You Rebuild with Today's Mainstream Technologies?,** *Rooms 203-204*						

Rooms 213-214	Room 215	Room 301	Room 304
Registration Open, *South Lobby, Moscone Center*			
Joint Plenary Session Coffee Break, *Outside of Esplanade Ballroom*			
Tu1A • Plenary Session, *Esplanade Ballroom*			
Exhibition, *Halls A-F* (concessions available)			
Unopposed Exhibit-only Time, *Exhibition Halls A-F* (coffee service 10:00–10:30)			
The Art of Writing the Perfect OFC Paper, *Room 104*			
OFC and Co-Sponsors Awards Ceremony and Luncheon, *Separate registration required. Salon 9, Marriott Marquis Hotel*			
Tu2H • Optical Network Optimization and Routing	**Tu2I • Coherent PON Optimization**	**Tu2J • Modulator Structures with EML, Thin Film LN and Ring-Based**	**Tu2K • Stable Lasers and Applications in Fiber Sensing**
Coffee Break, *Level 2 Corridors and Exhibition Halls A-F*			
Tu3H • Programmable and Interferometric Photonics Processors	**Tu3I • Advanced Transmission Technologies**	**Tu3J • Integarted Micro-Ring and Micro-Disk Modulators**	**Tu3K • Modelling for Ultra-Wideband Transmission**
Exhibitor Happy Hour, *Esplanade Ballroom, Mezzanine*			
Conference Reception, *Salons 7-9, Lower B2 Level, Marriott Marquis Hotel*			
Rump Session: If a Global Disaster Struck and all the Optical Infrastructure was Wiped Out, Would You Rebuild with Today's Mainstream Technologies?, *Rooms 203-204*			

Expo Theater I CISCO ACACIA	Expo Theater II Amphenol COMMUNICATIONS SOLUTIONS	Expo Theater III OFC net
Exhibition Opens 10:00		
MW1 • State of the Industry **10:45–12:15** **MW2 • New Technologies Driving Spectral Efficiency Gains in Next-Gen Networks - Beyond Modems** **12:30–14:00** **MW3 • Optical Modules, Transceivers and Applications** **14:15–15:45** **The Journey to Optimize Converged IP and Optical** **16:00–17:00**	**SF1 • OPC: Lighting the Path to Exascale AI: Photonics in High-Performance Clusters** **10:45–11:45** **DCS • Keynote: Potential Brick Walls in the Age of AI/ML** **12:00–12:30** **DCS1 • Trends at Data Centers. Architectures, Enablers and Challenges** **12:30–14:00** **DCS2 • The Impact of AI on Networking Inside and Outside of the Date Center** **14:15–15:45** **SF2 • IEEE Future Directions: The Emerging Photonics Ecosystem for AI/ML Interconnects.** **16:00–17:00**	**SF3 • MOPA: Optical Solutions for Open Cloud RAN with 6G** **11:00–12:00** **Tech Showcase: Optimized Interconnect for Ethernet Scale-Out and Scale-Up** BROADCOM **12:15–12:45** **Tech Showcase: Lighting the Future, Open Optical Networking at the Intersection of AI and Photonics** Infinera **13:00–13:30** **OFCnet Overview and Architecture Focus** **13:45–14:15** **SF4 • OpenROADM MSA Updates and Demonstration** **14:30–15:30** **Fiber Sensing** **15:45–16:15** **Applications - Timing Presentation** **16:30–17:00**
Exhibition Closes 17:00		

Agenda of Sessions — Wednesday, 02 April

	Rooms 201-202	Rooms 203-204	Rooms 205-206	Room 207	Room 208	Rooms 209-210	Rooms 211-212
06:00–07:00	**OFC Fun Run/Walk,** *Dr. Martin Luther King Fountain, 750 Howard Street*						
07:30–18:00	**Registration Open,** *South Lobby, Moscone Center*						
08:00–10:00	**W1A • Network Evolution and AI**	**W1B • Which Phase Tuning Technologies Have the Potential to Supplant Thermal Tuning in Silicon Photonics?**	**W1C • Submarine and Field Trials**	**W1D • Optical Signal Processing**	**W1E • Datacenter Wavelength and Mode Multiplexing**	**W1F • High-Speed Direct-Detection PON**	**W1G • Light-Source, QD and Comb**
10:00–17:00	**Exhibition,** *Halls A-F, (concessions available, coffee service 10:00–10:30)*						
10:00–14:00	**Unopposed Exhibit-only Time,** *Exhibition Halls A-F*						
10:30–12:30	**W2A • Joint Poster Session I,** *Room 303*						
12:00–13:00	**Optica Panel Discussion on Challenges and Solutions for Enabling Distributed Fiber Optical Sensing Networks,** *(RSVP requested) Rooms 203-204*						
12:30–14:00	**The Journal Review Process: All You Need to Know!,** *Room 104*						
14:00–16:00	**W3A • Advanced Packaging and Integrated Optics for Scale-Up AI interconnects I**	**W3B • Towards Operational Large-Scale Quantum Networks**	**W3C • Multi-Core Fibers**	**W3D • Photonics Enabled High Performance Computing**	**W3E • Optical Performance Monitoring and Longitudinal Power Monitoring**	**W3F • Switches and Control of Photonic Circuits**	**W3G • Imaging and Shape Sensing**
16:00–16:30	**Coffee Beak,** *Level 2 Corridors and Exhibition Halls A-F*						
16:30–18:30	**W4A • Advanced Packaging and Integrated Optics for Scale-Up AI interconnects II**	**W4B • In Future Fixed Access, is Monitoring Built in For Free?**	**W4C • SDM Fiber Cables**	**W4D • Novel Photonic Computing and Switching Paradigms**		**W4E • Advanced Optical and Electronic Techniques in Transmission**	**W4F • Integrated Sensing and Communication in RoF/FSO (ends at 18:45)**
17:00–18:00	**Network Operator Happy Hour,** *Mezzanine Alcove*						
17:00–19:00	**Photonics Society of Chinese Heritage: Photonics Horizons: the Future of AI, Computing, and Connectivity,** *Room 208*						

Rooms 213-214	Room 215	Room 301	Room 304
OFC Fun Run/Walk, *Dr. Martin Luther King Fountain, 750 Howard Street*			
Registration Open, *South Lobby, Moscone Center*			
W1H • Optical Wireless Communication (OWC)	**W1I • Waveguide Devices Based on Nonlinearities**	**W1J • Long-Distance and CV-QKD**	**W1K •Modelling and Nonlinearity Mitigation/ Compensation**
Exhibition, *Halls A-F, (concessions available, coffee service 10:00–10:30)*			
Unopposed Exhibit-only Time, *Exhibition Halls A-F*			
W2A • Joint Poster Session I, *Room 303*			
Optica Panel Discussion on Challenges and Solutions for Enabling Distributed Fiber Optical Sensing Networks, *(RSVP requested) Rooms 203-204*			
The Journal Review Process: All You Need to Know!, *Room 104*			
W3H • Coherent and Direct Detect Transmission Technologies	**W3I • Radio-over-Fiber (RoF) Transmission**	**W3J • Sensing and Protection in Access Networks**	**W3K • Specialty Fiber Devices I**
Coffee Beak, *Level 2 Corridors and Exhibition Halls A-F*			
W4G • Digital Twins in Network Control and Management	**W4H • Machine Learning DSP**	**W4I • CV-QKD and Frequency Combs**	**W4J • Specialty Fiber Devices II**
Network Operator Happy Hour, *Mezzanine Alcove*			
Photonics Society of Chinese Heritage: Photonics Horizons: the Future of AI, Computing, and Connectivity, *Room 208*			

Expo Theater I	Expo Theater II	Expo Theater III
Exhibition Opens at 10:00		
NOS • Keynote: Empowering Hyper-Connected Digital Ecosystems with Programmable Networks 10:15–10:45 **NOS1 • Panel I: Interoperation of Optical Pluggable Transceivers and IP/Optical Integration 10:45–12:15** **NOS2 • Panel II: Optical Access, Radio Access Networks, Front- and Backhaul 12:30–14:00** **MW4 • Inside Data Centers: Pluggable Optics Evolution 14:15–15:45** **SF5 • OIF: Coherent Optics Unleashed: 400ZR Success to 800ZR/LR Advancements and 1600ZR/ZR+ Kick-off 16:00–17:00**	**SF6 • Ethernet Alliance: Will the Complexity and Higher Link Speeds of Hyperscale Data Centers Hinder Interoperability? 10:15–11:15** **SF7 • Open XR Optics Forum: Open XR Optics Update 11:30–12:30** **SF8 • ITU-T SG15: Standards Update on Higher Speed PON, Latest OTN Technologies and Interoperable Optical Interfaces 12:45–13:45** **SF9 • AIM Photonics Presents PICs, Heterogeneous Integration, and Packaging for Next-Gen Integrated Photonics 14:00–15:00** **Shining Light on Interconnect Trends Shaping Tomorrow's Data Centers 15:15-16:15** **Network Operator Briefing 16:30–17:00**	**Tech Showcase: Source to Solutions, Semiconductor Devices and Fiber Lasers 10:15–10:45** **Tech Showcase: Advanced Circuit Board Technology for High Speed Optical Interconnects 11:00–11:30** **Application Demonstrations - Network Performance 13:00–13:30** **SF10 • ETSI F5G: Advances in International Standards on Optical Networks Towards 2030 13:45–14:45** **Tech Showcase: Arrayed Fiberoptics Innovative Multi-Fiber Connectors for the AI Age 15:00–15:30** **The Marriage of AI and Optical Networking - Lightwave Panel 15:45–16:45**
Exhibition Closes at 17:00		

Agenda of Sessions — Thursday, 03 April

	Rooms 201-202	Rooms 203-204	Rooms 205-206	Room 207	Room 208	Rooms 209-210	Rooms 211-212
07:30–16:30	**Registration Open,** *South Lobby, Moscone Center*						
8:00–10:00	**Th1A • Machine Learning for Network Operations**	**Th1B • Weather Resilient Communications of the Future**	**Th1C • Optical Computing**	**Th1D • Coherent for Datacenters**	**Th1E • Advanced Modulator and Detectors**	**Th1F • Photonic Advancements for Scalable and Secured Networks**	**Th1G • Low Loss Passives**
10:00–16:00	**Exhibition,** *Halls A-F, (concessions available, coffee service 10:00–10:30)*						
10:00–14:00	**Unopposed Exhibit-only Time,** *Exhibition Halls A-F*						
10:30–12:30	**Th2A • Posters Session II,** *Room 303*						
14:00–16:00	**Th3A • Frontiers of Optical Network Architecture Summit – Network Architecture Evolution in the Age of AI**	**Th3B • What Building-to-Building Optical Interconnect Will Enable Gigawatt Scale Training Clusters?**	**Th3C • Ultra-Wideband Transmission**	**Th3D • Point to Multipoint and Satellite Networks**	**Th3E • Photo-Detector and Integration**	**Th3F • Fiber Sensing and Characterization**	**Th3G • Enabling Techniques for PON**
16:00–16:30	**Coffee Break,** *Level 2 Corridors*						
16:30–18:30	**Postdeadline Paper Sessions,** *Rooms 203-204, 205-206, 211-212, 213-214*						

Rooms 213-214	Room 215	Room 301	Room 304
Registration Open, *South Lobby, Moscone Center*			
Th1H • Multiband Optical Networks	Th1I • Distributed Acoustic Sensing	Th1J • Advances in Future PON	Th1K • Direct Detection DSP
Exhibition, *Halls A-F, (concessions available, coffee service 10:00–10:30)*			
Unopposed Exhibit-only Time, *Exhibition Halls A-F*			
Th2A • Posters Session II, *Room 303*			
Th3H • Packaging and Coupling Techniques	Th3I • Free-Space Optical QKD, QRNG, and Classical Techniques	Th3J • Device Applications for Wireless Communications	Th3K • Coherent DSP
Coffee Break, *Level 2 Corridors*			
Postdeadline Paper Sessions, *Rooms 203-204, 205-206, 211-212, 213-214*			

Expo Theater I CISCO ACACIA COMMUNICATIONS, INC.	Expo Theater II Amphenol COMMUNICATIONS SOLUTIONS	Expo Theater III OFCnet
Exhibition Opens at 10:00		
MW5 • Optical Network Evolution for AI/ML, Architectures and Drivers 10:15–11:45 **MW6 • Digital Twin, Telemetry, Monitoring and Testing 12:00–13:30** **SF11 • OPC: Moving Beyond 200 Gb/s Signaling and the Future of AI Systems 13:45–14:45** **SF12 • Advanced Photonics Coalition From Vision to Reality: Enabling Robust Volume Manufacturing of Photonic ICs for AI Networks 15:00-16:00**	**SF13 • Hyperlight - Commercial Readiness of Thin-Film Lithium Niobate Photonics 10:15–11:15** **SF14 • Cable Labs: Out of the Darkness: A Sneak Peek at CableLabs' CPON Specifications 11:30–12:30** **SF15 • OIF: Optical Interconnects for AI 12:45–13:45** **SF16 • Coherent Moving to Client Optics 14:00–15:00** **Application Demonstrations at OFCnet 15:15-15:45**	**Tech Showcase: Introduction to NGK Bonded Wafer for Optical Communication** NGK INSULATORS **10:15–10:45** **Quantum at OFCnet 11:00-11:30** **Tech Showcase: Suzhou Suna Optoelectronics Co., Ltd** SUNA **11:45-12:15** **Tech Showcase: Sumitomo Electric Lightwave** SUMITOMO ELECTRIC LIGHTWAVE **13:15–13:45** **SF17 • IPEC: How Will Optical Interconnects to Meet AI Demand? 14:45–15:45**
Exhibition Closes at 16:00		

2025 OFC Conference and Exhibition Session Guide

Disclaimer: this guide is limited to technical program with abstracts and author blocks as of 21 March 2025. For updated and complete information with special events, reference the online schedule or mobile app.

Monday, 30 August
08:00 -- 10:00
Room 207
M1D • Multi-Mode and Polarization-Dependent Devices

M1D.1 • 08:00

Ultra-Compact and Low-Loss Pixelated Mode (De)-Multiplexer for Mode-Division Multiplexed Coherent-Lite Optical Interconnects, Aolong Sun[1,2], Hua Tan[1,2], Xuyu Deng[1], An Yan[1], Qiyuan Li[3], Zengfan Shen[3], Sizhe Xing[1], Yuqin Yuan[1], Junhao Zhao[1], Yongzhu Hu[1], Zhongya Li[1], Boyu Dong[1], Fangchen Hu[2], Ziwei Li[1], Jianyang Shi[1], Chao Shen[1], Li Shen[3], Wei Chu[2], Haiwen Cai[2], Nan Chi[1], Junwen Zhang[1]; *[1]Fudan Univ., China; [2]Zhangjiang Laboratory, China; [3]Huazhong Univ. of Science and Technology, China.* We demonstrate an ultra-compact and low-loss pixelated four-TE-mode (de)multiplexer with sub-1 dB insertion loss for all modes at 1550 nm, enabling net 1.09 Tb/s/λ SCM-32QAM signal transmission across 16 wavelengths in mode-division-multiplexed coherent-lite optical interconnects.

M1D.2 • 08:15

Orbital Angular Momentum Beam Generation with Inversedesigned Multimode Meta-Waveguides, Tiange Wu[1], Kaiyuan Wang[1], Jing Luan[1], Yifei Chong[1], Shuang Zheng[1], Minming Zhang[1]; *[1]Huazhong Uni of Science and Technology, China.* We design, fabricate and demonstrate chip-scale inverse-designed multimode meta-waveguides to generate OAM beam. By experimental measurement, eight kinds of optical vortex beams can be generated in the wavelength range of 1530 nm to 1570 nm.

M1D.3 • 08:30

High-Performance and Scalable Four-Mode Cyclic Mode Converter Enabled by Semi-Inverse Designed Directional Couplers, Yongchen Wang[1], Zhe Yuan[1], Hangming Fan[1], Junlin Pan[1], Xiaoyang Liu[1], Mengfan Cheng[1,2], Qi Yang[1,3], Deming Liu[1,3], Lei Deng[1,2]; *[1]Wuhan National Laboratory for Optoelectronics and School of Optical and Electronic Information, Huazhong Univ. of Science and Techn, China; [2]Shenzhen Huazhong Univ. of Science and Technology Research Inst., China; [3]JinYinHu Laboratory, China.* We present a high-scalability, wide-bandwidth, and high-performance four-mode cyclic-mode converter based on efficient semi-inverse design with variable-length segments. The measured insertion loss is <1.8dB, the crosstalk is <-15dB, and 110Gbps-PAM4 signal transmission is experimentally achieved.

M1D.4 • 08:45

Ultra-Broadband Double-Layered Polarization Rotator by Inverse Design and 193-nm DUV Lithography, Hao Chen[1], Zengqi Chen[1], Yipeng Zang[2], Qinfen Hao[3], Yeyu Tong[1]; *[1]Hong Kong Univ of Sci & Tech (Guangzhou), China; [2]Wuxi Inst. of Interconnect Technology Ltd, China; [3]Inst. of Computing Technology, Chinese Academy of Sciences, China.* We experimentally demonstrated an integrated polarization rotator using always-feasible inverse design and 193-nm DUV lithography. An experimental peak insertion loss of -0.41 dB and 1-dB bandwidth of >100 nm can be obtained.

M1D.5 • 09:00

Spatial and Polarization Mode Multiplexer Using a Reflective Metasurface Chip, Go Soma[1], Kento Komatsu[1], Yoshiaki Nakano[1], Takuo Tanemura[1]; *[1]School of Engineering, The Univ. of Tokyo, Japan.* We demonstrate a spatial and polarization mode multiplexer based on

reflective metasurface. Using a compact device with ~0.65-mm^2 chip size, we achieve simultaneous conversion of six input modes to the desired spatial and polarization modes.

M1D.6 • 09:15 (Top-Scored)
Multimode-Enabled Silicon Photonic Delay Line, Shihan Hong[1], Long Zhang[1], Jiachen Wu[1], Yingying Peng[1], Linyan Lyu[1], Yinpeng Hu[1], Yiwei Xie[1], Daoxin Dai[1]; *[1]Zhejiang Univ., China.* We demonstrated a multimode-enabled silicon photonic delay line by supporting multiple modes propagating in parallel in a single ultralow-loss multimode waveguide spiral, towards an ultra-large delay range and ultra-high delay density time delay system.

M1D.7 • 09:30 (Invited)
Mode Control Devices Based on Silica-PLC for SDM, Kunimasa Saitoh[1], Takanori Sato[1], Takayoshi Mori[2], Taiji Sakamoto[2], Takashi Matsui[2], Kazuhide Nakajima[2]; *[1]Hokkaido Univ., Japan; [2]NTT Corporation, Japan.* Recent advances in silica-based planar lightwave circuit (PLC) devices for spatial mode control in space division multiplexing (SDM) are presented, focusing on device designs achieving low loss, tunability, and broadband performance for mode-division-multiplexing (MDM) transmission.

08:00 -- 10:00
Room 208
M1E • System Characterization and Monitoring
Presider: Zhixin Liu; Univ. College London, UK

M1E.1 • 08:00
An Accurate, Sensitive, and Wide-Range Skew Calibration Method for Transmitter with Segmented Modulator Using Probability-Maintained Multi-Notch Sequence, Tong Ye[1], Jingnan Li[1], Ke Zhang[1], Xiaofei Su[1], Shinsuke Tanaka[2], Yohei Sobu[2], Hisao Nakashima[2], Takeshi Hoshida[2], Zhenning Tao[1]; *[1]Fujitsu R&D Center, China; [2]Fujitsu Ltd., Japan.* Probability-maintained multi-notch sequence is proposed for skew calibration in segmented modulator. For fine calibration, the sensitivity is 4 times that of conventional method. The estimation error of coarse calibration that covers 0.5-3 UI is only 0.023 UI.

M1E.2 • 08:15
In-Field Self-Calibration Scheme Enabling Separation of Frequency Response/IQ Skew of Coherent Optical Transceivers, Hongyu Li[1], Mengfan Cheng[1], Qi Yang[1], Ming Tang[1], Deming Liu[1], Lei Deng[1]; *[1]huazhong Univ. Of Science and Technology, China.* The in-field self-calibration scheme is proposed for coherent optical transceivers separating the frequency-response/IQ-skew characterization of Tx/Rx without extra optical equipment. Sub-ps timing correction (<0.2ps) and frequency-response (<1dB, <0.25rad) correction enable the 40/20GBaud 16/64QAM signals transmissions.

M1E.3 • 08:30
Low-Complexity Digital Twinning of Optical I/Q Modulator by Direct-Detection With Widely Non-Linear Phase Retrieval, Yuki Yoshida[1], Shoichiro Oda[2], Naokatsu Yamamoto[1], Takeshi Hoshida[2], Kouichi Akahane[1]; *[1]National Inst of Information & Comm Tech, Japan; [2]Fujitsu Limited, Japan.* A direct-detection based simultaneous monitoring and modeling of I/Q-dependent frequency responses and Volterra-type high-order nonlinearities in an optical

I/Q modulator is proposed and demonstrated experimentally in a 10-Gbaud 128-QAM system.

M1E.4 • 08:45
Characterizing Devices Nonlinearity in Optical Communications: a Notch-Free Approach, Xiang Lin[1], Zhiping Jiang[1], Meng Qiu[1], Xuefeng Tang[1]; *[1]Huawei Technologies Canada Co. Ltd, Canada.* In high-speed optical communications, device imperfections, especially nonlinear ones, significantly degrade signals. We experimentally proved that the nonlinear noise-to-signal ratio can be characterized through frequency subband analysis, without altering the nonlinear system's transfer function.

M1E.5 • 09:00 (Top-Scored)
In-Service Monitor and Pre-Compensation of 100 Gbaud-Class Coherent Transmitter by a 5 GHz Photodetector, Ke Zhang[1], Jingnan Li[1], Tong Ye[1], Hisao Nakashima[2], Takeshi Hoshida[2], Zhenning Tao[1]; *[1]Fujitsu Research & Development Center CO., LTD, China; [2]Fujitsu Limited, Japan.* We experimentally verify that the inherent imperfection of a 100 Gbaud-class coherent transmitter can be accurately monitored and pre-compensated in the background merely by a single photodetector of 5GHz-bandwidth based on error backpropagation scheme.

M1E.6 • 09:15
Experimental Demonstration of a Precision-Enhanced ADC Using a Dual-Stage Quantization, Qiuyan Li[1], Jifang Qiu[1], Ziqi Zhang[1], Yuepeng Wu[1], Bowen Zhang[1], Yan Li[1], Jian Wu[1]; *[1]Beijing Univ. of Posts & Telecom, China.* We propose a precision-enhanced ADC scheme combining optical phase quantization and electrical amplitude quantization. Experimental results show a 2-bit improvement in ENOB compared to an unenhanced ADC at a sampling rate of 10Gs/s.

M1E.7 • 09:30
A Modulation-Agnostic Pilot-Aided Fiber Length Estimator for High-Speed Coherent Links, Nestor D. Campos[1], Marcos Olmos Rebellato[1], Agustin Martinez Balsa[1], Damian Morero[1]; *[1]Marvell Semiconductor Inc., Argentina.* We propose and validate an algorithm for estimating the optical fiber length in a 375 km (max) coherent link. The algorithm uses a tailored pilot symbol sequence, assessed with QAM16 at 90GBd.

M1E.8 • 09:45
Localization of Multipath Interference in IM/DD Systems by Receiver-Side DSP Using Signal and Noise Correlation, Leyan Fei[1], Mengfan Fu[1], Yicheng Xu[1], Yu Guo[1], Xi Chen[1], Weisheng Hu[1], Qunbi Zhuge[1]; *[1]Shanghai Jiao Tong Univ., China.* We propose and experimentally demonstrate an MPI localization scheme based on signal and noise correlation (SNC) and cyclic accumulation (CA), achieving localization accuracy of 3m and a 4000-fold reduction in storage requirement for correlation operations.

08:00 -- 10:00
Room 215
M1I • Optical X-Haul and In-Door Architectures

Presider: Lihua Ruan; Peng Cheng Laboratory, China

M1I.1 • 08:00

Cloned-Comb Enabled Communication & Clock Distribution Integrated Fronthaul Architecture, Jingjing Lin[1], Chenbo Zhang[1], Weihan Liang[1], Yixiao Zhu[2], Weisheng Hu[2], Zhangyuan Chen[1], Weiwei Hu[1], Xiaopeng Xie[1]; *[1]Peking Univ., China; [2]Shanghai Jiaotong Univ., China.* We propose an integrated fronthaul architecture that simultaneously realizes 1-ps timing jitter clock distribution and DSP-simplified 2.88-Tb/s self-homodyne transmission by comb cloning, yielding simple, low-cost solution for multi-functional 6G-network, empowering both large-capacity communication and high-precision positioning.

M1I.2 • 08:15

First Demonstration of OTFS in a D-Band Indoor Wireless Communication System Based on Photonics-Aided Scheme, Mingxu Wang[1], Jianjun Yu[1], Xianming Zhao[2], Xiongwei Yang[1], Chengzhen Bian[1], Qiutong Zhang[1], Wen Zhou[1], Kaihui Wang[1], Weiping Li[1]; *[1]Fudan Univ., China; [2]Harbin Inst. of Technology, China.* First experimental demonstration of OTFS is achieved in a photonics-aided D-band indoor wireless communication system, achieving better BER performance, >2 dB power sensitivity improvement and higher capacity over OFDM in both static and mobile channels.

M1I.3 • 08:30

Optical X-Haul for Beyond 5G: Cost-Effective Deployment Strategies, Brianna Laird[1], Chathurika Ranaweera[1], Julien Ugon[1]; *[1]Deakin Univ., Australia.* We introduce a scalable optimization framework for cost minimized network planning in beyond 5G. The results demonstrate how scalable optical x-haul networks can be designed across different deployment scenarios, optimizing cost and performance for B5G infrastructure.

M1I.4 • 08:45

Cross-Layer Resource Optimization for Energy Minimization in Reconfigurable Optical Crosshaul Architecture, Yijie Tao[1], Chathurika Ranaweera[2], Sampath Edirisinghe[3], Christina Lim[1], Ampalavanapillai Nirmalathas[1], Lena Wosinska[4], Tingting Song[1]; *[1]Univ. of Melbourne, Australia; [2]Deakin Univ., Australia; [3]Univ. of Sri Jayewardenepura, Sri Lanka; [4]Chalmers Univ. of Technology, Sweden.* We formulated a cross-layer optimization framework for next-generation reconfigurable optical crosshaul architecture in Radio Access Networks (RAN) that jointly optimizes optical, packet, and RAN function-layer resources to minimize power consumption while meeting service demands.

M1I.5 • 09:00 (Invited)

From Artificial Intelligence to Active Inference: "Natural Intelligence" - the Future of AI-Native 6G, Martin Maier[1]; *[1]INRS-Energie Materiaux et Telecom, Canada.* Today's complex networks increasingly resemble biological superorganisms with brain-like cognitive capabilities. This paper elaborates on today's AI and what it can become by using active inference to biomimic key elements found in living intelligent systems.

M1I.6 • 09:30 (Invited)

Optical Home LAN Innovations to Meet Current and Future Needs, Philippe Chanclou[1], Fabienne Saliou[1], Gael Simon[1], Jeremy Potet[1], Stephane Le Huerou[1], Hugues Le Bras[1]; *[1]Orange Labs, France.* Optical Home LAN, utilizing PON and PtP technologies, offers a "FTTH-like" experience with high throughput, low latency, and improved Wi-Fi coverage. It ensures seamless connectivity and enhances the overall user experience within the home network.

08:00 -- 10:00

Room 301

M1J • Intelligent and Autonomous Network Management

Presider: Ricard Vilalta; Centre Tecnològic Telecom de Catalunya, Spain

M1J.1 • 08:00

ML-Assisted Traffic Grooming with Low Design Margins, Oleg Karandin[1], Francesco Musumeci[1], Yvan Pointurier[2], Massimo Tornatore[1]; *[1]Politecnico di Milano, Italy; [2]Huawei Technologies, Paris Research Center, France.* Low-margin design allows significant resource savings, but synergy with traffic grooming is unexplored. We propose a new low-margin-design procedure with traffic grooming and show up to 12% throughput increase from lower margins estimated via ML.

M1J.2 • 08:15

Demonstration of Flexible Congestion Control Mechanism for Distributed ML Traffic in Metro All-Optical Collaborative Switching Networks, Huitao Zhou[1], Jiawei Zhang[1], Haoyang Chen[1], Yuanhang Shi[1], Ruikun Wang[1], Yuefeng Ji[1]; *[1]Beijing Univ. of Posts and Teles, China.* We demonstrate a flexible congestion control mechanism for distributed ML traffic in an all-optical collaborative switching network through an FPGA-based testbed. Experimental results show that it accelerates flow completion time and provides low latency jitter.

M1J.3 • 08:30 (Invited)

Scalable Machine Learning Models for Optical Transmission System Management, Zehao Wang[1,3], Agastya Raj[2], Giacomo Borraccini[3], Shaobo Han[3], Yue-Kai Huang[3], Ting Wang[3], Marco Ruffini[2], Daniel C. Kilper[2], Tingjun Chen[1]; *[1]Duke Univ., USA; [2]Trinity College Dublin, Ireland; [3]NEC Laboratories America, Inc., USA.* Optical transmission systems require accurate modeling and performance estimation for autonomous adaption and reconfiguration. We present efficient and scalable machine learning (ML) methods for modeling optical networks at component- and network-level with minimized data collection.

M1J.4 • 09:00

Enhancing EDFAs Greybox Modeling in Optical Multiplex Sections Using Few-Shot Learning, Rocco DIngillo[1], Andrea D Amico[2], Renato Ambrosone[1], Hideki Nishizawa[3], Toru Mano[3], Tatsuya Matsumura[3], Stefano Straullu[4], Francesco Aquilino[4], Vittorio Curri[1]; *[1]Politecnico di Torino, Italy; [2]NEC Labs America, USA; [3]NTT Network Innovation Labs, Japan; [4]LINKS Foundation, Italy.* We combine few-shot learning and grey-box modeling for EDFAs in optical lines, training a single EDFA model on 500 spectral loads and transferring it to other EDFAs using 4-8 samples, maintaining low OSNR prediction error.

M1J.5 • 09:15

QoT Estimation with Margin-Driven Transfer Learning in Time-Varying Optical Networks, Piotr T. Lechowicz[1], Carlos Natalino[1], Paolo Monti[1]; *[1]Chalmers Univ. of Technology, Sweden.* Estimating transmission quality in an optical network is critical for resource efficiency but challenging due to the infrastructure time-varying state. We propose a transfer learning solution to adapt a data-driven model to network changes.

M1J.6 • 09:30

Transceiver Penalty and Amplifier Noise Figure Characterization for Accurate QoT Estimation in Hyperscale Disaggregated DCI Networks, Yan He[1], Zhiqun Zhai[2], Sai Chen[2], Huan Zhang[2], Chuang Xu[1], Liang Dou[3], Yuanchao Su[4], Chao Lu[1], Alan Pak Tao Lau[1]; *[1]The Hong Kong Polytechnic Univ., Hong Kong; [2]Alibaba Cloud, China; [3]Alibaba Cloud, China; [4]Alibaba Cloud, China.* We demonstrated that experimentally characterizing the input/frequency-dependent amplifier noise figure and input power dependent transceiver penalty can reduce the RMSE of QoT estimation from 0.662dB to 0.287dB in hyperscale disaggregated DCI production networks.

M1J.7 • 09:45

Autonomous Closed-Loop Operations to Ensure QoT Connections in SDN-Controlled Elastic Optical Networks, Ricardo Martínez[1], Josep Maria Fàbrega[1], Ramon Casellas[1], Ricard Vilalta[1], Raul Muñoz[1], Henry Yu[2], Yanpeng Wang[2], Mahdi Hemmati[2], Christopher Janz[2], Hao Li[3], Haoyu Feng[3]; *[1]Centre Tecnològic Telecom de Catalunya, Spain; [2]Huawei Technologies Canada Co, Ltd., Canada; [3]Huawei Technologies, China.* This work presents an autonomous SDN controller for EONs, detailing closed-loop QoT management with telemetry, a QoT tool, and a Path Computation Server. Two recovery strategies for QoT-degraded services are proposed and numerically compared.

08:00 -- 10:00
Room 304
M1K • Light-Source and Integration I
Presider: Connie Chang-Hasnain; HC Meta Ple. Ltd., USA

M1K.1 • 08:00

Ultra-Wideband Precision Tunable Laser with Wavelength Locking Based on a High-Density Integrated DFB Laser Array, Yaqiang Fan[1], Haolin Xia[1], Zilong He[1], Yuan Lv[1], Pan Dai[1], Wei Yuan[1], Jingxuan Zhang[1], Zhenxing Sun[1], Xiangfei Chen[1]; *[1]Nanjing Univ., China.* This paper presents an ultra-wideband DFB laser array with an 80 nm tuning range, employing a wavelength-locking and feedback control mechanism for rapid and precise wavelength control, suitable for future data centers and access networks.

M1K.2 • 08:15

Power-Efficient Tuning (<150 mW) of Electro-Optically Tunable RTF Laser with Control Board for Digital Coherent Communications, Yuta Ueda[1], Yusuke Saito[1], Takahiko Shindo[1], Shigeru Kanazawa[1], Makoto Shimokozono[1], Fumito Nakajima[1]; *[1]NTT Device Innovation Center, Japan.* We developed an electro-optically tunable RTF laser with a control board composed of commercially available ICs. A tuning power of <150 mW at 75°C and practical light-source performance for a 400G-coherent system was demonstrated.

M1K.3 • 08:30 (Tutorial)
Laser Source for Silicon Photonics System, Di Liang[1]; *[1]Univ. of Michigan, USA.* This tutorial covers advancements in laser sources for silicon photonics, including hybrid, heterogeneous, and monolithic integration of diode lasers and frequency combs, addressing progresses and challenges in efficiency, scalability, and stability for interconnects and emerging applications.

M1K.4 • 09:30
High-Temperature Silicon-Based InAs QD Laser for Optical Interconnects, Jiajian Chen[2,1], Wenqi Wei[2], Shihuan Ran[4], Yuanhang Wang[5], Jiale Qin[3], Bo Yang[3], Xiangru Cui[3], Liangjun Lu[4], Linjie Zhou[4], Yu Li[4], Zihao Wang[3], Ting Wang[3], Changyuan Yu[1], Jianjun Zhang[3,2]; *[1]Hong Kong Polytechnic Univ., Hong Kong; [2]Songshan Lake Materials Laboratory, China; [3]Inst. of Physics, Chinese Academy of Sciences, China; [4]State Key Laboratory of Advanced Optical Communication Systems and Networks, China; [5]State Key Laboratory of Optical Communication Technologies and Networks, China.* This paper presents a silicon-based InAs quantum dot laser for optical transmitter, operating up to 80 C, supports 4λ× 32 Gbps data transmission, making it ideal for high-efficiency, cost-effective optical interconnects.

M1K.5 • 09:45
Flip-Chip Bonded 450-nm InGaN Laser Diodes in a Foundry Fabricated Visible-Light Silicon Photonics Platform, Xin Mu[1,2], Frank Weiss[1], Hongyao Chua[3], Robert Lawrowski[4], Jared Mikkelsen[1], John Straguzzi[1], Hannes Wahn[1], Joyce K. Poon[2], Guo-Qiang Lo[3], Mariel Jama[4], Wesley Sacher[1]; *[1]Max Planck Inst. of Microstructure Physics, Germany; [2]Univ. of Toronto, Canada; [3]Advanced Micro Foundry Pte. Ltd., Singapore; [4]ams OSRAM International GmbH, Germany.* We report hybrid integration of blue InGaN laser diodes in a visible-light silicon photonics platform using passive-alignment flip-chip bonding. We demonstrate continuous-wave on-chip optical powers of 9.6 mW and integration with optical switches and photodetectors.

08:00 -- 10:00
Rooms 201-202
M1A • The Year of Quantum: Applications, Architectures and Enabling Technologies for Quantum Communication and Computing I
Presider: Cheryl Sorace-Agaskar; MIT Lincoln Laboratory, USA

M1A.1 • 08:00 (Invited)
Xanadu's Path to Fault Tolerant Photonic Quantum Computing, Dylan Mahler[1]; *[1]Xanadu Quantum Technologies Inc., Canada.* We discuss Aurora, our recent demonstration of scaling and networking in a modular architecture, as well as other recent breakthroughs on Xanadu’s path to universal, fault-tolerant photonic quantum computing.

M1A.2 • 08:30 (Invited)
Building the QEYSSat Mission by Putting Quantum Optics Experiments Into Space, Thomas Jennewein[1]; *[1]Univ. of Waterloo, Canada.* Quantum communication in space allows to bridge large distances and also extend the tests over large distances, and represents an important step towards building a quantum internet. We discuss translating quantum optics

experiments from laboratory setups to the upcoming QEYSSat space mission.

M1A.3 • 09:00 (Invited)
How to Build a Quantum Computer One Atom at a Time, Crystal Noel[1]; *[1]Duke Univ., USA.* The intrinsic properties of atoms combined with engineering innovation have made trapped ions the most controllable quantum system in use today – paving the way for precision sensing, secure communication, and powerful computation.

08:00 -- 10:00
Rooms 203-204
M1B • Submarine Transmission
Presider: Haik MARDOYAN; Nokia Bell Labs, France

M1B.1 • 08:00 (Tutorial)
Power-Limited Submarine Transmission: Cable Design, Amplification Strategies and Capacity Limits, Alexei N. Pilipetskii[1]; *[1]SubCom LLC, USA.* The tutorial focuses on the challenges of powering subsea cables while continuing to grow capacity. It discusses the transition to SDM cables and examines the limitations of current technology. Potential ways forward are also explored.

M1B.2 • 09:00
403 km, 10.3 Tb/s, Unrepeatered Link Using Incoherent Raman Amplification Without ROPA, Ruben S. Luis[1], Divya A. Shaji[1,2], Daniele Orsuti[3], Norihiro Ohishi[4], Junji Yoshida[4], Benjamin J. Puttnam[1], Luca Palmieri[3], Cristian Antonelli[2], Hideaki Furukawa[1]; *[1]NICT, Japan; [2]Univ. of L'Aquila, Italy; [3]Univ. of Padova, Italy; [4]Furukawa Electric Co., Ltd, Japan.* We use incoherent co-propagating and conventional counter-propagating Raman pumps to transmit a 73x49 GBaud, PM-QPSK, 30 nm signal over a record 403 km link with a minimum 62 dB loss for a 10.3 Tb/s throughput.

M1B.3 • 09:15 (Invited)
High Capacity Optical Transmission for Transoceanic and Space Communication Convergence, Hidenori Takahashi[1]; *[1]KDDI Research Inc., Japan.* This paper reviews the recent implementation of optical transmission technologies in submarine cable and optical satellite communications. It discusses the differences in preferred aspects of digital coherent transmission technologies between these two fields.

M1B.4 • 09:45 (Top-Scored)
Real-Time Unrepeatered Transmission of 28.13Pb/s●km With 800G Transciever and Novel Bi-Directional ROPA, Xu Jian[2,1], Mingxiong Duan[1], William Shieh[3], Qianggao Hu[1], Jiekui Yu[1], Chen Liu[2], Tian Qiu[2], Jiale Liu[2], Yuming Zhao[2], Jianjun Wu[1], Shujuan Sun[1], Chengpeng Fu[1], Liyan Huang[1], Han Long[1], Bozhong Li[4], Fang Chen[4], Hao Chen[5], Qi Yang[2]; *[1]ACCELINK, China; [2]Huazhong Univ. of Science and Technology, China; [3]Westlake Univ., China; [4]State Grid Information & Telecommunication Branch, China; [5]Corning Corporation Inc, USA.* We first experimentally demonstrate real-time 76.8Tb/s (96×800G) unrepeatered transmission over 366.3km employing C&L bands, which is a record capacity-distance (28.13Pb/s●km), using commercial coherent transciever, high-order remote pumping unit, optimized C+L remote gain unit, and ultra low-loss G.654E fiber.

08:00 -- 10:00
Rooms 205-206
M1C • Sensing Applications I
Presider: Md Saifuddin Faruk; Bangor Univ., UK

M1C.1 • 08:00 (Top-Scored)
Field Trials of Manhole Localization and Condition Diagnostics by Using Ambient Noise and Temperature Data with AI in a Real-Time Integrated Fiber Sensing System, Ming-Fang Huang[1], Shaobo Han[1], Yaowen Li[1], Glenn Wellbrock[2], Tiejun Xia[2], Scott Kotria[2], James Moore[2], Philip Ji[1], Tingfeng Li[1], Yuheng Chen[1], Ting Wang[1], Yoshiaki Aono[3]; *[1]NEC Laboratories America Inc., USA; [2]Verizon, USA; [3]NEC Corporation, Japan.* Field trials of ambient noise-based automated methods for manhole localization and condition diagnostics using a real-time DAS/DTS integrated system were conducted. Cross-referencing multiple sensing data resulted in a 94.7% detection rate and enhanced anomaly identification.

M1C.2 • 08:15
Thermal Imaging-Based Localization Technique for Fiber Breakpoints in Drop Cables, Tomokazu Oda[1], Kei Makino[1], Takayuki Hosome[1], Masami Miyazaki[1], Hiromu Hashimoto[1]; *[1]NTT EAST, Japan.* We investigated the requirements for locating fiber breakpoints in drop cables using a thermal imaging camera. We revealed that breakpoints could be located with 3-dBm input power, with temperature saturation occurring around 100 seconds.

M1C.3 • 08:30 (Invited)
Repeaterless Brillouin OTDR Sensing, Neethu Mariam Mathew[1], Mads H. Vandborg[1], Jesper B. Christensen[2], Zepeng Wang[1], Lars E. Grüner-Nielsen[1], Lars S. Rishøj[1], Roger Crickmore[3], Thibault North[3], Tommy Geisler[4], Mikael Lassen[2], Karsten Rottwitt[1]; *[1]DTU Electro, Denmark; [2]DFM, Denmark; [3]LUNA Innovations, Germany; [4]OFS, Denmark.* We demonstrate a Brillouin OTDR sensing range of 250 km on a telecommunication fiber. Including a normal dispersion fiber at a selected position helps to reduce the nonlinear noise arising from modulation instability at the remote end.

M1C.4 • 09:00
First Field Demonstration of Diagnosis of Aerial Telecom Facilities by Using High-Precision Φ-OTDR DAS, Yoshifumi Wakisaka[1], Hiroshi Takahashi[1], Takahiro Ishimaru[1], Daisuke Iida[1], Keisuke Murakami[1], Chihiro Kito[1], Yusuke Koshikiya[1], Kunihiro Toge[1]; *[1]NTT Corporation, Japan.* We measure a field-deployed telecommunication fiber cable before and after repairing detachment from hanger by using multi-frequency Φ-OTDR DAS, showing possibility of detecting the abnormality based on change of vibration patterns for the first time.

M1C.5 • 09:15
Experimental Validation for Early Earthquake Detection Using Transfer Learning, Hasan Awad[1], Fehmida Usmani[2,1], Stefano Straullu[3], Rudi Bratovich[4], Emanuele E. Virgillito[1], Francesco Aquilino[3], Roberto Proietti[1], Vittorio Curri[1]; *[1]Politecnico di Torino, Italy; [2]National Univ. of Computer and Emerging Sciences, Pakistan; [3]Links Foundation, Italy; [4]SM-Optics, Italy.* We apply transfer learning with an LSTM-attention model, trained on simulated earthquake

SOP data and tested on experimentally emulated data over a 38 km deployed fiber link, achieving 98% accuracy in early earthquake detection.

M1C.6 • 09:30
Field Tests of AI-Driven Road Deformation Detection Leveraging Ambient Noise Over Deployed Fiber Networks, Tingfeng Li[1], Ming-Fang Huang[1], Shaobo Han[1], Yaowen Li[1], Glenn Wellbrock[2], Tiejun Xia[2], Scott Kotria[2], James Moore[3], Ting Wang[1]; *[1]NEC Laboratories America, Inc., USA; [2]Verizon, USA; [3]Verizon, USA.* This study demonstrates an AI-driven method for detecting road deformations using Distributed Acoustic Sensing (DAS) over existing telecom fiber networks. Utilizing ambient traffic noise, it enables real-time, long-term, and scalable monitoring for road safety.

M1C.7 • 09:45
Highly-Precise Fiber Co-Route Segment Location With Multi-Modal Vibration Analysis and Field Demonstration for Intelligent Optical Network, Yucong Liu[1], Dong Wang[1], Yunbo Li[1], Ji Deng[2], Hongen Yang[2], yang Zhao[1], Mingqing Zuo[1], Dechao Zhang[1], Han Li[1]; *[1]China Mobile Research Inst., China; [2]Taclink Optoelectronics Technology Co., Ltd, China.* We propose a highly-precise co-route fiber location scheme leveraging intelligent pattern recognition aided by multi-modal vibration analysis, which is verified by a field trial simultaneously achieving record meter-level positioning precision and over 98% identification accuracy.

08:00 -- 10:00
Rooms 209-210
M1F • Hollow and Solid Core Ultra Low Loss Fibers
Presider: Tristan Kremp; OFS Fitel LLC, USA

M1F.1 • 08:00 (Tutorial)
Anti-Resonant Hollow-Core Fibers, Francesco Poletti[1,2]; *[1]Optoelectronics Research Centre, UK; [2]Microsoft Azure Fiber, UK.* Discovered by accident and initially only a tool for physicists, antiresonant hollow core fibers have recently achieved performances attracting the attention of optical communications. We will review their key properties and highlight their potential uses.

M1F.2 • 09:00 (Top-Scored)
Hollow-Core Double Nested Antiresonant Nodeless Fiber Cable With Polarization Mode Dispersion< 0.1 ps/km$^{1/2}$, Chenyang Hou[2,1], Guoqun Chen[2], Xiaokai Wang[2], Mingfeng Mao[2], Liyan Zhang[2], Peng Li[2], Lei Zhang[2], Jie Luo[2], Jinmin Ding[1], Zeyi Duan[1,2], Sheng Liang[1]; *[1]Beijing Jiaotong Univ., China; [2]Yangtze Optical Fibre and Cable Joint Stock Limited Company, China.* We report a double nested antiresonant nodeless fiber (DNANF) cable with polarization mode dispersion coefficient of 0.046 ps/km$^{1/2}$, achieved by spinning DNANF, with the loose sheath layer stranded air blown micro cable used for cabling.

M1F.3 • 09:15
Field Trial of CO_2 Absorption Impact on Coherent Transmission Over 36.8km Deployed AR-HCFs, Dawei Ge[1], Yifan Xiong[2], Mingqing Zuo[1], Baoluo Yan[3], Dong Wang[1], Shoufei Gao[2,4], Dechao Zhang[1], Hu Shi[3], Yingying Wang[4,2], Wei Ding[3,2], Han Li[1], Zhangyuan Chen[5], Xiaodong Duan[1]; *[1]China Mobile Research Inst., China; [2]Linfiber Technology (Nantong) Co., Ltd., China; [3]WDM System Department, ZTE Corporation, China; [4]Inst. of Photonics Technology,*

Jinan Univ., China; [5]State Key Laboratory of Advanced Optical Communication Systems and Networks, Peking Univ., China. Severe impact to coherent transmission caused by CO_2 absorption in 36.8km field-deployed AR-HCF is reported for the first time. 1 channel in C-band and 29 channels in L-band are over FEC threshold for 800G signals.

M1F.4 • 09:30 (Invited)
Ultra-Low Loss 0.1397dB/km Silica-Core Single-Mode Fiber, Shin Sato[1], Yuki Kawaguchi[1], Hirotaka Sakuma[1], Tetsuya Haruna[1], Takemi Hasegawa[1]; *[1]Sumitomo Electric Industries Ltd, Japan.* Ultra-low-loss silica-core single-mode fibers are advanced to the minimum loss of 0.1397 dB/km at 1566 nm wavelength due to reduced Rayleigh scattering enabled by lowering the fictive temperature and designing refractive index profile

08:00 -- 10:00
Rooms 211-212
M1G • Datacenter IM/DD I
Presider: Fabio Bottoni; Cisco Photonics Italy Srl, Italy

M1G.1 • 08:00
Optical Amplification-Free 400 Gbps Net Bitrate Links With a TFLN-Based Transmitter, Armands Ostrovskis[1,2], Said El-Busaidy[2], Toms Salgals[1], Michael Koenigsmann[2], Kristaps Rubuls[1], Benjamin Krueger[2], Arvids Sedulis[1], Darja Cirjulina[1], Fabio Pittala[2], Lu Zhang[3], Xianbin Yu[3], Rafael Puerta[4], Sandis Spolitis[1], Richard Schatz[5], Katia Gallo[5], Hadrien Louchet[2], Robert Jahn[2], Kazuo Yamaguchi[2], Markus Gruen[2], Vjaceslavs Bobrovs[1], Marcel Zeiler[2], Xiaodan Pang[5], Oskars Ozolins[1]; *[1]Riga Technical Univ., Latvia; [2]Keysight Technologies Deutschland GmbH, Germany; [3]Zhejiang Univ., China; [4]Ericsson, Sweden; [5]KTH Royal Inst. of Technology, Sweden.* We show a record optical amplification-free 400 Gbps PAM4/6/8 net bitrate transmission in the O-band over 500-meter SMF with performance below 6.25% OH HD-FEC threshold using 1 V_{pp} driving voltage on the TFLN MZM.

M1G.2 • 08:15
Traveling-Wave Silicon Photonics Mach-Zehnder Modulator for Beyond 350 Gb/s Transmission in C-Band, Armands Ostrovskis[1,2], Darja Cirjulina[1], Toms Salgals[1], Minkyu Kim[3], Michael Koenigsmann[2], Benjamin Krueger[2], Fabio Pittala[2], Lu Zhang[4], Xianbin Yu[4], Richard Schatz[5], Markus Gruen[2], Hadrien Louchet[2], Robert Jahn[2], Kazuo Yamaguchi[2], Vjaceslavs Bobrovs[1], Peter De Heyn[3], Xiaodan Pang[5], Oskars Ozolins[1]; *[1]Riga Technical Univ., Latvia; [2]Keysight Technologies Deutschland GmbH, Germany; [3]interUniv. microelectronics centre, Belgium; [4]Zhejiang Univ., China; [5]Kungliga Tekniska hogskolan, Sweden.* We demonstrate record transmission of 256 Gbaud OOK, 175 Gbaud PAM4 and 145 Gbaud PAM6 using a C-band differential-drive silicon photonics traveling-wave Mach-Zehnder modulator, achieving BER performance below the 6.25 % HD-FEC threshold after 100 m SMF transmission.

M1G.3 • 08:30 (Invited)
Integrated Receivers Based on Thin-Film Lithium Niobate for Data Center Applications, Ao Cui[1], Kaixuan Chen[1], Liu Liu[2], Changjian Guo[1]; *[1]South China Normal Univ., China; [2]Zhejiang Univ., China.* We review several key components on TFLN platform for high-speed optical interconnects, include EO modulators, wavelength (de)multiplexers and self-

coherent receivers with polarization controllers, and demonstrate a self-coherent system with 400-krad/s polarization tracking.

M1G.4 • 09:00
200-Gbaud PAM4 O-Band Transmission Using Advanced MLSE With Simple-Soft-Output Scheme and Turbo Product Codes, Shuto Yamamoto[1], Hiroki Taniguchi[1], Masanori Nakamura[1], Etsushi Yamazaki[1]; *[1]NTT Corporation, Japan.* We demonstrate 200-Gbaud PAM4 transmission with 10-dB bandwidth of 68 GHz in which an advanced MLSE with simple-soft-output scheme improves NGMI. We show that the simple-soft-output scheme is applicable to turbo product codes.

M1G.5 • 09:15
340-Gb/s PAM-4 Transmissions With 128-GSa/s DAC Enabled by Joint PRE and MRS-MLSE Decoder for AI Computing Clusters, Jiahao Zhou[1], Jing Zhang[1], Shaohua Hu[1], Zhaopeng Xu[2], Bo Xu[1], Kun Qiu[1]; *[1]Univ of Electronic Science & Tech. China, China; [2]Peng Cheng Laboratory, China.* We experimentally demonstrate a 340-Gb/s PAM-4 signal transmissions with a 128-GSa/s DAC enabled by transmitter-side sub-sampling. The 3rd-order partial response equalization and 71%-complexity reduced MLSE according to the mapping rule are used for signal recovery.

M1G.6 • 09:30 (Invited)
The Road Towards 400G/Lane IMDD Optics, Dirk Lutz[1]; *[1]Eoptolink Technology Inc., Ltd., Sweden.* Abstract not available

08:00 -- 10:00
Rooms 213-214
M1H • Space-Division Multiplexing and Hollow-Core Fiber Transmission
Presider: Sergejs Makovejs; Corning Inc., UK

M1H.1 • 08:00 (Top-Scored)
Full C-Band 3317-km 12-Coupled-Core-Fiber Transmission With 266.2-Tbps Capacity Using Field-Installed Fiber-Optic Cable, Kohki Shibahara[1], Akira Kawai[1], Megumi Hoshi[1], Masanori Nakamura[1], Takayuki Kobayashi[1], Ryota Imada[2], Takayoshi Mori[2], Taiji Sakamoto[2], Yusuke Yamada[2], Kazuhide Nakajima[2], Munehiko Nagatani[3], Hitoshi Wakita[3], Yuta Shiratori[3], Hiroshi Yamazaki[3], Hiroyuki Takahashi[3], Soichi Endo[4], Takemi Hasegawa[4], Koichi Maeda[5], Shigehiro Takasaka[5], Ryo Nagase[6], Yutaka Miyamoto[1]; *[1]NTT Network Innovation Laboratories, NTT Corporation, Japan; [2]NTT Access Service Systems Laboratories, NTT Corporation, Japan; [3]NTT Device Technology Laboratories, NTT Corporation, Japan; [4]Optical Communications Laboratory, Sumitomo Electric Industries, Ltd., Japan; [5]Furukawa Electric Co., Ltd., Japan; [6]Faculty of Engineering, Chiba Inst. of Technology, Japan.* We demonstrate 266.2-Tbps 3317-km full-C-band transmission using field-installed standard-cladding 12-coupled-core fiber cable. MDL impact is effectively suppressed to 0.2 dB per span by using per-core gain control of hybrid MC-EDFA and spatially diverse FEC coding.

M1H.2 • 08:15
Real-Time 25.2 Tb/s/Core Unrepeatered Transmission Over 256 km of 2-Uncoupled Core MCF Fiber, Hans Bissessur[1], Alexis Busson[1], Farana Hedaraly[1], Daryna Kravchenko[1]; *[1]Alcatel*

Submarine Networks, France. We show 2 x 25.2 Tb/s transmission over the C-band in 2 core MCF with full scale amplification and real-time transponders. We evidence and discuss crosstalk effects in unidirectional and bidirectional transmission.

M1H.3 • 08:30

On the Impact of Four-Wave Mixing in Coupled-Core Multicore Fiber Transmissions, Chiara Lasagni[1], Paolo Serena[1], Alberto Bononi[1], Antonio Mecozzi[2], Cristian Antonelli[2]; *[1]Universita degli Studi di Parma, Italy; [2]Univ. of L'Aquila, Italy.* We show through simulations that spatial mode dispersion makes four-wave mixing non-negligible compared to self- and cross-phase modulation in coupled-core multi-core fiber full C-band transmissions, potentially compromising the accuracy of simple disaggregated models.

M1H.4 • 08:45

Analytical Model for the Information Rate of Coupled SDM Systems with MMSE Equalizers, Lucas Zischler[1], Ruby S. Ospina[2], Menno van den Hout[3], Chigo M. Okonkwo[3], Darli A. Mello[1]; *[1]Unicamp, Brazil; [2]Nokia Bell Labs, France; [3]Eindhoven Univ. of Technology, Netherlands.* We propose an analytical model for the information rates of MDG-impaired strongly-coupled SDM systems employing MMSE equalizers. The results are validated through simulations of long-distance links and experiments carried out in a 73-km 3-mode setup.

M1H.5 • 09:00

Nonlinearity-Free DP-144QAM-PCS Beyond-1Tbps Transmission Over 100km AR-HCF for OTN-Based Decentralized Intelligent Training, Jiang Sun[1], Dong Wang[1], Mingqing Zuo[1], Baoluo Yan[2], Dawei Ge[1], Lei Zhang[3], Huan Chen[2], Peng Li[3], Qiang Qiu[2], Jie Luo[3], Hu Shi[2], Dechao Zhang[1], Han Li[1], Xiaodong Duan[1]; *[1]China Mobile Research Inst., China; [2]State Key Laboratory of Mobile Network and Mobile Multimedia Technology & WDM System Department of ZTE Corporation, ZTE Corporation, China; [3]State Key Laboratory of Optical Fiber and Cable Manufacture Technology, Yangtze Optical Fibre and Cable Joint Stock Limited Company, China.* Single-channel DP-144QAM-PCS 1.09Tbps transmission over 100km AR-HCF with 0.164 dB/km at 1550nm for decentralized intelligent training was experimentally verified for the first time. Nonlinearity-free input power is improved from 7dBm for G.652 to above 15dBm.

M1H.6 • 09:15

Demonstration of Single-Span 100km Hollow Core Fiber Bidirectional Transmission With 1Tb/s/λ Real-Time Signals, Lipeng Feng[1], Anxu Zhang[1], Jie Luo[2], Lei Zhang[2], Peng Li[2], Jun Chu[2], Yuyang Liu[1], Xiaoli Huo[1], Junjie Li[1], Chengliang Zhang[1]; *[1]China Telecom Research Inst., China; [2]State Key Laboratory of Optical Fiber and Cable Manufacture Technology, Yangtze OpticaFibre and Cable Joint Stock Limited Company (YOFC), China.* We demonstrate a bidirectional transmission using real-time 1Tb/s/λ transponders over single-span 100km HCF with attenuation coefficients ≤0.2dB/km at the C band. The system performance penalties caused by absorption loss and bidirectional transmission are analyzed.

10:30 -- 12:30
Room 207
M2D • Applications of Passive Photonics

M2D.1 • 10:30 (Top-Scored)
Reconfigurable Multi-Port Multi-Wavelength Coherent Receiver, Haoshuo Chen[1], Nicolas K. Fontaine[1], Roland Ryf[1], Giammarco Di Sciullo[2], Lauren Dallachiesa[1], Kwangwoong Kim[1], Tran C.[1], Mikael Mazur[1], Xiaonan Xu[1], Jesse E. Simsarian[1], René-Jean Essiambre[1], Kawashima T.[3], Oonuma T.[3], Kawakami S.[3], Takemi Hasegawa[4], Tetsuya Hayashi[4], Cristian Antonelli[2], David T. Neilson[1]; *[1]Nokia Bell Labs, USA; [2]Univ. of L'Aquila, Italy; [3]Photonic Lattice, Inc., Japan; [4]Sumitomo Electric Industries, Ltd., Japan.* We demonstrate a coherent receiver detecting multiple spatial and wavelength channels simultaneously. It combines a surface-normal optical hybrid array and a wavelength-selective element, and is experimentally validated for space-wavelength-division multiplexing reception in two-core fiber systems.

M2D.2 • 10:45
Arrayed High Performance Optical Circulators, Chun He[1]; *[1]Focuslight Technologies Inc., USA.* An 8-channel optical circulator array has been fabricated using a high precision microlens array. The array achieves ISO >50dB, IL 0.41dB, and PDL 0.002dB across all channels. Such an arranged optical circulator has never been reported.

M2D.3 • 11:00 (Invited)
Integrated Photonics for Space Applications, Milos Nedeljkovic[1], Bharat Pant[1], Zhen Liu[1], Aiman Hazim Shafizam[1], Zixuan Wang[1], Jinhao Liang[1], James Le Besque[1], Eleni Tsanidou[1], Xingzhao Yan[1], Martin Ebert[1], Callum Littlejohns[1], Jize Yan[1], David Thomson[1]; *[1]Univ. of Southampton, UK.* This talk explores opportunities for applying integrated photonics to the rapidly expanding space optics sector, and presents our recent progress on silicon photonic beam steering for satellite-based free-space optical communications.

M2D.4 • 11:30
Integrated Reconstructive Spectrometer with Dispersion-Engineered Components, Wanlu Zhang[1], Chunhui Yao[1,2], Peng Bao[1], Kangning Xu[2], Ting Yan[2], Liang Ming[2], Richard Penty[1], Qixiang Cheng[1], Tongyun Li[1]; *[1]Cambridge Univ., UK; [2]GlitterinTech Limited, China.* We describe a design of chip-scale near-infrared reconstructive spectrometer that operates towards >1000nm wavelength range, with dispersion-engineered ring-resonators. A 500nm-bandwidth on-chip spectrometer is demonstrated with 10pm resolution, setting up a new record in bandwidth-to-resolution ratio.

M2D.5 • 11:45 (Invited)
Absorption/Scattering Limits of SiN Visible Photonics, Michal Lipson[1]; *[1]Columbia Univ., USA.* Abstract not available

M2D.6 • 12:15
Measuring Broadly Spanning Lasers at Nanosecond Speed with a Silicon Photonic Wavemeter, Brian Stern[1], Kovendhan Vijayan[1], Robert Borkowski[1], Bob Farah[1], Ed Sutter[1], Kwangwoong Kim[1]; *[1]Nokia Bell Labs, USA.* We demonstrate nanosecond-scale measurements of laser wavelength using an integrated silicon wavemeter covering a 95 nm range with high accuracy. We measure the wavelengths of multiple alternating, bursting lasers within 10 ns.

10:30 -- 12:30
Room 208
M2E • Digital Signal Processing, Machine Learning and Electrically-Enhanced Phase Noise

Presider: Deepa Venkitesh; Indian Inst. of Technology Madras, India

M2E.1 • 10:30 (Invited)
Application of Artificial Intelligence in Nonlinear Performance Analysis of Optical Links, Amirhossein Ghazisaeidi[1], Xiaoyan Ye[2], Leonardo Sorensen Braga[1]; *[1]Nokia Bell Labs France, France; [2]Univ. of Cambridge, UK.* We report on our novel QoT estimation tool leveraging neural networks to speed-up nonlinear accurate variance computations by several orders of magnitude.

M2E.2 • 11:00
Nonlinearity Estimation Leveraging PSD-Based Monitoring and Machine Learning, Joana Girard-Jollet[1], Lina SHI[1], Fabien Boitier[1], Patricia Layec[1]; *[1]Nokia Bell Labs, France.* We propose a regression model to estimate Kerr nonlinearity proportion in fiber optic transmissions. Trained on simulations and validated experimentally, the model achieves a 4% RMSE across varying power profiles, CPE parameters, and transmission reaches.

M2E.3 • 11:15
Active Learning with Gaussian Process Regression and Physical Models for Robust SNR Estimation, Xiaoyan Ye[1], Mariane Mansour[1], Md Saifuddin Faruk[2], Charles Laperle[3], Michael Reimer[3], Maurice O'Sullivan[3], Seb J. Savory[1]; *[1]Univ. of Cambridge, UK; [2]Bangor Univ., UK; [3]Ciena Corporation, Canada.* We demonstrate improved performance using active learning for both GPR and hybrid models to predict SNR using experimental data from a 15-channel WDM system over 1000km. Physical model interpreted GPR agrees with interpreting measured data.

M2E.4 • 11:30
A Kolmogorov-Arnold Networks-Based Low-Complexity Equalizer for High-Speed IMDD System, Xiangmin Fang[1], Meihua Bi[1,2], Lu Zhang[3], Min Zhu[4], Xi Chen[2], Miao Hu[1]; *[1]Hangzhou Dianzi Univ., China; [2]Shanghai Jiao Tong Univ., China; [3]Zhejiang Univ., China; [4]Southeast Univ., China.* A low-complexity equalizer based on Kolmogorov-Arnold Networks is designed for high-speed PAM-4 IMDD system. Results show that, our equalizer reduces the computational complexity by 64.6% compared to the common DNN equalizer without performance degradation.

M2E.5 • 11:45
On Second-Stage Timing Recovery for Equalization-Enhanced Phase Noise Mitigation, Sebastian Jung[1], Tim Janz[1], Stephan ten Brink[1]; *[1]Inst. of Telecommunications, Univ. of Stuttgart, Germany.* An optimized version of Mueller-Muller (MM) timing recovery algorithm for equalization-enhanced phase noise mitigation is introduced and compared to standard MM showing gains of 0.15 dB. Addtionally, a comparable adaptive post-equalizer is adjusted outperforming both MM designs by up to 0.4 dB.

M2E.6 • 12:00
A Novel Phenomenological Model of Equalization-Enhanced Phase Noise, Benedikt Geiger[1], Fred Buchali[2], Vahid Aref[2], Laurent Schmalen[1]; *[1]Karlsruhe Inst. of Technology, Germany; [2]Nokia, Germany.* We show that equalization-enhanced phase noise manifests as a time-varying, frequency-dependent phase error, which can be modeled and reversed by a time-varying all-pass finite impulse response filter.

M2E.7 • 12:15
Low-Cost and Power-Efficient EEPN Mitigation Enabled by Accurate Jitter Waveform Estimation, Jingnan Li[1], Xiaofei Su[1], Tong Ye[1], Ke Zhang[1], Hisao Nakashima[2], Takeshi Hoshida[2], Zhenning Tao[1]; *[1]Fujitsu Research & Development Center Co., Ltd., China; [2]Fujitsu Ltd., Japan.* Jitter waveform induced by equalization-enhanced phase noise is accurately estimated from the low-cost and power-efficient measurement of LO laser instant frequency. With the jitter mitigation using existing DSP functions, the tolerable chromatic dispersion improves 70%.

10:30 -- 12:30
Room 215
M2I • Coherent Access Networks
Presider: Luca Valcarenghi; Scuola Superiore Sant'Anna, Italy

M2I.1 • 10:30 (Tutorial)
Coherent PON: Recent Evolutions and Expected Trends, Roberto Gaudino[1]; *[1]Politecnico di Torino, Italy.* This Tutorial will explore the potential future transition from IM-DD to coherent PON, evaluating their technical Pros and Cons and presenting the ultimate scalability laws for both solutions, including their potential for extended reach metro+PON convergence.

M2I.2 • 11:30 (Top-Scored)
480 Gbit/s and 240 Gbit/s Single-Carrier Super-Rated Upstream Burst-Mode Coherent PON Utilizing Off-the-Shelf Coherent Receiver., Kovendhan Vijayan[1], Robert Borkowski[1], Qian Hu[1], Dora van Veen[1], Vincent Houtsma[1]; *[1]Nokia Bell Labs, USA.* We demonstrate 480 Gbits/s (400G-PON) and 240 Gbits/s (200G-PON) upstream burst-mode coherent PON operation over 29 dB and 41 dB path loss, respectively with SOA boosters acting as shutter and pre-levelers, using off-the-shelf coherent receiver.

M2I.3 • 11:45
200 Gb/s Coherent PON with a 40 dB Power Budget Over 20 km Anti-Resonant Hollow-Core Fiber, Xumeng Liu[1], Chao Li[1], Peng Sun[1], Qibing Wang[1], Mingshi Zhang[1], Zichen Liu[1], Songyuan Hu[1], Yunhong Liu[1], Peng Li[2], Jie Luo[2], Lei Zhang[2], Lei Wang[1], Zhixue He[1], Shaohua Yu[1]; *[1]Pengcheng Laboratory, China; [2]YOFC, China.* We propose and demonstrate a 200 Gb/s/λ coherent PON over a 20-km NANF link achieving a power budget of 40 dB, in which the local oscillator is transmitted simultaneously with signal for heterodyne detection.

M2I.4 • 12:00 (Top-Scored)
Single-Laser BiDirectional Coherent PON: A Hybrid SC/DSC Architecture for Flexible and Cost-Efficient Optical Access Networks, Haipeng Zhang[1], Zhensheng Jia[1], Luis Alberto Campos[1], Karthik Choutagunta[1], Curtis Knittle[1]; *[1]CableLabs, USA.* We demonstrate a single-

laser BiDi coherent PON with hybrid SC/DSC support, offering flexible-rate upstream burst transmission and reduced complexity, enabling adaptable, high-performance, and cost-effective next-generation optical access networks.

10:30 -- 12:30
Room 301
M2J • LiDAR, Ranging and Urban Demonstrations
Presider: Kevin Shortt; Airbus Defence & Space GmbH, Germany

M2J.1 • 10:30
Demonstrated High-Frame-Rate Real-Time 4D Imaging of Optical Phased Array Solid-State LiDAR System, Baisong Chen[1], Yingzhi Li[1], Quanxin Na[2], Qijie Xie[2], Ziming Wang[1], Min Tao[1], Haolun Hao[1], Heming Hu[1], Xianqi Pang[1], Jie Li[1], Zihao Zhi[1], Xuetong Li[1], Huan Qu[1], Guo-Qiang Lo[3], Junfeng Song[1,2]; *[1]Jilin Univ., China; [2]Peng Cheng Laboratory, China; [3]Advance Micro Foundry, Singapore.* We present a silicon-based OPA all-solid-state LiDAR system that achieves real-time 4D imaging. The system achieved a 40 kHz LiDAR point frequency and demonstrated real-time 4D imaging up to 30 frames per second.

M2J.2 • 10:45
Towards Phase Noise-Free in FMCW LiDAR Sensors for Autonomous Driving, Javier Perez Santacruz[1], Jac Romme[1], Xuebing Zhang[1], Esteban Venialgo Araujo[1], Marcus Dahlem[2], Ruud Oldenbeuving[1], Dongjae Shin[1]; *[1]IMEC NL, Netherlands; [2]IMEC BE, Belgium.* This work introduces a novel phase noise compensation technique for FMCW LiDAR in automotive applications, achieving an 18x linewidth reduction to tens of kHz, experimentally tested and evaluated under various AWGN and long-distance conditions.

M2J.3 • 11:00
Photonics-Enabled Code-Division Multiplexing FMCW Distributed Radar, Chang-Shao Shen[1,2], Nishant Singh[1,3], Anirudh Kankuppe[1], Kristof Vaesen[1], Piet Wambacq[1,2], Guy Torfs[1,3]; *[1]imec, Belgium; [2]Electronics and Informatics, Vrije Universiteit Brussel, Belgium; [3]IDLab, Ghent Univ., Belgium.* This paper presents a 144-GHz Hadamard code-division multiplexing distributed FMCW radar with the phase encoder integrated with the optical distribution network providing the chirps to remote radar units. A proof-of-concept experiment demonstrates successful range measurements.

M2J.4 • 11:15
Highly Efficient Algorithm for Frequency Linearization in FMCW Lidar Using Directly-Modulated DFB Laser, Ying Lu[1], Jun Zhou[1], Siyu Duan[1], Wenjie Xiao[1], Ning Cheng[1], Xuezhe Zheng[1]; *[1]InnoLight Technology (Suzhou) Ltd., China.* A non-iterative pre-distortion algorithm is presented for linear frequency sweep in FMCW LiDAR using directly-modulated semiconductor lasers. This method achieves a residual frequency nonlinearity of ±0.6MHz and an accuracy of 18.7cm for 300m ranging distance.

M2J.5 • 11:30
VLC Over High-Flux LEDs Using Simple Baseband Signaling: Spectral Stitching vs. Beam Combining, Bernhard Schrenk[1]; *[1]Austrian Inst. of Technology, Austria.* Ethernet-over-VLC transmission is accomplished over medium- and high-flux (>50lm) LEDs, revealing that

broadband modulation with simple coding prevails over distortion-sensitive modulation techniques. Towards that, a sub-20lm LED can cater for 100-m real-time LiDAR point-cloud transmission.

M2J.6 • 11:45
Demonstration of Combined Coarse and Fine Underwater Ranging Using Structured Light of Varying Longitudinal Wavenumbers for Enhanced Dynamic Range and Accuracy, Yuxiang Duan[1], Yingning Wang[1], Huibin Zhou[1], Zile Jiang[1], Muralekrishnan Ramakrishnan[1], Zixun Zhao[1], Ruoyu Zeng[1], Yue Zuo[1], Hongkun Lian[1], Xinzhou Su[1], Robert Bock[2], Moshe Tur[3], Alan Willner[1]; *[1]Univ. of Southern California, USA; [2]R-DEX Systems, Inc., USA; [3]Tel Aviv Univ., Israel.* We demonstrate combined coarse and fine underwater ranging by tuning the longitudinal wavenumber difference of structured light beams. ~4X enhanced dynamic range (1 meter) and accuracy (average error of 4.2 mm) is achieved under scattering water (γ= 1.3 m^{-1}).

M2J.7 • 12:00 (Top-Scored)
5.7 Tb/s Transmission Over a 4.6 km Field-Deployed Free-Space Optical Link in Urban Environment, Vincent van Vliet[1], Menno van den Hout[1], Kadir Gumus[1], Eduward Tangdiongga[1], Chigo M. Okonkwo[1]; *[1]Eindhoven Univ. of Technology, Netherlands.* We transmitted 5.7 Tb/s over a 4.6 km free-space optical link in an urban environment, spanning the city of Eindhoven, the Netherlands, using a 1.1 THz wide wavelength-division multiplexed signal.

M2J.8 • 12:15
Wireless Transmission of 220-GHz Terahertz Signals Over 4.6 km Using Photonics-Aided Technology, Yi Wei[1], Jianjun Yu[1], Xiongwei Yang[1], Mingxu Wang[1], Si q. wang[1], Qiutong Zhang[1], Chenzhen Bian[1], Jingwen Tan[1], Peng Tian[1], Yang Han[1], Sicong Xu[1], Wen Zhou[1], Kaihui Wang[1], Feng Zhao[2]; *[1]Fudan Univ., China; [2]Xi'an Univ. of Posts and Telecommunications, China.* Based on photonics-aided technology, we achieved a record-breaking 4.6-km wireless transmission of 220-GHz terahertz signals and attained a 2,000-Mbps transmission rate for QPSK signals in this system.

10:30 -- 12:30
Room 304
M2K • Light Source and Integration II
Presider: Yuichi Tohmori; Tsurugi Photonics Foundation, Japan

M2K.1 • 10:30
90 GHz Silicon Mach-Zehnder Modulator with Integrated Equalizer for 1.6 Tbps (200G/λ) IMDD Transceivers, Haibo Wang[1], James Y. Tan[1], Hanzhi Tang[1], Tingyu Teo[1], Wu Xie[1], Chewping Leong[1], Wenxu Gu[1], Chao Li[1], Guo-Qiang Lo[1]; *[1]Advanced Micro Foundry, Singapore.* We successfully demonstrated 90 GHz Silicon Mach-Zehnder modulator using an integrated equalizer, which was fabricated using foundry standard silicon photonics technology. This potentially enables high volume manufacturable 1.6Tbps (200G/(λ)) and beyond IMDD transceivers.

M2K.2 • 10:45
135 GHz Waveguide-Coupled Germanium Photodiode, Mingjie Zou[1], Yang Shi[1], Zuhang Li[1], Xiaojun Xie[2], Yu Yu[1]; [1]*Wuhan National Laboratory for Optoelectronics & School of Optical and Electronic Information, Huazhong Univ. of Science and Technology, China;* [2]*Key Laboratory of Photonic-Electronic Integration and Communication-Sensing Convergence, School of Information Science and Technology, Southwest Jiaotong Univ., China.* We demonstrate a high-bandwidth waveguide-coupled germanium photodiode compatible with the complementary metal-oxide-semiconductor fabrication, achieving a bandwidth of 135 GHz at -1 V and enabling four-level pulse amplitude modulation signal reception up to 270 Gb/s.

M2K.3 • 11:00 (Invited)
High Speed and High Temperature Operating III-v on Si Membrane DFB Lasers, Koji Takeda[1,2], Takuro Fujii[1,2], Suguru Yamaoka[1], Tatsurou Hiraki[1,2], Yoshiho Maeda[1,2], Shinji Matsuo[1]; [1]*NTT Device Technology Labs, Japan;* [2]*NTT Device Innovation Center, Japan.* Heat dissipation is an important factor limiting the operating speed and temperature of lasers on Si. We review our recent progress on III-V membrane lasers on Si, SiC, and sapphire/Si, including the transfer printing technique.

M2K.4 • 11:30
Monolithically Integrated Ultra-Dense Polarization Insensitive 8x8 InP Switch for Optical Networks, Aref Rasoulzadehzali[1], Marijn Rombouts[1], Shiyi Xia[1], Steven Kleijn[2], Luc Augustin[2,1], Nicola Calabretta[1]; [1]*TUe, Netherlands;* [2]*Smart Photonics, Netherlands.* For the first time, we experimentally demonstrated an ultra-dense polarization-insensitive C-band 8x8 broadcast&select switch based on bulk SOAs. Results show broadband net-gain, low PDG<2dB, error-free operation with <0.2dB power-penalty at 30Gbps NRZ-modulated signal in C-band.

M2K.5 • 11:45
5-mW 300-GHz-Band THz-Wave Generator Consisting of two SiC-Based Photomixers and Power Combiner, Yoshiki Kamiura[1], Ryo Doi[1], Kentaro Soeda[3], Kazunori Naganuma[3], Yoshinori Yamaguchi[3], Chengyuan Qian[1], Ming Che[1], Yuya Mikami[1], Junji Yumoto[3], Tadao Nagatsuma[3,2], Tadao Ishibashi[4], Kazutoshi Kato[1]; [1]*Kyushu Univ., Japan;* [2]*Osaka Univ., Japan;* [3]*The Univ. of Tokyo, Japan;* [4]*wavepackets LLC, Japan.* A high-power UTC-PD on a SiC substrate has achieved 5 mW output power and 87 GHz bandwidth in the 300-GHz band. This breakthrough was accomplished using a compact WR-3.4 waveguide module and Y-junction power combiner.

M2K.6 • 12:00 (Top-Scored)
Integrated Optical Link on Si Wafer Using Low Energy Membrane InP-Based Photonic Devices, Tatsurou Hiraki[2,1], Koji Takeda[2,1], Takuro Fujii[2,1], Takuma Aihara[2,1], Yoshiho Maeda[2,1], Hiroki Sugiyama[1], Tomonari Sato[2,1], Shinji Matsuo[1]; [1]*NTT Device Technology Labs, Japan;* [2]*NTT Device Innovation Center, Japan.* An integrated optical link on a Si wafer is demonstrated with a short-cavity membrane laser, over-67-GHz-bandwidth electro-absorption modulator, 48-GHz-bandwidth photodetector, and 7.6-mm-long SiO_x waveguide. It demonstrates 0.26-pJ/bit operation for 64-Gbit/s non-return-to-zero signals.

M2K.7 • 12:15 (Top-Scored)
230 GHz MUTC Photodiodes Integrated on Thin-Film Lithium Niobate, Luyu Wang[1], Hanke Feng[2], Zhouze Zhang[1], Linze Li[1], Tianyu Long[1], Chengfei Shang[2], Cheng Wang[2], Baile Chen[1]; *[1]Shanghaitech Univ., China; [2]City Univ. of Hong Kong, Hong Kong.* We report an ultrafast modified uni-traveling carrier photodiode (MUTC PD) heterogeneously integrated on thin-film lithium niobate (TFLN) waveguides, achieving a record-high 3-dB bandwidth of 230 GHz and a responsivity of 0.51 A/W at 1550-nm wavelength.

10:30 -- 12:30
Rooms 201-202
M2A • The Year of Quantum: Applications, Architectures and Enabling Technologies for Quantum Communication and Computing II
Presider: Cheryl Sorace-Agaskar; MIT Lincoln Laboratory, USA

M2A.1 • 10:30 (Invited)
Quantum Technologies with Semiconductor Color Centers in Integrated Photonics, Jelena Vuckovic[1]; *[1]Stanford Univ., USA.* Optically interfaced spin qubits based on diamond and silicon carbide color centers are considered promising candidates for scalable quantum networks and sensors. However, they can also be used to build chip-scale quantum many body systems with tunable all to all interactions between qubits enabled by photonics - useful for quantum simulation and possibly computing.

M2A.2 • 11:00 (Invited)
Title to be Announced, Zhiliang Yuan[1]; *[1]Beijing Academy of Quantum Info Sciences, China.* Abstract not available.

M2A.3 • 11:30 (Invited)
High-Dimensional Entanglement in Quantum Frequency Combs, Chee Wei Wong[1]; *[1]Univ. of California Los Angeles, USA.* We describe high-dimensional entanglement in biphoton frequency combs, providing multi-qubits-per-photon and dramatically-large Hilbert spaces for quantum communications, sensing and computation. Measurement-efficient certification via arbitrary bases, steering, non-locality, and multi-party high-dimensional network testbeds will be described.

10:30 -- 12:30
Rooms 205-206
M2C • Sensing Applications II
Presider: Ting Wang; NEC Laboratories America Inc., USA

M2C.1 • 10:30
DiffOptics: A Conditional Diffusion Model for Fiber Optics Sensing Data Imputation, Zhuocheng Jiang[1], Yue Tian[1], Yangmin Ding[1], Sarper Ozharar[1], Ting Wang[1]; *[1]NEC Laboratories America, Inc, USA.* We present a generative AI framework based on a conditional diffusion model for distributed acoustic sensing (DAS) data imputation. The proposed DiffOptics model generates high-quality DAS data of various acoustic events using telecom fiber cables.

M2C.2 • 10:45
Dual-Mentor Guided Incremental Learning for Robust Anomaly Detection in Optical Networks, Khouloud Abdelli[1], Matteo Lonardi[1], Fabien Boitier[2], Diego Correa[1], Jurgen Gripp[1], Samuel Olsson[1], Patricia Layec[2]; *[1]Nokia, Italy; [2]Nokia Bell Labs, France.* We present a dual-mentor approach for anomaly detection, achieving up to 94x reduction in training time and significant performance improvements (up to 79%) over baselines, effectively addressing catastrophic forgetting with minimal data and optimized computation.

M2C.3 • 11:00
Simple and Fast Optical Fiber Flap Localization Based on Two-Edge Channel Power in Wideband System, Shengnan Li[1], Yuchen Song[1], Zihao Cui[1], Jin Li[1], Min Zhang[1], Danshi Wang[1]; *[1]BUPT, China.* We propose a fast method to localize optical fiber flap using the monitored power of two edge channels, achieving average location and attenuation errors below 0.64 km and 0.1 dB in a C96+L96 experimental system.

M2C.4 • 11:15
Boosting Mechanical Event Classification with Limited Field Data via Conditional GANs and Knowledge Distillation, Khouloud Abdelli[1], Christian Dorize[1], Sterenn Guerrier[1], Haik Mardoyan[1], Patricia Layec[1], Jeremie Renaudier[1]; *[1]Nokia Bell Lab, Germany.* We propose a two-step approach combining conditional generative adversarial networks and knowledge distillation addressing field-data scarcity. Validated on field data, we outperform baselines, boosting accuracy from 83% to 99% with an error rate of 0.6%.

M2C.5 • 11:30 (Invited)
Advanced Optical Link Tomography for Optical Network Monitoring, Alix A. May[1], Fabien Boitier[1], Patricia Layec[1]; *[1]Nokia Bell Labs France, France.* We review methods for optical link tomography, particularly receiver-based power profile estimation. We highlight key works including a demonstration over 10,000 km and an accuracy comparison between linear least squares method and deconvoluted correlation-based method.

M2C.6 • 12:00
Raman Amplifier-Induced OTDR Trace Distortion Correction Using Higher-Order ReLU Kolmogorov-Arnold Network (HRKAN), Md Ghulam Saber[1], Qingyi Guo[1], Zhiping Jiang[1]; *[1]Huawei Technologies Canada, Canada.* A method to correct Raman amplifier-induced OTDR trace distortions utilizing the Higher-Order ReLU Kolmogorov-Arnold Network (HRKAN) is presented. A reduction of mean squared error (MSE) by at least two orders of magnitude is achieved experimentally.

M2C.7 • 12:15
Optical Fiber Anomaly Detection Using Channel Power Tilt Through Forward and Inverse Calculation of ISRS, Zihao Cui[1], Yuchen Song[1], Xiao Luo[1], Shengnan Li[1], Jiele Li[1], Min Zhang[1], Danshi Wang[1]; *[1]Beijing Univ. of Posts and Telecommunications, China.* The proposed low-complexity fiber anomaly detection method, utilizes power tilt comparison from forward and backward ISRS calculation, demonstrating maximum positioning error of 0.7% and strength estimation error of 4.2% in an 80km C+L-band experiment link.

10:30 -- 12:30
Rooms 209-210
M2F • Hollow-Core Fiber Characterizations and Applications
Presider: Natalie Wheeler; Univ. of Southampton, UK

M2F.1 • 10:30
Preliminary Experimental Analysis of Birefringence in a 5-Tube NANF, Silvia Zampato[1], Austin Taranta[2], Gianluca Guerra[2], Seyed Mohammad Abokhamis Mousavi[2,3], Thomas W. Kelly[2], Hesham Sakr[2,3], Konstantin Vidiajev[2], Andrea Galtarossa[1], Marco Santagiustina[1], Francesco Poletti[2], Luca Palmieri[1]; *[1]Department of Information Engineering, Univ. of Padova, Italy; [2]Optoelectronics Research Centre, Univ. of Southampton, UK; [3]Microsoft Azure Fiber, UK.* Preliminary experimental measurements of birefringence in a 5-tube NANF using polarization-sensitive reflectometry are reported. Results show an average beat length of approximately 6 m, consistent with numerical simulations. The effects of fiber bending are discussed.

M2F.2 • 10:45
Simultaneous C/L-Band Power and Data Delivery Over 3.1km of NANF, Douglas McCulloch[1], Kyle R. Bottrill[1], Suttikarn Wantee[1], Nura Adamu[1], Gregory T. Jasion[1], Hesham Sakr[1], John R. Hayes[1], Francesco Poletti[1], Periklis Petropoulos[1]; *[1]Optoelectronics Research Centre, UK.* We show that hollow-core fibre outperforms single-mode fibre at three-channel 28 GBd DP-16QAM transmission when copropagating with up to 37.5 dBm feed. There is no sign of power-dependent signal degradation in the hollow-core fibre.

M2F.3 • 11:00
Fluorescence Lifetime Measurements of a Trapped Microparticle in a Hollow-Core Fiber for Remote Temperature Sensing with High Spatial Resolution, Jasper G. Freitag[1,2], Max Koeppel[1], Mohammad Sahil[1], Nicolas Joly[2,3], Bernhard Schmauss[1,2]; *[1]Inst. of Microwaves and Photonics, Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU), Germany; [2]Max Planck Inst. for the Science of Light, Germany; [3]Department of Physics, Friedrich-Alexander-Universität Erlangen-Nürnberg (FAU), Germany.* Fluorescence lifetime measurements of trapped microparticles in hollow-core fibers can probe temperature with high sensitivity. We use coherent optical frequency domain reflectometry to demonstrate remote flying particle temperature measurements with sub-mm spatial resolution.

M2F.4 • 11:15
Hollow-Core Fiber Side-View Imaging for Non-Destructive Clocking Angle Measurement and Structural Analysis, Jie Liu[1]; *[1]Corning Inc., USA.* We report side-view images of a HCF compared with the simulated transmission interference patterns to clarify clocking angle and feasibility of side-view imaging for HCF non-destructive structural analysis.

M2F.5 • 11:30 (Invited)
Hollow-Core Fibers: Design and Applications, Rodrigo Amezcua Correa[1]; *[1]Univ. of Central Florida, CREOL, USA.* Abstract not available

10:30 -- 12:30
Rooms 211-212
M2G • Datacenter IM/DD II
Presider: Kang Ping Zhong; Hong Kong Polytechnic Univ., Hong Kong

M2G.1 • 10:30
Multi-Rate PAM4 Silicon Photonic Based Receiver Assembly With -10dBm IFEC Sensitivity at 226Gb/s/λ and 125mW/Ch CMOS TIA, Mahdi Parvizi[1], Hao Song[1], Bahar Jalali[1], Masoud Madiseh[1], John Rogers[1], Tie Sun[1], Toshi Omori[1], Brandon Davis[1], Bernd Huebner[1], Mark Heimbuch[1], Michael Soskind[1], Md Jubayer Shawon[1], Ren Jye Shiue[1], Jonathan Roth[1], Qianfan Xu[1], Li Chen[1], John Heanue[1], Richard Zhou[1], Long Chen[1], Alex Turukhin[1], Ricardo Aroca[1]; [1]*Cisco Systems, Canada.* We demonstrate a multi-rate PAM4 Silicon-photonic based receiver assembly that supports 226Gb/s/λ, with -10dBm iFEC OMA sensitivity, and 212Gb/s/λ and 106Gb/s/λ with -8.5dBm and -11.5dBm OMA KP4-FEC sensitivity, respectively. The CMOS TIA achieves 0.55pJ/b power efficiency.

M2G.2 • 10:45
42-Gbps/ch x 4 ch Simultaneous Error-Free Operation with Low-Power Transmitter Flip-Chip-Bonded 1.3-µm LD-Array-on-Si, Toshiki Kishi[1], Munehiko Nagatani[1], Shigeru Kanazawa[2], Takuro Fujii[1], Hidetaka Nishi[1], Tadashi Minotani[1], Norio Sato[1], Tomonari Sato[1], Shinji Matsuo[1]; [1]*NTT Device Technology Labs., Japan;* [2]*NTT Device Innovation Center, Japan.* 42-Gbps/ch NRZ PRBS-31 x 4 ch simultaneous error-free BtoB operation was achieved with a 4-ch transmitter used LD drivers with EO-bandwidth-improvement functions, yielding an LD bandwidth increase of 60% and power efficiency of 2.06 mW/Gbps.

M2G.3 • 11:00 (Invited)
Electronics for 100 Gbaud and Beyond, Lian Qin[1]; [1]*Marvell Semiconductor Inc., USA.* the advancements in 200G and 400G per lane technologies are significant for the future of high-speed data transmission: 200G per lane technology is being rapidly adopted, and widely used in hyperscalers. 400G per lane technology is anticipated to play a key role in 3.2T optical modules, which will be essential for next-generation switches and large-scale AI clusters.

M2G.4 • 11:30
Low Complexity Optical Multipath Interference Mitigation Using Long-Term Memory Postfilter in IM-DD System, Weihao Ni[1], Zhaohui Li[1], Fan Li[1]; [1]*Sun Yat-Sen Univ., China.* We propose a low-complexity clustered long-term memory postfilter to whiten the MPI noise in high-speed IM-DD systems. Experiments with 112 Gbit/s PAM-4 transmission show that the signal-to-interference ratio tolerance can be improved by >4.6 dB.

M2G.5 • 11:45
Probabilistic Shaping for Peak Power Constrained IM-DD Systems: Perspective of Envelope Control, Dongdong Zou[1], Wang Wei[2], MingZhu Yin[2], Weihao Ni[2], Zhongxing Tian[1], Huan Huang[1], Fan Li[2], Yi Cai[1]; [1]*School of Electronic and Information Engineering, Soochow Univ., China;* [2]*School of Electrical and Information Technology, Sun Yat-Sen Univ., China.* A novel indirect probabilistic shaping scheme tailed for peak-power constrained IM-DD systems is proposed based on dynamic selective mapping. Collaborating with turbo equalization, about 1dB receiver sensitivity improvement is observed in a 56GBaud PAM8 system.

M2G.6 • 12:00

Real-Time Deployment of Nonlinear Compensation Equalizer Based on Pruning and non-Uniform Quantization in Short-Reach Optical Links, Xinda Sun[1], Kaihui Wang[1], Bohan Sang[1], Zonghui Zhu[1], Yumeng Gou[1], Yuanxiao Meng[1], Tianqi Zheng[1], Sheng Hu[1], Jianghao Wu[1], Jianjun Yu[1], Wen Zhou[1], Yun Chen[1]; *[1]Fudan Univ., China.* We propose a low-complexity Volterra RTL design to achieve 212Gbit/s PAM4 1km transmission and real-time FPGA-based 29.4912 Gbit/s 25km PAM4 transmission. The design saves 75.3% of DSP and reduces power consumption by 26.2%.

10:30 -- 12:30
Rooms 213-214
M2H • Optical Transceiver Technologies
Presider: Sudip Shekhar; Univ. of British Columbia, Canada

M2H.1 • 10:30

Performance Limitations and Optimizations of Linear Driver Optics for 200G/Lane and Beyond, Jianying Zhou[1], Lei Xin[2], Jin Hong[3]; *[1]Hisense Broadband Inc, USA; [2]Hisense Broadband Inc., China; [3]Hisense Broadband Inc., USA.* We studied performance limitations and optimizations using digital equalization and modulation bandwidth in linear-driver-optics for 200G/lane and beyond. The results show linear pluggable modules can support 30dB bump-to-bump loss for 200G/lane using an enhanced CTLE.

M2H.2 • 10:45

A 4λx128Gb/s PAM-4 Si-Photonic Transmitter with Micro-Ring Modulator and Co-Designed Linear Driver for Chiplet Optical I/O, Siyuan Ma[1,2], Yingjie Ma[1,2], Chaoyang Dai[1], Sikai Chen[1], Qianli Ma[1,2], Yihan Chen[1,2], Haoran Yin[1,2], Yujun Xie[1], Guike Li[1,2], Jian Liu[1,2], Ming Li[1], Liyuan Liu[1,2], Nan Qi[1,2]; *[1]Inst. of semiconductor, Chinese Academy of Sciences, China; [2]Univ. of Chinese Academy of Sciences, China.* A 4λ×128Gb/s PAM4 Silicon-Photonic WDM transmitter is designed in CMOS, consisting of a linear driver and a micro-ring modulator for optical I/O. Measurement results demonstrate optical eye diagrams > 3.5dB extinction ratio while consuming 1.5pJ/bit.

M2H.3 • 11:00

A 100 Gbps, sub-pJ/bit Transimpedance Amplifier in 90-nm SiGe in a Reconfigurable IMDD/Coherent Optical Receiver, Aaron T. Wissing[1], James Dalton[1,2], Viviana Arrunategui Norvick[1,3], Evan Chansky[1], Xinhong Du[1], Junqian Liu[1], Hector Andrade[1,4], Aaron Maharry[1,4], Stephen Misak[1,4], Mario Milicevic[5], Luis Valenzuela[1,6], Larry A. Coldren[1], Adel A. Saleh[1], James F. Buckwalter[1], Clint Schow[1]; *[1]Department of Electrical and Computer Engineering, Univ. of California, Santa Barbara, USA; [2]MaxLinear Incorporated, USA; [3]Colorado School of Mines, USA; [4]Lucidean Incorporated, USA; [5]MaxLinear Incorporated, USA; [6]Intel Corporation, USA.* We report a 0.91 pJ/bit, differential dual-channel TIA with variable gain reaching 64 dBΩ in 90-nm SiGe measured in a reconfigurable PAM4/QPSK O-band receiver at 53.125 Gbaud with BERs below the KP4-FEC threshold of 2.2e-4.

M2H.4 • 11:15

Adaptive Wavelength Tracking and Temperature Tuning of a 45Gbps Coupled Ring Resonator Based DWDM Link, Zhaowen Wang[1], Ade Bekele[1], Mingshan Li[1], Mayank Raj[1], Chuan Xie[1], Anish Joshi[1], Gareeyasee Saha[1], Zakriya Mohammed[1], Stuart Daudlin[1], Parag Upadhyaya[1], Yohan Frans[1]; [1]*Advanced Micro Devices, USA.* We demonstrate an adaptive wavelength locking system for micro-ring-based DWDM transceivers with high-order filters, utilizing DC data. Despite 20°C temperature fluctuations, system-level measurements at 45Gbps achieve BER<1E-10 with 1.2pJ/bit EIC power and 0.3pJ/bit heater power.

M2H.5 • 11:30 (Invited)
Electronic-Photonic Co-Design for Next Generation Optical Transceivers, Ali Pirmoradi[1], Han Hao[1,2], Kaisarbek Omirzakhov[1], Firooz Aflatouni[1]; [1]*Univ. of Pennsylvania, USA;* [2]*Intel Corporation, USA.* Recent advances in monolithically integrated energy efficient high data-rate optical receivers, transmitters, and WDM light sources are presented and opportunities and challenges of next generation optical transceivers are discussed.

M2H.6 • 12:00 (Invited)
Next-Generation Data Center Interconnects in the Age of AI, Reza Motaghian[1]; [1]*Amazon Web Services, USA.* This talk explores optical technology advancements enhancing AI performance in data centers through high-speed data transfer. We highlight requirements and challenges in managing complex optical networks, focusing on scalability and troubleshooting for next-generation AI infrastructure.

14:00 -- 16:00
Room 207
M3D • Satellite and THz Communications
Presider: Oskars Ozolins; RISE Research Inst.s of Sweden AB, Latvia

M3D.1 • 14:00 (Invited)
High-Capacity THz Wireless Transmission Supporting Future 6G Optical Networks, Colja Schubert[1], Robert Elschner[1], Oliver Stiewe[1], In-Ho Baek[1], Simon Schütze[1], Andreas Maassen[1], Kallyan Das[1], Robert B. Kohlhaas[1], Simon Nellen[1], Milan Deumer[1], Thomas Merkle[2], Axel Tessmann[2], Markus Rösch[2], Fred Meier[3], Frederik Bart[3], Ronald Freund[1,3], Martin Schell[1,3]; [1]*Fraunhofer Institue for Telecommunications Henrich-Hertz-Institut, Germany;* [2]*Fraunhofer Inst. for Applied Solid State Physics, Germany;* [3]*Technische Universität Berlin, Germany.* We review recent developments in high-capacity THz wireless transmission, focusing on point-to-point links in the lower THz frequency range around 300 GHz. Available technologies and challenges for integration into future 6G optical networks are discussed.

M3D.2 • 14:30
Ultra-Fast Fibre Optic Alignment System for Free-Space Optical Communications Utilizing Multi-Spot Beams, Ruixue Guo[1], Xun Yu[1], Haining Yang[1]; [1]*Southeast Univ., China.* This paper demonstrated a holographic fibre coupling method, which achieved a 98% reduction in the average search steps with an enhanced efficiency compared with the traditional method using FSM.

M3D.3 • 14:45 (Invited)
Fully Reconfigurable Silicon Photonic Transceiver for Optical Inter-Satellite Links, Vignesh Gopal[1], Asher Novick[1], Xinzhou Su[2], James Venditto[1], Muralekrishnan Ramakrishnan[2], Zile Jiang[2], Maarten Hattink[1], Anthony Rizzo[1], Ricard Menchon-Enrich[3], Xiang

Meng[1], Alan Willner[2], Keren Bergman[1]; *[1]Columbia Univ., USA; [2]Univ. of Southern California, USA; [3]Intel Corporation, USA.* Over the past two decades, LEO satellites have rapidly proliferated, fragmenting communication protocols. We propose a reconfigurable silicon-photonic link enabling versatile modulation formats to promote seamless interoperability and efficiency in inter-satellite communications.

M3D.4 • 15:15
1.2 Tb/s/λ Real Time Mode Division Multiplexing Free Space Optical Communication with Commercial 400G Open and Disaggregated Transponders, Giacomo Borraccini[1], Giovanni Milione[1], Andrea D Amico[1], Yue-Kai Huang[1], Ezra Ip[1], Jian Fang[1], Philip Ji[1], Koji Asahi[2], Ting Wang[1]; *[1]NEC Laboratories America Inc., USA; [2]NEC Corporation, Japan.* We experimentally demonstrate real time mode division multiplexing free space optical communication with commercial 400G open and disaggregated transponders. As proof of concept, using HG_{00}, HG_{01}, and HG_{10} modes, we transmit 1.2 Tb/s/λ (3×1λ×400 Gb/s) error free.

M3D.5 • 15:30 (Invited)
Challenges and Opportunities in Free Space Optical Satellite Communication, Mustafa Cardakli[1]; *[1]Amazon, USA.* This paper examines the technical challenges and potential solutions for implementing optical communications in low-Earth-orbit (LEO) constellations, with an emphasis on achieving high photon efficiency, enabling adaptable high data rates, and minimizing power consumption.

14:00 -- 16:00
Room 208
M3E • Integration and Devices for Quantum Systems
Presider: Cheryl Sorace-Agaskar; MIT Lincoln Laboratory, USA

M3E.1 • 14:00
Integrated Visible Light Coil-Resonator Stabilized Brillouin Lasers for Sr Neutral and Trapped-ion Clock and Qubit Transitions, Meiting Song[1], Nitesh Chauhan[1], Nick Montifiore[1], Kaikai Liu[1], Andrew S. Hunter[1], Andrei Isichenko[1], Robert J. Niffenegger[2], Daniel J. Blumenthal[1]; *[1]Univ. of California, Santa Barbara, USA; [2]Univ. of Massachusetts Amherst, USA.* We demonstrate stabilization of 698 and 674 nm integrated Brillouin lasers to integrated 3-m coil resonators for neutral and trapped-ion strontium clock applications, achieving record-low 17 Hz fundamental and 660 Hz integral linewidths.

M3E.2 • 14:15
Strong Nanophotonic Quantum Squeezing Exceeding 3.5 dB in Kerr Microresonator, Yichen Shen[1], Ping-Yen Hsieh[1,2], Sashank K. Sridhar[1], Samantha Feldman[1,3], You-Chia Chang[2], Thomas Smith[4], Avik Dutt[1]; *[1]Univ. of Maryland, USA; [2]Department of Photonics, National Yang Ming Chiao Tung Univ., Taiwan; [3]Department of Mechanical Engineering and Materials Science, USA; [4]Quantum Research and Applications Branch, Naval Air Warfare Center, USA.* We report the highest level of squeezing directly detected from a microresonator, 3.7 dB (10.7 dB inferred). We use Si$_3$N$_4$ nanophotonic microrings operated in the continuous-wave regime and observe stable squeezing with minimal excess classical noise.

M3E.3 • 14:30 (Invited)
Quantum Light Source Technologies Based on Silicon Nitride Photonic Integrated Circuits, Kartik Srinivasan[1,2]; *[1]National Inst of Standards & Technology, USA; [2]Joint Quantum Inst., Univ. of Maryland, USA.* I will discuss three types of quantum light sources in silicon nitride photonics based on: (1) bulk $c^{(3)}$ nonlinearity, (2) heterogeneous integration with III-V epitaxial quantum dots, and (3) heterogeneous integration with Rb alkali vapor.

M3E.4 • 15:00
Nonlinear Interference in Silicon Photonics for Enhanced Photon Pair Generation, Haoran Ma[1], Huihui Zhu[2], Fanjie Ruan[1], Li'ao Ye[1], Zichao Zhao[1], Qishen Liang[1], Donghui Chen[1], Denghui Wang[1], Yuehai Wang[1], Jianyi Yang[1]; *[1]Zhejiang Univ., China; [2]The Hong Kong Polytechnic Univ., China.* We observed quantum nonlinear interference in a silicon chip and propose a scheme to utilize it for improving the photon pair rate. The numerical analysis shows that a gain of over two can be attained.

M3E.5 • 15:15
Tapered Optical Fibres With a Xenon Gas Cladding for Entangled Photon Pair Generation, Tom Bradley[1], Liudmila Silanteva[1], Menno van den Hout[1], Chigo M. Okonkwo[1]; *[1]Technische Universiteit Eindhoven, Netherlands.* Photon pair generation compatible with quantum memories and telecommunication systems is critical for integration into optical fiber networks. A feasibility study was conducted on the phase-matching conditions necessary for spontaneous four-wave-mixing in tapered single-mode fiber.

M3E.6 • 15:30 (Invited)
Photonics for Trapped Ion Systems, Jeremy Sage[1]; *[1]IonQ Inc., USA.* Abstract not available

14:00 -- 16:00
Room 215
M3I • Optical Switches for Datacenters
Presider: Brandon Buscaino; Ciena Corporation, USA

M3I.1 • 14:00 (Tutorial)
Photonic Switching in Data Centers and Computing Systems, S. J. Ben Yoo[1]; *[1]Univ. of California Davis, USA.* Abstract not available.

M3I.2 • 15:00
First Demonstration of Net 2.276Pbit/s Real-Time Co-Frequency Co-Time Full-Duplex Optical Switching Network Node, Linbojie Huang[1], Peng Sun[1], Zichen Liu[1], Zhongyi Li[1], Chao Li[1], Songyuan Hu[1], Yunhong Liu[1], Ji Wang[1], Ming Luo[2], Songtao Chen[3], Zhixue He[1], Shaohua Yu[1]; *[1]Pengcheng Laboratory, China; [2]State Key Laboratory of Optical Communication Technologies and Networks, China Information Communication Technologies Group Corporation (CICT), China; [3]Fiberhome Telecommunication Technologies Co., Ltd, China.* We report the first real-time co-frequency co-time full-duplex optical switching network node using 400G and 800G mixed commercial coherent optical modules with ultra-high net capacity of 2.276Pbit/s for intra data center switching network application.

M3I.3 • 15:15
Experimental Demonstration of DWDM-SDM Amplification Transmission and Optical Switching (150-km MCF+ Silicon Chip+ 120-km MCF) Assisted by MCF-EDFA and Silicon Switch Array, Guofeng Yan[1], Kang Li[1], Bing Han[1], Lei Shen[2], Shuo Xu[2], Li Zhang[2], Lei Zhang[2], Jun Chu[2], Jie Luo[2], Jian Wang[1]; *[1]HUST, China; [2]YOFC, China.* We propose and demonstrate the DWDM-SDM amplification transmission and optical switching system (150-km MCF-Chip-120-km MCF) with 4×175×24.5 Gbaud QPSK signals in C-band, employing 4-core EDFAs for amplification and silicon chip for optical processing.

14:00 -- 16:00
Room 301
M3J • Lasers and Ranging
Presider: Sabarni Palit; Anello Photonics, USA

M3J.1 • 14:00 (Top-Scored)
Highly Linear and Stable III-v/Si_3N_4 FMCW Laser Equipped with a Customized Electro-Optical Phase-Locked Loop, Keyi Han[1], Ruiyang Xu[1], Yuyao Guo[1,2], Weihan Xu[1], Xinhang Li[1], Yihao Fan[1], Liangjun Lu[1,2], Jianping Chen[1,2], Linjie Zhou[1,2]; *[1]Shanghai Jiao Tong Univ., China; [2]SJTU-Pinghu Inst. of Intelligent Optoelectronics, China.* We demonstrate a high-performance FMCW laser source comprising a III-V/Si_3N_4 hybrid laser and an EO-PLL. The ranging precision is significantly improved from 4.44 m to 10.28 cm at a 300-m fiber length.

M3J.2 • 14:15
A Novel on-Chip Bridged Balanced Photodetector with High Common-Mode Rejection Ratio (~49dB) for FMCW LiDAR, Xuetong Li[1], Huan Qu[1], Weipeng Wang[1], Heming Hu[1], Ziming Wang[1], Baisong Chen[1], Yingzhi Li[1], Xiaolong Hu[1], Xueyan Li[1], Guo-Qiang Lo[1], Junfeng Song[1,2]; *[1]Jilin Univ., China; [2]Peng Cheng Laboratory, China.* We reported a bridge balanced photodetector that increases the common mode rejection ratio by 20 dB at 1550 nm, reaching 49 dB, and improves the signal-to-noise ratio for frequency modulated continuous wave LiDAR.

M3J.3 • 14:30
LiDAR Chip-Based Ranging and Velocity Through Timing Jitter Correction, Jia-Yan Huang[1], Cheng-Chi Hsiao[1], Ming-Yang Hung[1], Shih-Hsiang Hsu[1]; *[1]National Taiwan Univ of Science & Tech, Taiwan.* Through low-dispersion silica-based auxiliary interferometry with 1.6-meter optical-path difference, 12.5-times shorter than the measured distance, a silicon-based LiDAR is demonstrated for the 20-meter ranging and 200-mm/s velocity, limited to swept-source linewidth, through optical-clock Hilbert-transform resampling.

M3J.4 • 14:45
C- and L-Band Tunable Integrated Erbium Lasers via Scalable Manufacturing, Xinru Ji[1], Yang Liu[1], Xuan Yang[1], Zheru Qiu[1], Grigory Lihachev[1], Simone Bianconi[1], Andrey Voloshin[1], Taegon Kim[2], Joseph C. Olson[2], Tobias J. Kippenberg[1]; *[1]École Polytechnique Fédérale de Lausanne, Switzerland; [2]Applied Materials Inc, USA.* We demonstrate an integrated Erbium-based tunable laser using wafer-scale fabrication and ion implantation of silicon nitride photonic integrated circuits. We achieve single-frequency lasing tunable from 1530 nm to 1621 nm covering nearly the entire optical C- and L-band.

M3J.5 • 15:00 (Invited)
Quantum Dot Lasers on Silicon Photonics, Xuhan Guo[1]; [1]*Shanghai Jiao Tong Univ., China.* Silicon photonics excels in data communications, sensing, and computing but faces challenges in lasing. This report demonstrates monolithic integration of InAs/GaAs quantum dot lasers on SOI substrates, offering a scalable, cost-effective path for full wafer-scale photonic circuits.

M3J.6 • 15:30
A Zero-Change Isolator-Replacement Circuit in Silicon-on-Insulator Leveraging Controlled Self-Injections, Omid Esmaeeli[1], Lukas Chrostowski[1], Sudip Shekhar[1]; [1]*Univ. of British Columbia, Canada.* A silicon photonic circuit enables amplitude- and phase-controlled self-injections to stabilize a hybrid-integrated DFB laser. Isolator-free signaling at 25 Gbps over a fiber link is demonstrated.

M3J.7 • 15:45
Ultra-Low Bit Error Rate Plastic Optical Fiber Link with Enhanced Optical Return Loss Tolerance and Alignment Robustness for Advanced PAM4 Transceiver Design, Kenta Muramoto[1], Yasuhiro Koike[1]; [1]*Keio Photonics Research Inst. (KPRI), Keio Univ., Japan.* Ultra-low bit error rate graded-index plastic optical fiber link with enhanced optical return loss tolerance and alignment robustness is proposed, enabling simplified PAM4 transceiver design and offering a cost-effective solution for data center interconnects.

14:00 -- 16:00
Room 303
M3Z • Demo Zone

M3Z.1
Demonstration of State-of-Polarization Change Localization Based on Digital Coherent Transceivers, Naoya Okada[1], Joji Terashi[1], Setsuo Yoshida[1], Reiko Kuroiwa[1], Yu Tajima[1], Ichiro Yokokura[1], Atsushi Kanai[1], Junichi Sugiyama[1], Norihiro Yoshida[1], Shoichiro Oda[1], Kousuke Komaki[1], Takeshi Hoshida[1]; [1]*Fujitsu Limited, Japan.* We demonstrate location-resolved visualization of state-of-polarization change along a transmission link by digital coherent transceivers. Experimental verification showed the distance resolution better than 3.4km in a 150km-long link.

M3Z.2
Demonstration of Cooperative Transport Interface Over Open Source 7.2 Split RAN and Virtualised Open PON Network, Merim Dzaferagic[1], Kevin O'Sullivan[2], Bruce Richardson[2], Brendan Ryan[2], Robin Giller[2], Marco Ruffini[1]; [1]*Univ. of Dublin Trinity College, Ireland;* [2]*Intel Corporation Ireland, Ireland.* We demonstrate end-to-end 5G Open RAN over PON using off-the-shelf open networking hardware and open source RAN software. The implementation of the Cooperative Transport Interface provides timely synchronisation of PON and RAN schedulers.

M3Z.3
Adaptive Silicon Photonic Switch and Machine Learning Based Quality of Transmission Estimation, Jonathan F. Förste[1], Samarth Vadia[1], Tibor Cornelli[1], Julius Hussl[1]; [1]*Ludwig-Maximillians-Universität Munchen, Germany.* All-photonic networks are critical for the next-

generation of communication infrastructure, promising reduced energy consumption and low-latency transmission. We demonstrate an all-optical smart switch combining network reconfiguration with AI-based quality-of-transmission estimation on a silicon photonic device.

M3Z.4

Automated Measurement Setup for High-Bandwidth-Density Multicore Fiber Links, Victor I. Kopp[1], Jing Zhang[1], Jongshul Park[1], Jon Singer[1], Dan Neugroschl[1], Johnny Issa[2], Clyde Troutman[2]; *[1]Chiral Photonics Inc, USA; [2]3SAE Technologies, Inc., USA.* The adoption of multicore fiber links requires the development of a suite of supporting tools facilitating component fabrication and testing. Fast and comprehensive link testing is accomplished by integrating state-of-the-art tools.

M3Z.5

International Testbed Data Sharing Framework with Data Sovereign Features for Network AI/ML Empowerment, Yusuke Hirota[1], Sugang Xu[1], Angela Mitrovska[2], Yuki Yoshida[1], Pooyan Safari[2], Behnam Shariati[2], Johannes K. Fischer[2], Ronald Freund[2], Hideaki Furukawa[1], Kouichi Akahane[1], Yoshinari Awaji[1]; *[1]National Inst of Information & Comm Tech, Japan; [2]Fraunhofer Inst. for Telecommunications Heinrich Hertz Inst., Germany.* We demonstrate regulated telemetry data sharing for AI model validation in diverse environments, while complying with export control policies across countries by implementing IDSA principles using Eclipse data spaces component connectors.

M3Z.6

First Live Demonstration of Remote Controllable SFP28 APN-Transceiver for Mobile Fronthaul Use Cases, Yuya Saito[1], Naoki Umezawa[1], Yasuhiro Takizawa[1], Manabu Kotani[1], Shinya Ito[1], Shinichi Koyama[1], Yasuhiro Tanaka[1], Daisuke Umeda[1]; *[1]Sumitomo Electric Industries, Ltd., Japan.* We show the first-ever live demonstration of a PON-based remote control and 30 km transmission using our SFP28 APN-Transceiver. Our demonstration shows an innovative architecture to apply APN practically to mobile fronthaul.

M3Z.7

Demonstration of a Programmable Node Prototype for Spatial Lane Switching and Band Switching, Abdelrahmane Moawad[1], Robert Emmerich[1], Hussein Zaid[1], Caio Santos[1], Alessio Giorgetti[2,3], Roberto Morro[4], Colja Schubert[1], Behnam Shariati[1], Johannes K. Fischer[1]; *[1]Fraunhofer-HHI, Germany; [2]CNIT, Italy; [3]Univ. of Pisa, Italy; [4]TIM, Italy.* This demonstration shows a multi-band over SDM, SDN-capable node prototype, enabling flexible add/drop across S-, C-, and L-bands. It offers a cost-efficient, two levels switching node.

M3Z.8

Real-Time Diverse Fiber Sensing Multi-Event Detection Using Phase OTDR Measurements, Konstantinos Alexoudis[1,2], Jasper Müller[1], Sai K. Patri[1], Vincent Sleiffer[1], Vishal Chandraprakash Rai[1], André Sandmann[1], Sander L. Jansen[1], Tom Bradley[2], Chigo M. Okonkwo[2]; *[1]Adtran Networks SE, Germany; [2]High-Capacity Optical Transmission Laboratory, Eindhoven Univ. of Technology, Netherlands.* We demonstrate an experimental phase optical time-domain reflectometry (OTDR) system capable of simultaneous detection and classification of various environmental events, such as wind-induced fiber movement, vehicle movement, and audio signatures, with real-time visualization.

M3Z.9

Dynamic Adaptation of IP Virtual Network Topologies Over Multi-Granular (Wavelength and Waveband) Optical Networks Supported by ETSI TeraFlowSDN Multi-Layer Control, Lluis Gifre Renom[1], Andrea Sgambelluri[2], Carlos Manso[1], Michael Enrico[4], Hussein Zaid[3], Nicola Sambo[2], Waleed Akbar[1], Carsten Schmidt-Langhorst[3], Javier Vilchez[1], Colja Schubert[3], Ricard Vilalta[1], Behnam Shariati[3], Johannes K. Fischer[3], Josep Maria Fàbrega[1], Ronald Freund[3,5], Raul Muñoz[1]; *[1]Centre Tecnologic Telecom. Catalunya, Spain; [2]Scuola Superiore Sant'Anna, Italy; [3]Fraunhofer Inst. for Telecommunications, Heinrich-Hertz-Institut, Germany; [4]HUBER+SUHNER Polatis, UK; [5]Technical Univ. of Berlin, Germany.* This demonstration will highlight the multi-layer control of dynamic IP full-mesh virtual network topologies over ultra-wideband WDM optical networks, showcasing multi-band and single-band optical channel control, with IP-layer-triggered configurations and wavelength backfilling innovations.

M3Z.10

Cross-Domain Orchestration with Multi-Agent LLM Framework for Enhanced Task Automation, Xiaonan Xu[1], Haoshuo Chen[1], Roland Ryf[1], Sarvesh S. Bidkar[1], Jesse E. Simsarian[1], Nicolas K. Fontaine[1], Mikael Mazur[1], Lauren Dallachiesa[1], David T. Neilson[1], Jeff McLaird[1], Paul Rea[1]; *[1]Nokia Bell Labs, USA.* We evaluate the performance of LLMs in multi-agent systems for complex cross-domain network orchestration, interoperability and task automation. We demonstrate the effectiveness of this approach across IP, optical, and robotic domains.

M3Z.11

Withdrawn

M3Z.12

Live Demonstration of Modulation Format Identification Using a Photonic Neural Network, Guillermo von Hünefeld[1,2], Mahdi Kaveh[1], Joseph Hopfmüller[3], Pooyan Safari[1], Ener Seker[4,5], Rijil Thomas[4], Mahtab Aghaeipour[1], David Stahl[3], Stephan Suckow[4], Max Lemme[4,5], Johannes K. Fischer[1], Colja Schubert[1], Ronald Freund[1,2]; *[1]Fraunhofer HHI, Germany; [2]Technical Univ. of Berlin, Germany; [3]ID Photonics, Germany; [4]AMO GmbH, Germany; [5]RWTH Aachen, Germany.* We demonstrate modulation format identification on a micro ROADM ring using a photonic neural network with low-speed photodiodes. The goal is identifying dual-polarized 4QAM and 16QAM signals with symbol rates between 32 and 35 GBd.

M3Z.13

Autonomous SDN-Driven Operations in Disaggregated Open Optical Transport Network with Coherent Pluggable Transceivers: A Demonstration, Luca Vettori[1], Javier Vilchez[1], Carlos Hernandez-Chulde[1], Konstantinos kyriakopoulos[1], Josep Maria Fàbrega[1], Ramon Casellas[1], Ricardo Martínez[1]; *[1]Centre Tecnològic Telecom de Catalunya, Spain.* This demonstration validates autonomous operations of an optical SDN controller to deliver QoT-enabled optical connectivity services, leveraging open control interfaces, real-time telemetry, and effective recovery strategies in a disaggregated, multi-vendor optical transport network.

M3Z.14

Open-Source, Standards-Based, and API-Driven SDN Control and Service Management of F5G-Advanced Optical Access and Transport Networks, Enabling Quality-on-Demand for Cloud Immersive Applications, Hesam Rahimi[1], Lluis Gifre[2], Shayan Hajipour[2], Ricard Vilalta[2], Raul Muñoz[2], Pablo Armingol[3], Oscar Gónzalez-de-Dios[3], Juan Pedro Fernandez-Palacios[3], Henry Yu[1], Yanpeng Wang[1], Ruilin Cai[1], Christopher Janz[1], Yi Lin[4], Zhang Liang[4]; *[1]Huawei Technologies, Canada; [2]Centre Tecnològic de Telecomunicacions de Catalunya (CTTC-CERCA), Spain; [3]Telefonica, Spain; [4]Huawei Technologies, France.* This paper introduces a novel open-source and standards-based Network-as-a-Service platform exposing quality on demand service API to users and application developers by deploying an end-to-end optical (access and transport) slice with traffic classification and differentiation.

M3Z.15

Demonstration of End-to-End Cross-Border Service Provisioning and Monitoring Using TeraFlowSDN and Eclipse Dataspace Components Connectors, Angela Mitrovska[1], Aydin Jafari[1], Behnam Shariati[1], Pooyan Safari[1], Vignesh Karunakaran[2], Achim Autenrieth[2], Johannes K. Fischer[1], Ronald Freund[1,3]; *[1]Fraunhofer Inst. for Telecommunications, Heinrich-Hertz-Institut, Germany; [2]Adtran Networks SE, Germany; [3]Technical Univ. of Berlin, Germany.* We demonstrate a novel solution for autonomous service provisioning and monitoring across international transit gateways that satisfies regulatory compliance and enables data sovereignty. Our demonstration is performed on a multi-domain packet-optical testbed with commercial equipment.

M3Z.16

Trust-Enhanced Quantum Key Management System for Meshed QKD Networks, Jonas Berl[1,2], Mario Wenning[1,3], Ciarán Mullan[1], Helmut Grießer[1], Tobias Fehenberger[1]; *[1]Adva Network Security GmbH, Germany; [2]Communications Engineering Lab, Karlsruhe Inst. of Technology, Germany; [3]Chair of Communication Networks, Technical Univ. of Munich, Germany.* We demonstrate a distributed quantum key management system that preserves end-to-end security despite a limited number of compromised TNs. With an emulated nation-wide QKD network, we verify operation and showcase an automated deployment.

M3Z.17

Demonstration of Automated ML-Driven Energy-Efficient Spectrum Defragmentation for Optical Transport Networks, Quan Pham Van[1], Huu Trung Thieu[1], Kody Deng[1], Nakjung Choi[1]; *[1]Mobile Network Systems, Nokia Bell Labs, USA.* We introduce an ML-driven framework for energy-efficient spectrum defragmentation, automatically forecasting daily traffic, setting optical channels to standby during low-demand, and reallocating spectrum to reduce fragmentation while reactivating optical channels as necessary.

14:00 -- 16:00
Room 304
M3K • Modulators with Silicon and Alternative Materials
Presider: Hai-Feng Liu; HG Genuine Optics Tech Co Ltd, USA

M3K.1 • 14:00
A 336 Gbps Traveling-Wave Mach-Zehnder Modulator in a 300 mm Silicon Photonic Platform, Erse Jia[1], Fenghe Yang[1], Yufei Liu[1], Ying Wang[1], Yue Zhou[1], Xiao Hu[1], Xinran Zhao[1], Wei Chu[1], Haiwen Cai[2]; *[1]Zhangjiang Laboratory, China; [2]Shanghai Inst. of Optics and Fine Mechanics, Chinese Academy of Sciences, China.* A high-speed traveling-wave Mach-Zehnder modulator is designed and wafer-scale fabricated in a 300 mm silicon photonic platform, achieving 336 Gbps of PAM-8 operation and high-efficiency of 1.1 V-cm at 1310 nm.

M3K.2 • 14:15
Thin-Film Lithium Niobate Modulators with Ultra-High Modulation Efficiency, Xiangyu Meng[2], Can Yuan[2], Xingran Cheng[2], Shuai Yuan[2], Chenglin Shang[2], An Pan[2], Zhicheng Qu[1], Xuanhao Wang[2], Jun Wang[2], Jiang Tang[2], Chao Chen[2], Cheng Zeng[2], Jinsong Xia[2]; *[1]Wuhan National Lab for Optoelectronics, China; [2]Wuhan National Laboratory for Optoelectronics and School of Optical and Electronic Information, Huazhong Univ. of Science and Technology, China.* We demonstrate a transparent-conductive-oxide combined thin-film lithium niobate modulator with an ultra-high modulation efficiency of 1.02 V cm. The modulator exhibits an EO 3 dB transmission roll-off at 108 GHz, and presents up to 224 Gbit s^{-1} PAM-4 transmission.

M3K.3 • 14:30 (Invited)
Silicon Photonics Platform with Heterogeneously Integrated Lasers and EAMs for 1.6/3.2T, Erik J. Norberg[1], Hanxing Shi[1], John Sonkoly[1], Kimchau Nguyen[1], Han Yun[1], Krzysztof Szczerba[1], Molly Piels[1], Steve Alleston[1], Volkan Kaman[1]; *[1]OpenLight Photonics, USA.* We review Openlight's open-market Si-IIIV photonics platform, including DFBs and EAMs capable of exceeding 224 Gbps. This platform can enable single-chip transmitter PICs for emerging 1.6 Tbps and 3.2 Tbps transceivers in the AI-driven market.

M3K.4 • 15:00
112 GBaud PAM4 Barium Titanate Coupling Modulated Ring Modulator Monolithically Integrated on a Silicon Substrate, Benton Qiu[1], Charles St. Arnault[1], Weijia Li[1], Jinsong Zhang[1], Aleksandar Nikic[1], Santiago Bernal[1], Zixian Wei[1], Kaibo Zhang[1], Thomas Kornher[2], Cyriel Minkenberg[2], Felix Eltes[2], Mateusz Zbik[2], Stefan Abel[2], Katelin Smith[2], Lukas Czornomaz[2], David Plant[1]; *[1]McGill, Canada; [2]Lumiphase AG, Switzerland.* We demonstrate a BTO coupling modulated ring modulator featuring a 500 µm phase shifter, 4.8 V V_π with < 1 dB insertion loss enabling ultra-dense and low power consumption optical interfaces delivering 112 GBaud PAM4.

M3K.5 • 15:15
A 290 Gbps Silicon Photonic Microring Modulator With 83 aJ/bit Power Consumption, Xin Wang[1,3], Fenghe Yang[3], Yufei Liu[3], Ying Wang[3], Fangchen Hu[3], Xinran Zhao[3], Wei Chu[3], Haiwen Cai[2]; *[1]Fudan Univ., China; [2]Shanghai Inst. of Optics and Fine Mechanics, China; [3]Zhangjiang Laboratory, China.* We design and experimentally demonstrate a microring modulator based on a 300 mm silicon photonic platform, achieving 112 GBaud of PAM-4 and

PAM-6 operation with the power consumption of 114 aJ/bit and 83 aJ/bit respectively.

M3K.6 • 15:30
Differential Drive EML with P/N Electrode Isolated Toward Low Vpp Application, Zhenning Zhang[1], Weijiang Li[1], Mahui Li[1], Wei Wang[1]; *[1]Yuanjie Semiconductor Technology CO., LT., China.* Differential drive EML with P doping isolation at N side was demonstrated. The bandwidth is higher than 50 GHz and reflection is lower than -10 dB at both anode and cathode drive condition. The bandwidth of conventional single-ended-drive EML is greater than 60 GHz, and the reflection is less than -5 dB in the range of 0~70 GHz.

M3K.7 • 15:45
DSP-Free 500-Meter Single-Mode Fiber Transmission with Record High Bandwidth 1060nm Intra-Cavity Metal-Aperture Coupled-Cavity VCSEL, Hameeda R. Ibrahim[1,2], Ahmed Hassan[1,3], Chang Ge[1], Xiaodong Gu[1,4], Fumio Koyama[1]; *[1]Inst. of Science Tokyo, Japan; [2]Minia Univ., Egypt; [3]Al-Azhar Univ., Egypt; [4]Ambition Photonics Inc., Japan.* We demonstrate 500-meter single-mode-fiber transmission using record-breaking 45-GHz modulation bandwidth, single-mode 1060-nm VCSELs with an intra-cavity metal aperture structure. We achieve NRZ-100 Gbps and PAM-180 Gbps data transmission over 500m of SMF with DSP-free receivers.

14:00 -- 16:00
Rooms 201-202
M3A • Generative AI in Networking: From Proof of Concept to Production I
Presider: Olga Vassilieva; Fujitsu Network Communications Inc, USA and Deepa Venkitesh; Indian Inst. of Technology Madras, India and Ricard Vilalta; Centre Tecnològic Telecom de Catalunya, Spain and Qiong Zhang; Amazon Web Services, USA

M3A.1 • 14:00 (Invited)
Generative AI Applications in Telecom, Larry Zhou[1]; *[1]AT&T Corp, USA.* This presentation explores GenAI's transformation role in telecom, enhancing predictive maintenance, automated troubleshooting, network modeling, and AI-driven service assurance. By leveraging multimodal AI and edge computing, we enable smarter, more efficient, and resilient network operations.

M3A.2 • 14:20 (Invited)
Generative AI for Network Operations, Imen Grida Ben Yahia[1]; *[1]Amazon Web Services, UK.* Abstract not available.

M3A.3 • 14:40 (Invited)
AIOps: The Autonomous Network Journey, Anurag Sharma[1]; *[1]Google LLC, USA.* Abstract not available.

M3A.4 • 15:00 (Invited)
LLM-Centric Transport Network Configuration Management Framework and Demonstration, Cen Wang[1], Noboru Yoshikane[1], Chenxiao Zhang[1], Yuta Wakayama[1], Daiki Soma[1], Takehiro Tsuritani[1]; *[1]KDDI Research Inc., Japan.* We demonstrate the multivendor use case of LLM-based transport network assimilation, configuration and telemetry automations through parameter-efficiently fine tuning the LLM over an evolutionarily designed LLM-centric

control and management framework.

M3A.5 • 15:20 (Invited)
Measuring and Mitigating Generative AI Risk: Successes and Challenges from a Practitioner Perspective, Harish Babu Arunachalam[1], Joshua Andrews[1]; [1]*Verizon Communications Inc, USA.* Generative AI (GenAI) is a powerful technology but brings with it significant risks. We showcase real examples of GenAI risks, their impacts, and discuss strategies to identify, measure, and mitigate risks for safe business deployments.

M3A.6 • 15:40 (Invited)
Operations Science and Automation in Optical Networks: From Machine Learning to Generative AI, Christopher Janz[1]; [1]*Huawei Canada, Canada.* Abstract not available.

14:00 -- 16:00
Rooms 205-206
M3C • High Symbol Rates Transceivers
Presider: Ming-Fang Huang; NEC Laboratories America Inc., USA

M3C.1 • 14:00 (Tutorial)
Components, DSP, and Subsystem Design for Ultra-High-Speed Optical Transceivers, Vivian Xi Chen[1]; [1]*Nokia Bell Labs, USA.* An overview of the critical parts of high-speed optical transceivers will be given, including DSP and high-speed signal generation, modulators, CW sources, etc. Thoughts on possible research directions of future transceivers will also be shared.

M3C.2 • 15:00 (Invited)
Single-Carrier High-Capacity Transmission in Bandwidth-Limited Systems, Guoxiu Huang[1], Hisao Nakashima[1], Takeshi Hoshida[1]; [1]*Advanced Technology Development Office, Photonics System Business Unit, Fujitsu Limited, Japan.* Towards next coherent system, the technologies to dealing with insufficient analog bandwidth with low power consumption is attractive. We experimentally evaluated Tomlinson-Harashima pre-coding to the probabilistic-shaped signal with low-speed receiver DSP and required OSNR improvements.

M3C.3 • 15:30 (Top-Scored)
628 Gb/s Net Bitrate IMDD Transmission Using Ultra-Broadband InP-DHBT-Based Electrical Mixer with Upper-Sideband Gain-Enhanced Mode, Masanori Nakamura[1], Teruo Jyo[2], Munehiko Nagatani[1,2], Hitoshi Wakita[2], Miwa Mutoh[2], Yuta Shiratori[2], Hiroki Taniguchi[1], Shuto Yamamoto[1], Fukutaro Hamaoka[1], Etsushi Yamazaki[1], Takayuki Kobayashi[1], Hiroyuki Takahashi[1,2], Yutaka Miyamoto[1]; [1]*NTT Network Innovation Laboratories, Japan;* [2]*NTT Device Technology Laboratories, Japan.* We demonstrate a net bitrate of 633-Gb/s back-to-back and 628-Gb/s 11-km IMDD transmission with 224-GBd PS-PAM14 signal using upper-sideband gain-enhanced mode of a 150-GHz-bandwidth electrical mixer for frequency-domain multiplexing, achieving the first >600-Gb/s/lane IMDD transmission.

14:00 -- 16:00
Rooms 209-210
M3F • Multicore, Hollow Core, and Fiber-Based Networking
Presider: Jesse Simsarian; Nokia Bell Labs, USA

M3F.1 • 14:00 (Top-Scored)
Core-Level Routing in Long-Haul MCF Transmission System With FIFO-Less Multicore EDFA and Spatial Cross-Connect, Kosuke Komatsu[1], Shohei Beppu[1], Daiki Soma[1], Yuta Wakayama[1], Noboru Yoshikane[1], Masahiko Jinno[2], Takehiro Tsuritani[1]; *[1]KDDI Research, Inc., Japan; [2]Department of Engineering and Design, Kagawa Univ., Japan.* Core-level routing in a long-haul multicore fiber transmission system is experimentally demonstrated. Full C-band signals are transmitted over 1685-km 4-core fibers using fan-in/fan-out-less multicore fiber amplifiers and a spatial channel cross-connect for the first time.

M3F.2 • 14:15
Demonstration of 4-Core/16-Core Fiber Heterogeneous Spatial Channel Network Comprising 19-Core Fiber Core Selective Switch-Based Spatial Gateway, 4-Core EDFAs, and 19-Core EDFAs, Takumi Tani[1], Daiki Soma[2], Ryohei Otowa[3], Yusuke Matsuno[4], Kyosuke Nakada[1], Kosuke Komatsu[2], Yuji Hotta[3], Tsubasa Sasaki[4], Rika Tahara[1], Shohei Beppu[2], Koichi Maeda[4], Takuma Izumi[1], Yuta Wakayama[2], Noboru Yoshikane[2], Takehiro Tsuritani[2], Yasuki Sakurai[3], Ryuichi Sugizaki[4], Masahiko Jinno[1]; *[1]Kagawa Univ., Japan; [2]KDDI Research, Inc., Japan; [3]santec AOC corporation, Japan; [4]Furukawa Electric Co., Ltd., Japan.* Inter-domain spatial-channel establishment and fault recovery are demonstrated over a 4-core fiber (CF) and 16-CF heterogeneous spatial channel network comprising a 19-CF core-selective-switch-based spatial gateway, fan-in/fan-out-less 4-C EDFAs, and cladding-pumped 19-C EDFAs.

M3F.3 • 14:30
Hollow Core Fiber as a Long-Term Solution for Capacity Scaling in Optical Networks, Giovanni S. Sticca[1], Memedhe Ibrahimi[1], Nicola Di Cicco[1], Francesco Musumeci[1], Massimo Tornatore[1]; *[1]Politecnico di Milano, Italy.* We evaluate selectively upgrading optical networks with Hollow Core Fibers for long-term capacity scaling. Upgrading 50% of links with HCF delivers 2.1x more traffic and 38% lower cost-per-Tbps compared to multiband and parallel fiber networks.

M3F.4 • 14:45
Benefit of HCF for Throughput of Future WDM Networks, Thierry Zami[1], Nicola Rossi[1], Serge Melle[1], Bruno Lavigne[1]; *[1]Nokia Corporation, France.* We quantify the benefit from Hollow Core Fibers (HCF) versus common SSMF regarding the total capacity in modern WDM transparent backbone networks for various network sizes, various fiber losses in dB/km and various span lengths.

M3F.5 • 15:00
Statistical Assessment of System Margin in Metro Networks Impaired by PDL, Enrico Miotto[1,3], Andrea D Amico[2], Renato Ambrosone[1], Francesco Aquilino[4], Stefano Straullu[4], Vittorio Curri[1]; *[1]Politecnico di Torino, Italy; [2]NEC Laboratories America Inc., USA; [3]Consortium GARR, Italy; [4]LINKS Foundation, Italy.* We experimentally justify the need of analyzing stochastic PDL insertion in optical metro network nodes. Consequently, we assess conservative OSNR margin comparing different approaches to the case with maxwellian-distributed PDL, through Monte

Carlo simulation.

M3F.6 • 15:15 (Invited)
AI/ML-Based State-of-Polarization Monitoring in Optical Networks: Concepts and Challenges, Leyla Sadighi[1], Carlos Natalino[1], Stefan Karlsson[2], Lena Wosinska[1], Marco Ruffini[3], Marija Furdek[1]; *[1]Chalmers Tekniska Högskola, Sweden; [2]FMV, Sweden; [3]CONNECT Centre, Trinity College Dublin, Ireland.* Optical networks are vulnerable to various disturbances that can jeopardize service availability of privacy. We discuss AI/ML-based analysis of the incurred state-of-art polarization changes for cognitive management of complex disturbances.

14:00 -- 16:00
Rooms 211-212
M3G • Novel Materials, Metamaterial and Reconfigurable Devices
Presider: Sagi Mathai; Hewlett Packard Labs, USA

M3G.1 • 14:00
Nonvolatile PCM-Driven Photonic Computing Using Programmable Sub-Wavelength Metasurfaces, Liyun Hu[1,2], Yuexing Su[1,2], Yunlong Li[1,2], Shuang Zheng[1,2], Minming Zhang[1,2]; *[1]Huazhong uni of Science and Technology, China; [2]National Engineering Research Center for Next Generation internet Access System, China.* We demonstrate a programmable nonvolatile convolutional core based on sub-wavelength phase-change metasurfaces, offering advanced computing capacities for its zero static power consumption and multi-level reconfigurable weights.

M3G.2 • 14:15 (Invited)
Monolithic BEOL Integration of Phase Change Materials for Reconfigurable Silicon Photonics, Weiquan Wang[1], Kai Xu[1], Maoliang Wei[1], Kunhao Lei[1], Boshu Sun[2], Yiting Yun[1], Junying Li[1], Lan Li[2], Hongtao Lin[1], Xiaodan Pang[1]; *[1]College of Information Science and Electronic Engineering, Zhejiang Univ., China; [2]School of Engineering, Westlake Univ., China.* We present a monolithic back-end-of-line integration platform for phase change materials (PCMs) in silicon photonics. High-performance nonvolatile integrated photonic devices based on PCMs have been developed, demonstrating their potential applications.

M3G.3 • 14:45
PZT Optical Memristors for Integrated Photonics, Chenlei Li[1], Hongyan Yu[2], Tao Shu[1], Yueyang Zhang[1], Feng Qiu[2], Daoxin Dai[1]; *[1]Zhejiang Univ., China; [2]Univ. of Chinese Academy of Sciences, China.* We demonstrated first-ever PZT optical memristors capable of unprecedented functional duality by manipulating ferroelectric domains, featuring low loss, high precision, high-efficiency modulation, high stability quasi-continuity and reconfigurability, together with a scalable, CMOS-compatible sol-gel fabrication process.

M3G.4 • 15:00
85 fJ/bit Silicon-Organic Hybrid Kerr All-Optical Switch Based on Photonic Crystal Slot Nanobeam Cavity, Yizheng Chen[1], Xiaoyan Gao[1], Wentao Gu[1], Wentao Ye[4], Yilun Wang[1], Wenchan Dong[1,3], Lei Lei[4], Jing Xu[1,2], Xinliang Zhang[1,2]; *[1]Wuhan National Laboratory for Optoelectronics and School of Optical and Electronic Information, Huazhong Univ. of Science and Technology, China; [2]Optics Valley Laboratory, China; [3]Hubei Optical Fundamental*

Research Center, China; [4]State Key Laboratory of Radio Frequency Heterogeneous Integration (Shenzhen Univ.), China. A silicon-based Kerr all-optical switch utilizing PhC slot nanobeam cavity hybrid MEH-PPV is first demonstrated at 20 Gb/s signal rate with a power consumption of 85 fJ/bit and a switching contrast of 11.75 dB.

M3G.5 • 15:15
Triple-Waveguide-Coupling Based Reconfigurable Optical Power Splitter for Channel-Scalable Optical Interconnects with High Energy Efficiency, Xinyi Wang[1], Jiangbing Du[1], Wenjia Zhang[1], Ke Xu[2], Zuyuan He[1]; *[1]SJTU, China; [2]Department of Electronic and Information Engineering, Harbin Inst. of Technology (Shenzhen), China.* A triple-waveguide-coupling based reconfigurable optical power splitter is demonstrated for 1-to-15 channel-scalable optical interconnects leveraging only four switching elements, exhibiting no power wasting, low crosstalk and indicating significant potential for large-scale capacity reconfiguration scenarios.

M3G.6 • 15:30 (Invited)
Advances in Metamaterial Integrated Photonics, Jens H. Schmid[1], Pavel Cheben[1], Jianhao Zhang[1], Radovan Korcek[1], Md Saad-Bin-Alam[1], Ross Cheriton[1], Siegfried Janz[1], Dan-Xia Xu[1], Shurui Wang[1], Martin Vachon[1], Rubin Ma[1], Robert Halir[2], Gonzalo Wanguemert-Perez[2], Alejandro Ortega-Monux[2], Inigo Molina-Fernandez[2], Alejandro Sanchez-Postigo[2], Jose-Manuel Luque-Gonzalez[2], Alejandro Fernandez-Hinestrosa[2], Daniele Melati[3], Zindine Mokeddem[3], Carlos Alonso-Ramos[3], Laurent Vivien[3], Winnie Ye[4], Shahrzad Khajavi[4], william Fraser[4], Daniel Benedikovic[5], Denizhan Sirmaci[6], Isabelle Staude[6], Thomas Pertsch[6], Cameron Naraine[7], Jonathan Bradley[7], Andrew Knights[7], Thalia Dominguez-Bucio[8], Frederic Gardes[8]; *[1]National Research Council Canada, Canada; [2]Univ. of Malaga, Spain; [3]Universite Paris-Saclay, France; [4]Carleton Univ., Canada; [5]Univ. of Zilina, Slovakia; [6]Univ. of Jena, Germany; [7]McMaster Univ., Canada; [8]Univ. of Southampton, UK.* We provide an overview of recent developments in metamaterial integrated optics including ring resonators and grating couplers on silicon nitride, wide-angle optical antennas and phased arrays. We briefly discuss the emerging field of Mie-resonant metawaveguides.

14:00 -- 16:00
Rooms 213-214
M3H • Sensing and Monitoring for Network Control and Management
Presider: Mariam Kiran; Oak Ridge National Laboratory, USA

M3H.1 • 14:00 (Invited)
Sensing, Learning, and Protecting Optical Networks, Patricia Layec[1], Camille Delezoide[1], Khouloud Abdelli[1], Fabien Boitier[1]; *[1]Nokia Bell Labs, France.* We review recent advances in monitoring and sensing via coherent receivers highlighting use cases for visualizing network health and protecting optical networks through machine learning for risky event classification.

M3H.2 • 14:30
Supporting Human-to-Machine Applications in Next-Gen Optical Access Networks Through Explainable AI, Yuxiao Wang[1], Sourav Mondal[1], Ye Pu[1], Elaine Wong[1]; *[1]Univ. of Melbourne, Australia.* We propose a novel SHAP-enhanced haptic feedback prediction framework to extract key feature knowledge and advance predicted transmissions of human-to-machine applications. Through experiments and simulations, the framework shows significantly

improved training and inference times and propagation delay, meeting latency requirements.

M3H.3 • 14:45

Correlation-Constrained Topology Graphs for Root-Cause Localization in Optical Transport Networks, Armen Aghasaryan[1], Petros Ramantanis[1], Camille Delezoide[1]; *[1]Nokia Bell Labs, France.* Leveraging the network topology, we develop an efficient graph-based method for localizing root causes of massive anomaly events; we adapt the Betweenness Centrality metric to score the candidate root causes of correlated timeseries.

M3H.4 • 15:00

In-Band Collection and Control of end-to-end Latency in Programmable Packet-Optical Networks, Faris Alhamed[1], Andrea Sgambelluri[1], Chrysa Papagianni[2], Francesco Paolucci[3]; *[1]Scuola Superiore Sant'Anna, Italy; [2]Universiteit van Amsterdam, Netherlands; [3]CNIT, Italy.* A novel programmable INT collector, acting as active controller within the data plane, is proposed to enable fast closed-loop flow latency monitoring. Experimental evaluation on P4-based hardware switches demonstrates assurance reactions within few microseconds.

M3H.5 • 15:15

Alarm Priority Sorting with Multimodal Data Fusion in Optical Networks, Cheng Xing[1], Chunyu Zhang[1], Min Zhang[1], Yanlin Fan[2], Xunjie Jiang[2], Zhongbo Bi[2], Jiansheng Xiong[2], Danshi Wang[1]; *[1]Beijing Univ. of Posts & Telecom, China; [2]The Intelligent Network Innovation Center of Chinaunicom, China.* An alarm priority sorting scheme using multimodal data fusion is proposed, achieving 95.79% fault-related alarm classification accuracy, which has actual alarm priority ranking result and faster running time than traditional method.

M3H.6 • 15:30

Real-Time Streaming Telemetry Based Detection and Mitigation of OOK and Power Interference in Multi-User OSaaS Networks, Agastya Raj[1], Devika Dass[1], Daniel C. Kilper[1], Marco Ruffini[1]; *[1]Trinity College Dublin, Ireland.* We present a framework to identify and mitigate rogue OOK signals and user-generated power interference in a multi-user Optical-Spectrum-as-a-Service network. Experimental tests on the OpenIreland-testbed achieve up to 89% detection rate within 10 seconds of an interference event.

16:30 -- 18:30
Room 207
M4D • Optical and Microwave Signal Processing
Presider: Prince Anandarajah; Dublin City Univ., Ireland

M4D.1 • 16:30

Broadband Tunable Multi-Cavity Optoelectronic Oscillation on a Dispersion-Diversity Heterogeneous Multicore Fiber, Sergi García Cortijo[1], Ivana Gasulla[1]; *[1]Universitat Politècnica de València, Spain.* We report broadband tunable multi-cavity optoelectronic oscillators implemented on a 5-km dispersion-diversity heterogeneous multicore fiber. We experimentally demonstrate continuous 10- to 18-GHz oscillation and prove that oscillation frequency stability improves with the number of cavities.

M4D.2 • 16:45
Linearization of a Dual-Parallel Mach-Zehnder Modulator Using on-Chip Stimulated Brillouin Scattering, Cristina Catalá-Lahoz[1], Moritz Merklein[2,3], Choon Kong Lai[2,3], Duk Yong Choi[4], Stephen Madden[4], Benjamin J. Eggleton[2,3], Jose Capmany[1]; *[1]Photonics Research Labs, iTEAM Research Inst., Universitat Politècnica de València, Spain; [2]Inst. of Photonics and Optical Science (IPOS), School of Physics, The Univ. of Sydney, Australia; [3]The Univ. of Sydney Nano Inst. (Sydney Nano), The Univ. of Sydney, Australia; [4]Laser Physics Centre, Research School of Physics, The Australian National Univ., Australia.* We propose and demonstrate the linearization of a Dual-Parallel Mach-Zehnder Modulator by frequency-selectively controlling the phase and amplitude of the carrier utilizing a dual-pump, narrowband on-chip Stimulated Brillouin Scattering scheme.

M4D.3 • 17:00
Integrated Silicon Nitride Nonlinear Photonic Engine Enabling High-Frequency Analog Signal Generation for Microwave Photonic Systems, Ping Zhao[1], Magnus Karlsson[2], Peter A. Andrekson[2]; *[1]Sichuan Univ., China; [2]Chalmers Univ. of Technology, Sweden.* We present a flexible generation of various high-frequency analog signals with excellent wavelength scalability using a nonlinear Mach-Zehnder modulator enabled by a compact silicon nitride chip with 4π nonlinear phase shifts for the first time.

M4D.4 • 17:15
Ultra-Broadband Photonics-Assisted Integrated Microwave Identification Circuit, Xingyi Jiang[1], Qiang Zhang[2], Shengyu Fang[1], Qikai Huang[1], Zhujun Wei[1], Yuchen Shi[1], Jianyi Yang[1], Hui Yu[2]; *[1]Zhejiang Univ., China; [2]Zhejiang lab, China.* We proposed an ultra-broadband silicon-based microwave photonic signal identification circuit, which can analyze the arbitrary microwave signal over the frequency range from 2 to 125 GHz with resolution of 270 MHz.

M4D.5 • 17:30 (Invited)
Signal Processing for Microcomb Communications, Bill P. Corcoran[1,2]; *[1]Monash Univ., Australia; [2]Centre for Optical Microcombs for Breakthrough Science, Australia.* We review a range of signal processing tools that can help optical microcombs support data rates from tens of terabits-per-second to petabits-per-second. By understanding both electronic and optical signal processes, data rates can be optimized.

M4D.6 • 18:00
Electronic-Photonic Integrated Microwave Beamforming Chip for Broadband RF Applications, Yiwei Xie[1], Ke Wang[2], Daoxin Dai[1], Shihan Hong[1], Jiachen Wu[1]; *[1]Zhejiang Univ., China; [2]RMIT Univ., Australia.* We demonstrate an electronic-photonic microwave beamforming chip which monolithically integrate a 4-channel 5-bit thermally-tunable optical delay lines, photodetectors, and antennas. The chip can operate from 16–20 GHz with a steering range of ±40°.

M4D.7 • 18:15
Demonstration of a Silicon Nitride Optical Beamforming Network Based on Blass-Matrix Architecture, Eva V. Loukisa Kontonasopoulou[1], Efstathios Andrianopoulos[1], Adam Raptakis[1], Georgios Megas[1], Dimitrios Gounaridis[1], Adamantia Grammatikaki[1], Roelof B. Timens[2], Paul v. Dijk[2], Lefteris Gounaridis[1], Panos Groumas[1,3], Christos Tsokos[1], Christos Kouloumentas[1,3], Hercules Avramopoulos[1], Chris G. Roeloffzen[2]; *[1]Electrical and Computer Engineering, National*

Technical Univ. of Athens, Greece; [2]LioniX International, Netherlands; [3]Optagon Photonics, Greece. System evaluation of a silicon-nitride-integrated 4x4 Blass-matrix optical beamformer, demonstrating the first-ever error-free single-beam operation at frequencies up to 12 GHz with 1 Gbaud QPSK modulated signals across 30°–150° beam angles.

16:30 -- 18:45
Room 208
M4E • Quantum Entanglement and Computing
Presider: Rui Wang; Univ. of Bristol, UK

M4E.1 • 16:30
Nationwide Entanglement Distribution with Silicon Nanophotonic Chip, Jinyi Du[1], XIngjian Zhang[1], En Teng Lim[1,2], George Feng Rong Chen[3], Hongwei Gao[3], Dawn Tan[3,4], Alexander Ling[1,2]; *[1]Centre for Quantum Technologies, Singapore; [2]Department of Physics, National Univ. of Singapore, Singapore; [3]Singapore Univ. of Technology and Design, Singapore; [4]Inst. of Microelectronics, Agency for Science Technology and Research (A*STAR), Singapore.* We developed a silicon chip capable of producing and delivering a detected rate of 460,000 pairs of entangled photons with a fidelity of 97.90(3)% fidelity. The entangled photons were transmitted over 155 km of fiber deployed across Singapore (66 dB loss), demonstrating a major advance in silicon nanophotonics for powering future quantum networks.

M4E.2 • 16:45
High-Fidelity Entanglement Distribution Through Berlin Using an Operator's Fiber Infrastructure, Matheus Ribeiro Sena[1], Mael Flament[2], Mehdi Namazi[2], Shane Andrewski[2], Gabriel Portmann[2], Ralf-Peter Braun[3], Marwa Sayed[1], Ronny Döring[1], Michaela Ritter[1], Oliver Holschke[1], Marc Geitz[1]; *[1]Deutsche Telekom AG, Germany; [2]Qunnect, USA; [3]Orbit GmbH, Germany.* We successfully integrated an automated system for distributing entangled photons across a 30-km field-deployed fiber in Berlin. Over a 17-day continuous operation, it achieved >99% fidelity, underscoring its potential for scalable, city-wide quantum networks.

M4E.3 • 17:00
Demonstration of a Digital Twin for an Entanglement-Based Quantum Network, Ruizhi Yang[1], Rui Wang[1], Marcus J. Clark[1], Jianxiong Tan[1], James Tai[1], Ronaldo Balram[1], Shan Jiang[1], Siddarth K. Joshi[1], Dimitra Simeonidou[1]; *[1]Univ. of Bristol, UK.* We implemented a digital twin for an entanglement-based quantum network, demonstrating its ability to accurately mirror network's performance and experimentally enhance key rates through a DT-assisted control framework for the network executing the BBM92 protocol.

M4E.4 • 17:15
Experimental Test of Bell-State Measurement for Narrow-Band Ion-Photon Interfaces in the Quant-net Testbed, Yin Yue[2], Xiang Li[2], Damian Schon[2], Zhiyuan Chen[2], You-Wei Cheah[1], Erhan Saglamyurek[1], Wenji Wu[1], Hartmut Haffner[2], Inder Monga[1]; *[1]Lawrence Berkeley Lab, USA; [2]Univ. of California, Berkeley, USA.* This paper reports Bell-State Measurements using coherent light for testing the suitability of narrow-band ion-cavity interfaces for high-fidelity ion-ion entanglement in the QUANT-NET testbed. It also presents automated control of the experiment setup.

M4E.5 • 17:30
Entanglement of up to 6 Photons on a Silicon Photonic Quantum Circuit, Jong-Moo Lee[1], Woncheol Shin[1], Taewan Kim[1], Yongsoo Hwang[1]; *[1]ETRI, Korea (the Republic of).* Six-photon entanglement is demonstrated on a silicon photonic circuit integrating spirals, spectral filters, and linear-optic gates for eight path-encoded qubits. The indistinguishability of photons is verified through a 97% Hong-Ou-Mandel visibility measurement.

M4E.6 • 17:45
Quantum-Secure Deep Learning in Optical Networks, Kfir Sulimany[1], Sri K. Vadlamani[1], Ryan Hamerly[1,2], Prahlad Iyengar[1], Dirk R. Englund[1]; *[1]MIT, USA; [2]NTT, USA.* The demand for cloud-based deep learning has intensified the need for secure computation. Our quantum-secure deep learning protocol leverages quantum properties of light and telecommunication components for scalable, secure cloud-based deep learning in optical networks.

M4E.7 • 18:00
Rerouting in Quantum Wrapper Networks by Monitoring Single-Photon Level Noise, Mehmet Berkay On[1], Roberto Proietti[2], Gamze Gul[3], Gregory Kanter[3], Prem Kumar[3], S. J. Ben Yoo[1]; *[1]Univ. of California, Davis, USA; [2]Dipartimento di Elettronica e Telecomunicazioni, Politecnico di Torino, Italy; [3]Department of Electrical and Computer Engineering, Northwestern Univ., USA.* We demonstrate routing polarization-entangled photon payloads multiplexed with classical datagram headers. Our testbed quantum network guarantees >77% interference visibility as a quality of transmission metric by monitoring single-photon level noise due to coexisting classical traffic.

M4E.8
Withdrawn

16:30 -- 18:30
Room 215
M4I • Access Network Coexistence and Convergence
Presider: Annachiara Pagano; FiberCop S.p.A, Italy

M4I.1 • 16:30 (Top-Scored)
Coexistence of Digital Coherent, MmWave and sub-THz Analog RoF Services Using OSaaS Over Converged Access-Metro Live Production Network, Devika Dass[1], Amol Delmade[3], Agastya Raj[1], Eoin Kenny[2], Daniel C. Kilper[1], Liam P. Barry[3], Marco Ruffini[1]; *[1]Univ. of Dublin Trinity College, Ireland; [2]HEAnet, Ireland; [3]Dublin City Univ., Ireland.* We demonstrate the end-to-end transmission of digital coherent and analog radio-over-fiber signals, at mmWave and sub-THz frequencies, over the HEAnet live production metro network using Optical Spectrum-as-a-Service (OSaaS), transparently connected to a passive optical network.

M4I.2 • 16:45
Demonstration of Converged Metro+Access Bidirectional Transmission Using Coherent Transceivers and ROADMs, Giuseppe Rizzelli Martella[2,1], Mariacristina Casasco[1], Annachiara Pagano[3], Emilio Riccardi[3], Valter Ferrero[1], Roberto Gaudino[1]; *[1]Politecnico di Torino, Italy; [2]Photonext Center, Italy; [3]Fibercop, Italy.* We present the experimental demonstration of high-speed transmission in downstream and upstream direction using off-the-shelf coherent

transceivers in a 40-channel DWDM metro+access network configuration based on ROADMs for future all-optical metro-access converged solutions.

M4I.3 • 17:00
Robust Colorless Coherent Receiver for Next-Generation PONs: Coexistence with Legacy Systems and Multi-Wavelength Operation, Haipeng Zhang[1], Zhensheng Jia[1], John Bevilacqua[1]; *[1]CableLabs, USA.* We present a colorless coherent receiver for next-generation coherent PONs, demonstrating its robustness in coexisting with legacy PONs and multiple coherent channels, and provide crucial insights into fiber nonlinearity, channel spacing, and optical power impacts.

M4I.4 • 17:15
Demonstration of High-Power PON for Higher Split Ratio and Optical Powering Using a Hollow-Core Fiber, Hironori Yamaji[1], Natsuhiro Yamada[1], Takeshi Takagi[2], Kazunori Mukasa[2], Satoru Okamoto[3], Hiroyuki Tsuda[3], Naoaki Yamanaka[3], Motoharu Matsuura[1,3]; *[1]Univ. of Electro-Communications, Japan; [2]Furukawa Electric, Japan; [3]Keio Univ., Japan.* We demonstrate a high-power 1:256 PON with optical powering using a hollow-core fiber. We have succeeded in transmitting A-RoF signals with input power exceeding 36 dBm and feeding optical power of 40 dBm for powering.

M4I.5 • 17:30
SOA Remoting in PON With Minimalistic ONU Receiver, Bernhard Schrenk[1]; *[1]Austrian Inst. of Technology, Austria.* A remotely-powered SOA-based ODN extender is employed to consolidate distributed optical preamplifiers at the ONUs. An optical budget of 32 dB is supported despite the use of simple and cost-effective 10 Gb/s downstream PIN/TIA receivers.

M4I.6 • 17:45 (Invited)
Optimizing Capacity in Converged Access Networks: Design Guidelines for Coherent Optics Integration, Maryam Niknamfar[1]; *[1]Charter Communications, USA.* This paper presents design considerations for converged access networks, focusing on traffic management strategies and integrating coherent optics to improve spectral efficiency and meet the growing demands for traffic capacity and diverse services.

M4I.7 • 18:15
Quantification of Stimulated Raman Scattering Penalties Induced by Very High Speed PON in Quadruple Coexistence, Gael Simon[1], Jeremy Potet[1], Fabienne Saliou[1], Dylan Chevalier[1], Lise Pichard[1], Georges Gaillard[1], Philippe Chanclou[1]; *[1]Orange, France.* To determine the wavelength plan for VHSP, we study the penalties induced on legacy PONs through Raman scattering. The ~1300nm region seems the best tradeoff for IMDD-VHSP. Regarding S/C/L-bands, removing G-PON would relax the constraints.

16:30 -- 18:30
Room 301
M4J • Fiber and Chip Coupling Interfaces
Presider: Milos Popovic; Boston Univ., USA

M4J.1 • 16:30
Hybrid InP-Si Photonic Integration via 3D-Nanoprinted Non-Waveguided Couplers, Huiyu Huang[1], Zhitian Shi[1], Richard Penty[1], Qixiang Cheng[1,2], Tongyun Li[1]; *[1]Univ. of Cambridge, UK; [2]GlitterinTech Limited, China.* We report a novel hybrid InP-Si photonic integration scheme with 3D-nanoprinted couplers, achieving 2.1 dB die-to-die coupling loss over a 100 nm wavelength range. This versatile design is compatible with any material system.

M4J.2 • 16:45
Ultra-Compact Reflow-Compatible Detachable Optical Connector for Co-Packaged Optics, Kengo Watanabe[1], Shosuke Ikeda[1], Yuki Fujimaki[1], Tsunetoshi Saito[1], Masaki Kotoku[1]; *[1]Furukawa Electric Co., Ltd., Japan.* Ultra-compact detachable optical connector for Co-Packaged Optics is developed. The connector demonstrates low insertion loss ≤ 0.4 dB with small variation within ± 0.05 dB in multiple cycles connections and 260 °C reflow-compatibility.

M4J.3 • 17:00
200 mW High-Power Tolerant Vertically-Coupled Beam-Expanding Lens (VCBEL) for PIC to Fiber Coupling, Yasutaka Mizuno[1], Hiroshi Uemura[1], Tomoya Saeki[1], Keiji Tanaka[1], Katsumi Uesaka[1]; *[1]Sumitomo Electric Industries, Ltd., Japan.* We present vertically-coupled lens for CPO. Coupling efficiency of -1.8 dB and 1 dB alignment tolerance of ±10 μm were achieved, while demonstrating linear characteristic and long-term reliability of 3D-printed resin lens at 200 mW.

M4J.4 • 17:15
A Compact and Efficient 2D Grating Coupler for Polarization-Insensitive Fiber-to-Chip I/O, Wu Zhou[1], Yeyu Tong[1], Kaihang Lu[1]; *[1]Hong Kong Univ of Sci & Tech (Guangzhou), China.* We experimentally demonstrate a compact and efficient 2D grating coupler fabricated with optical lithography. A fiber-to-chip efficiency of -2.9 dB with a footprint of 55 × 37 μm^2 including spot size converters can be achieved.

M4J.5 • 17:30
Low-Loss Fan-in/Fan-out Device for Coupled Four-Core Fiber Using a Femtosecond Laser Direct Inscription Technique, Fengrui Yu[1], Lin Ma[1], Junjie Xiong[1], Linbin Bai[2], Mingjing Xu[1], Zuyuan He[1]; *[1]Shanghai Jiao Tong Univ., China; [2]Shanghai Optoweave Technology Co., China.* We demonstrate low-loss fan-in/fan-out device for 19 μm-core-pitch coupled four-core fiber using a femtosecond laser direct inscription technique, achieving an average insertion loss of 0.49 dB before packaging and 0.92 dB after packaging.

M4J.6 • 17:45
Highly Fabrication Tolerant, High-Power tri-tip SiN Edge Coupler on a CMOS Monolithic SiPh Platform, Yusheng Bian[1]; *[1]GLOBALFOUNDRIES, USA.* We report the successful demonstration of several monolithically integrated O-band Vgroove-based multi-tip SiN edge coupler designs with an average 0.5/0.7 dB TE/TM insertion loss, 0.1 dB PDL, high power

handling over 280 mW and <-40 dB ORL exceeding IEEE 802.3 standards.

M4J.7 • 18:00
Spot-Size-Adjustable Optical Mediator Using 3D-Tapered Silica Waveguides for SiPh/SMF Low-Loss Connection, Masashi Ota[1], Yoshinori Hibino[2], Mikihiro Kurosawa[2], Tomomasa Kiyozawa[1], Ai Yanagihara[1], Yoshie Morimoto[1], Keita Yamaguchi[1], Kenya Suzuki[1], Osamu Moriwaki[1]; *[1]NTT Corporation, Japan; [2]NTT Innovative Devices Corporation, Japan.* We propose an optical mediator using 3D-tapered silica waveguides for standard-single-mode fiber to silicon-waveguide connections, achieving adjustable spot sizes (3–9 mm), precise pitch conversion, and <0.7-dB coupling loss for TE-mode in the LAN-WDM band.

M4J.8 • 18:15
***7×100 Gb/s Multicore Fiber Link Enabled by an Inverse-Designed Dual-Polarization Coupler*,** Julian L. Pita Ruiz[1], Dipankar Sengupta[1], Christine Tremblay[1], Ming-Jun Li[2], Paulo C. Dainese, Jr.[2], Michaël Ménard[1]; *[1]École de Technologie Supérieure - ÉTS Montréal, Canada; [2]Corning, USA. We present the first integration of an array of seven freeform dual-polarization SOI couplers with a seven-core fiber featuring a 125 µm cladding diameter, achieving a 7×100 Gb/s error-free multicore link.*

16:30 -- 18:30
Room 304
M4K • Advancement of Integrated PD and APD
Presider: Patrick Runge; Fraunhofer HHI, Germany

M4K.1 • 16:30 (Top-Scored)
Silicon-Organic Hybrid (SOH) Mach-Zehnder Modulator (MZM) for Single-Carrier IMDD Line Rates of 500 Gbit/s and Beyond, Adrian Schwarzenberger[1,2], Dengyang Fang[1], Alexander Kotz[1], Hend Kholeif[1], Christoph Wilhelm[1,2], Carsten Eschenbaum[2], Mohamed Kelany[1], Lukas Grünewald[3], Stefan Singer[1,2], Cheng Feng[2], Malte Martens[2], Adrian Mertens[2], Sidra Sarwar[4], Patrick Kern[4], Masis Sirim[4], Peter Erk[1,2], Artem Kuzmin[1], Yolita M. Eggeler[3], Stefan Bräse[4], Sebastian Randel[1], Wolfgang Freude[1], Christian Koos[1,2]; *[1]Inst. of Photonics and Quantum Electronics (IPQ), Inst. of Microstructure Technology (IMT), Karlsruhe Inst. of Technology (KIT), Germany; [2]SilOriX, Germany; [3]Laboratory for Electron Microscopy (LEM), Karlsruhe Inst. of Technology (KIT), Germany; [4]Inst. of Ogranic Chemistry (IOC), Inst. of Biological and Chemical Systems–Functional Molecular Systems (IBCS-FMS), Karlsruhe Inst. of Technology (KIT), Germany.* We demonstrate PAM4, PAM6, and PAM8 signaling using a 280µm-long SOH MZM. We achieve PAM4 symbol rates of 204GBd and PAM8 line rates of 528Gbit/s (412.5Gbit/s net) – record-high values for devices on the SIP platform.

M4K.2 • 16:45

100 GHz Ultra-Thin Germanium Photodetector With 1.05 a/W Responsivity at 1550 nm, Xu Wang[1], Jinwen Song[2], Fengxin Yu[2], Fenghe Yang[2], Wei Chu[2], Haibin Zhao[1], Haiwen Cai[2], Xuezhe Zheng[3], Hao Wu[3], Xiao Hu[2,1]; *[1]Fudan Univ., China; [2]Zhangjiang Laboratory, China; [3]Innolight Technology Research Inst., China.* We demonstrate lateral-PIN germanium photodetectors with high bandwidth of up to 100 GHz, >0.8 A/W responsivity in the C-band and <20 nA dark current by utilizing ultra-thin germanium technology on CMOS silicon-photonic platform.

M4K.3 • 17:00

200 GHz Bandwidth Ultrafast Evanescently Coupled Waveguide MUTC-PDs With High Responsivity, Mingwei Sun[1], Bing Xiong[1], Changzheng Sun[1], Zhibiao Hao[1], Jian Wang[1], Lai Wang[1], Yanjun Han[1], Hongtao Li[1], Lin Gan[1], Yi Luo[1]; *[1]Tsinghua Univ., China.* Evanescently coupled waveguide modified uni-traveling carrier photodiodes integrated with a multilayer coupling waveguide are presented. The fabricated photodiode with matching resistor exhibits a 3-dB bandwidth of 200 GHz and a high responsivity of 0.62 A/W.

M4K.4 • 17:15

Ge/Si APD Receiver with Record-High Sensitivity Exceeding −30 dBm for 50G PON, Hengzhen Cao[1], Ning Wang[2], Xu Wang[3], Wenjun Chen[3], Qihong Wu[3], Weichao Sun[1], Zhen Dong[3], Zhiyong Feng[3], Zongzhao Zheng[3], Fan Xu[3], Daoxin Dai[1]; *[1]College of Optical Science and Engineering, Zhejiang Univ., China; [2]Department of Fundamental Network Technology, China Mobile Research Inst., China; [3]Optical R&D Mgmt Dept, Huawei Technologies, China.* A high-responsivity, low-dark-current Ge/Si waveguide APD is demonstrated and achieves ultra-high sensitivities of -30.3 dBm and -30.1 dBm at 50Gb/s at 25 °C and 85 °C for the first time. This high-performance device reveals the potential of integrated Ge/Si APDs for high-speed PON applications.

M4K.5 • 17:30

A 112 Gbps Silicon-Germanium Avalanche Photodiode with Ultra-High Gain-Bandwidth Product, Chao Cheng[1,2], Jintao Xue[1,2], Shenlei Bao[1,2], Qian Liu[1,2], Wenfu Zhang[1,2], Binhao Wang[1,2]; *[1]Xi'an Inst. of Optics and Precision, China; [2]Univ. of Chinese Academy of Sciences, China.* We present a Si-Ge APD with a GBP of 7078 GHz at an input optical power of -24 dBm. It demonstrates sensitivities of -14.9 dBm at 100 Gbps NRZ and -12.8 dBm at 112 Gbps PAM4, both with KP4-FEC.

M4K.6 • 17:45 (Top-Scored)

226 Gbps PAM4 Operation Using Differential Drive EA-DFB Laser With 2.0-Vppd Swing Over 10-km SSMF Transmission for 1.6TbE Transceivers, Shuhei Ohno[1], Takanori Suzuki[1], Hideaki Matsuzaki[1], Koichiro Adachi[1], Ryosuke Hatai[1], Ryo Nakao[1], Shinichi Tanaka[1], Atsushi Mimura[1], Takashi Suzuki[1], Noriko Sasada[1], Shigehisa Tanaka[1], Kazuhiko Naoe[1]; *[1]Lumentum Japan, Inc., Japan.* The newly developed differential drive EA-DFB confirmed 226 Gbps PAM4 eye opening with 4.8 dB ER by 2.0 Vppd (1.0 Vpp for each SE signal). TDECQ of 2.9dB was achieved after 10 km SSMF transmission with a 3-tap Tx equalizer.

M4K.7 • 18:00 (Invited)

Ultra-High Gain-Bandwidth Product APD, Yu Yu[1], Yang Shi[1], Xinliang Zhang[1]; *[1]Huazhong Univ of Science and Technology, China.* We present our recent progress on ultrafast germanium/silicon avalanche photodiodes achieving an unprecedented gain-bandwidth product of 1 THz under large bandwidth. Through comprehensive optimizations, further improvement can be expected.

16:30 -- 18:30
Rooms 201-202
M4A • Generative AI in Networking: From Proof of Concept to Production II
Presider: Olga Vassilieva; Fujitsu Network Communications Inc, USA and Deepa Venkitesh; Indian Inst. of Technology Madras, India and Ricard Vilalta; Centre Tecnològic Telecom de Catalunya, Spain and Qiong Zhang; Amazon Web Services, USA

M4A.1 • 16:30 (Invited)
Machine Learning Based Physical Layer Monitoring, Seb J. Savory[1]; *[1]Univ. of Cambridge, UK.* We review progress on machine learning for physical layer monitoring with a focus on Gaussian progress regression for nonlinear signal-to-noise estimation and amplifier characterization. We also discuss hybrid models to improve interpretability of ML models.

M4A.2 • 16:50 (Invited)
New Performance Monitoring Capabilities at Physical Layer, Zhiping Jiang[1], Choloong Hahn[1], Junho Chang[1], Qingyi Guo[1]; *[1]Ottawa Research Centre, Huawei Technologies Canada Co. Ltd., Canada.* Optical performance monitoring is critical in optical network optimization and fault classification/localization. In this presentation, the emerging monitoring techniques, such as pilot tone-based, Rx-side LPM-based monitoring, and Rx-based fault diagnosis framework, are reviewed.

M4A.3 • 17:10 (Invited)
Design Principle of Fiber-Longitudinal Power Monitor, Takeo Sasai[1,2]; *[1]NTT Network Innovation Laboratories, NTT, Japan; [2]2. The Research Center for Advanced Science and Technology, The Univ. of Tokyo, Japan.* We present the design principle of longitudinal power monitor. Analogous to the communication theory, we analytically show that the position-wise SNR fundamentally determines performance metrics such as minimum detectable loss and dynamic range.

M4A.4 • 17:30 (Invited)
Digital Twin Optical Networks Aided by DSP-Based Longitudinal Power Profile Monitoring, Inwoong Kim[1], Olga Vassilieva[1], Paparao Palacharla[1]; *[1]Fujitsu Network Communications Inc, USA.* Transmission link monitoring and actual physical parameters are essential for digital twin in optical networks. Receiver-side DSP enables not only monitoring longitudinal power profiles but also extracting physical parameters of transmission links.

M4A.5 • 17:50 (Invited)
Generative AI for Distributed Acoustic Sensing Event Classification in Telecom Networks, Ming-Fang Huang[1]; *[1]NEC Laboratories America Inc., USA.* Distributed fiber-optic sensing and machine learning enable continuous monitoring and protection of telecom networks. We evaluate the discriminative ability of generative models, which facilitates additional features such as selective classification, uncertainty quantification, and robustness.

M4A.6 • 18:10 (Invited)
Beyond Optical Layer Monitoring: Exploring the Full Potential of Coherent Signal Processing, Matheus Ribeiro Sena[1], Abdelrahmane Moawad[2], Robert Emmerich[2], Behnam Shariati[2], Philipp Nöckel[1], Andreas Gladisch[1], Rainer Schatzmayr[1], Ralf-Peter Braun[3], Johannes K. Fischer[2], Ronald Freund[2]; *[1]Deutsche Telekom AG, Germany; [2]Fraunhofer Heinrich Hertz Inst., Germany; [3]Orbit GmbH, Germany.* Extracting information from Rx-DSP can revolutionize optical fiber network monitoring. Beyond monitoring, it enhances QoT estimation, digital twin modeling, and network security. This talk explores the broader potential of coherent signal processing for optical networks.

16:30 -- 18:30
Rooms 205-206
M4C • Datacenter Interconnect
Presider: John Downie; Corning Inc., USA

M4C.1 • 16:30 (Tutorial)
IM-DD vs. Coherent in Datacenters: a Revisit in 2025, Xiang Zhou[1]; *[1]Google LLC, USA.* The rise of LLMs is driving explosive growth in datacenter bandwidth demand. This tutorial examines the scaling limitations of IM-DD based optical technologies and how datacenter-reach optimized coherent optics can address some of these challenges.

M4C.2 • 17:30
Demonstration of 12.3-THz Wide-Bandwidth Tunable CFP2 Coherent Transceiver Operating at C6T+L6T Band, Hao liu[1], Xia Sheng[1], Tianyang Zhao[2], Qianli Ma[3], Anxu Zhang[1], Kai Lv[1], Lipeng Feng[1], Yuyang Liu[1], Xishuo Wang[1], Xiaoli Huo[1]; *[1]China Telecom Beijing Research Inst., China; [2]ZTE Corporation, China; [3]ZTE Photonics Technology Co. Ltd., China.* We present a 130GBaud-based CFP2-DCO with nominal frequency tuning range from 184.35THz to 196.65THz. Experiment results show that the laser output is greater than 16.5dBm, and the maximum BtB OSNR tolerance in 400Gbit/s DP-QPSK is 16.79dB.

M4C.3 • 17:45
Bidirectional 3.2T (400Gb/s/λ×4λ×2) Optical Interconnect Enabled by 1.4 km NANF and PS-PAM16 With Linear FFE, Chao Li[1], Zichen Liu[1], Peng Sun[1], Songyuan Hu[1], Xumeng Liu[1], Qibing Wang[1], yingying Wang[2], Wei Ding[2], Zhixue He[1], Shaohua Yu[1]; *[1]Pengcheng Laboratory, China; [2]Jinan Univ., China.* Bidirectional optical interconnect link for beyond 3.2T application in C-band is proposed and experimentally demonstrated for the first time, enabled by high-performance NANF and probabilistic shaping 4Lambda 116GBaud PAM16 with linear equalizer only.

M4C.4 • 18:00 (Invited)
From 400G to 1600G - Cloud Scale Deployment and Intelligent Operation of Inter-Datacenter Coherent Links, Chuan Qin[1], Yishu Zhou[1], Binbin Guan[1], Ben Foo[1], Sasha Gazman[1], Matthew Tuggle[1], Jian Kong[1], Yawei Yin[1], Avinash Pathak[1], Deepak Garg[1], Deshraj Verma[1], Mounika Banda[1], Jeetesh Jain[1], Jamie Gaudette[1]; *[1]Microsoft, USA.* This paper discusses the transition from 400ZR to 1600ZR technology, emphasizing the need for robust forward error correction (FEC) mechanisms to maintain performance margins. The paper also explores intelligent operation using automated tools and AI to handle link failures, ensuring

seamless data transfer and network reliability. The findings highlight the significance of 1600ZR technology in meeting the bandwidth demand and enabling next-generation AI-driven applications.

16:30 -- 18:30
Rooms 209-210
M4F • Advanced Fibers and Applications
Presider: Georg Rademacher; Universität Stuttgart, Germany

M4F.1 • 16:30 (Invited)
Reduction of Modal Dispersion Through Mode Permutation in Multi-Mode Fiber Transmission, Giammarco Di Sciullo[1], Divya A. Shaji[1], Menno van den Hout[2], Georg Rademacher[3], Ruben S. Luis[4], Benjamin J. Puttnam[4], Nicolas K. Fontaine[5], Roland Ryf[5], Haoshuo Chen[5], Mikael Mazur[5], David T. Neilson[5], Pierre Sillard[6], Frank Achten[7], Jun Sakaguchi[4], Chigo M. Okonkwo[2], Antonio Mecozzi[1], Cristian Antonelli[1], Hideaki Furukawa[4]; *[1]Universita degli Studi dell'Aquila, Italy; [2]Eindhoven Univ. of Technology, Netherlands; [3]Univ. of Stuttgart, Germany; [4]National Inst. of Information and Communication Technology, Japan; [5]Nokia Bell Labs, USA; [6]Prysmian Group, France; [7]Prysmian Group, Netherlands.* We investigate mode permutation in a 15-mode fiber system to mitigate modal dispersion, effectively reducing the growth of the intensity impulse response duration with transmission distance, thereby decreasing MIMO-DSP complexity.

M4F.2 • 17:00
Maximizing Distributed Fiber Sensor Reach with Engineered Backscatter Profiles, Tristan Kremp[1], Zhou Shi[1], Kenneth S. Feder[1], Paul S. Westbrook[1]; *[1]OFS Fitel LLC, USA.* We use time domain simulations and experimental data to show how the backscattering profile along a fiber can be optimized to maximize sensor reach while maintaining acceptable attenuation and crosstalk for distributed sensing applications.

M4F.3 • 17:15 (Invited)
Toward in-Fiber Integrated Optical Signal Control, Yoko Yamashita[1], Masaki Wada[1], Kiyoshi Kamimura[1], Takayoshi Mori[1], Takashi Matsui[1], Kazuhide Nakajima[1]; *[1]NTT Corp., Japan.* Femtosecond (fs) laser inscription is beneficial in terms of integrating multiple functions within an optical fiber. Design basis and bandwidth controllability of a fs laser inscribed wavelength selective add/drop circuit are investigated.

M4F.4 • 17:45
Implementation of Digitally Scanned P-OFDR Using a Digital Coherent Transceiver, Fatima Al-Shaikhli[1], Rongqing Hui[1]; *[1]Univ. of Kansas, USA.* We present a novel measurement technique for P-OFDR with a digitally created linear chirp in the transmitter and vector complex optical field detection to measure the Stokes parameters along the fiber.

M4F.5 • 18:00 (Invited)
Wavefront Control with Metasurfaces for Optical Fiber Connectivity, Paulo C. Dainese, Jr.[1]; [1]*Corning Inc., USA.* Dielectric metasurfaces enable wavefront and polarization manipulation of light with high spatial resolution, enabling compact devices for high-density optical interconnects. I will review our recent results and future strategies to achieve high efficiency devices.

16:30 -- 18:45
Rooms 211-212
M4G • Free Space Optical Communications (FSOC)
Presider: Katherine Newell; Johns Hopkins Applied Physics Lab, USA

M4G.1 • 16:30
Demonstration of 29.49 dB Gain in C-Band NLOS Communication Using Masked Adaptive Focusing Shaping, Chaoxu Chen[1], Ziyi Zhuang[1], Yuan Wei[1], Haoyu Zhang[1], Fang Dong[1], Yingjun Zhou[1], Ziwei Li[1], Chao Shen[1], Junwen Zhang[1], Jianyang Shi[1], Nan Chi[1]; [1]*Fudan Univ., China.* We experimentally demonstrate a 29.49 dB gain in C-band non-line-of-sight (NLOS) communication using proposed masked adaptive focusing shaping method, achieving the highest reported gain to date. An 8.83 Gbps data rate is successfully reached in a 2.5 GHz-class OWC system with BPL-DMT signal.

M4G.2 • 16:45 (Top-Scored)
Real-Time 204Tb/s Mode/Wavelength Division Multiplexing Free-Space Optical Communication Enabled by 800G C6T+L6T-Band Transponder, Songyuan Hu[1,4], Peng Sun[1], Zhimu Huang[2], Chao Li[1], Juncheng Fang[2], Ting Lei[2], Zichen Liu[1], Xumeng Liu[1], Yunhong Liu[1], Ji Wang[1], Linbojie Huang[1], Songtao Chen[3], Wei Sun[4], Zhixue He[1], Shaohua Yu[1]; [1]*Pengcheng Laboratory, China;* [2]*Shenzhen Univ., China;* [3]*Fiberhome Telecommunication Technologies Co., Ltd., China;* [4]*Sun Yat-sen Univ., China.* Record net 204 Tb/s (850Gb/s/λ×80λ×3mode) real-time optical wireless connectivity over 1.6 m free-space link is experimentally achieved, enabled by C6T+L6T-band 800G transponder and MIMO-free 3-mode MUX/DeMUX.

M4G.3 • 17:00 (Top-Scored)
Bidirectional and Turbulence-Resilient Fi-Wi-Fi Bridge, Florian Honz[1], Bernhard Schrenk[1]; [1]*AIT, Austria.* We present a full-duplex 10Gb/s FSO bridge between two single-mode ports, utilizing centralized beamforming and simultaneous channel sounding. We further mitigate turbulence-induced fading through diversity reception enabled by wavelength-set coding.

M4G.4 • 17:15 (Top-Scored)
Enhanced Atmospheric Turbulence Resiliency in Free Space Optical Communication (FSOC) With MIMO Programmable Silicon-Photonics Processor, Yin-He Jian[1], Tun-Yao Hung[1], Dan Yi[2], Hon Ki Tsang[2], Chi-Wai Chow[1]; [1]*National Yang Ming Chiao Tung Univ., Taiwan;* [2]*The Chinese Univ. of Hong Kong, Hong Kong.* We present an integrated multiple-input-multiple-output (MIMO) programmable silicon-photonics (SiPh) processor, which improves the channel extinction-ratios (ERs) and enables overall data-rate enhancement from 9.75 to

50.7-Gbps. Experiment confirm the processor's resilience to handle atmospheric turbulence.

M4G.5 • 17:30 (Invited)
Wavelength Selection for Resilient Free-Space Optical Communication, Laura Resteghini[1], Lorenzo Luini[2], Carlo G. Riva[2], Roberto Nebuloni[3], Gianluca Galzerano[3], Elizabeth Verdugo[2], Alessandro D Acierno[1], Renato Lombardi[1]; *[1]Huawei Technologies Italia, Italy; [2]Department of Electronics, Information and Bioengineering, Polytechnic Univ. of Milan, Italy; [3]CNR-IEIIT, National Research Council, Italy.* Free Space Optics (FSO) communication is emerging as a promising approach for beyond 5G networks. The selection of the right optical wavelength for the system is a crucial parameter that significantly influences the architecture's definition.

M4G.6 • 18:00
FPGA-Based Real-Time Mode-Diversity Coherent Reception Experiment Over a 15.6 km Horizontal Turbulence Link, Kejia Xu[1], Wenjie Guo[1], Yan Li[1], Chao Liu[2,3], Bin Lan[2,3], Kaihe Zhang[2,3], Xinyu Guo[1], Zhengjie Wang[1], Pu Zhang[1], Shuai Wei[1], Jingwei Song[1], Xiaobin Hong[1], Jian Wu[1]; *[1]Beijing Univ. of Posts & Telecom, China; [2]National Laboratory on Adaptive Optics, China; [3]Key Laboratory on Adaptive Optics, Chinese Academy of Sciences, China.* In a 15.6 km near-ground FSO link, we observed turbulence-induced phase misalignment between modes. Using SC in a 1Gbaud BPSK real-time experiment over the same link, we demonstrated 87.7% error-free frames without precise phase alignment.

M4G.7 • 18:15
Fading-Resilient Coherent Receiver for Free-Space Communications with Real-Time Demonstration, Eric Dutisseuil[1], Rajiv Boddeda[1], Sébastien Bigo[1]; *[1]Nokia Bell Labs, France.* We propose an approach for enhancing the resilience of coherent receivers to fading caused by atmospheric turbulence in free-space systems. We validate it using a real-time receiver prototype demonstrating x1000 greater robustness to fading duration.

M4G.8 • 18:30 (Top-Scored)
Experimental Demonstration of Coherent Heterodyne Detection for Multiple Mid-IR Free-Space Optical (FSO) Data Channels with a Native Mid-IR Detector, Huibin Zhou[1], Yue Zuo[1], Abdulrahman Alhaddad[1], Xinzhou Su[1], Yuxiang Duan[1], Adam Heiniger[2], Moshe Tur[3], Alan Willner[1]; *[1]Univ. of Southern California, USA; [2]TOPTICA Photonics Inc, USA; [3]School of Electrical Engineering, Tel Aviv Univ., Israel.* We demonstrate mid-IR FSO coherent detection at ~3.4 µm using a native detector for (i) a single 1-Gbaud data channel with various modulation formats, including OOK, QPSK, 16 QAM, and 64 QAM, and (ii) five multi-carrier 1-Gbaud 16-QAM channels. We show >10-dB improvement in receiver sensitivity compared to direct detection using the same detector.

16:30 -- 18:30
Rooms 213-214
M4H • Networks with Optical Circuit Switching
Presider: George Michelogiannakis; Lawrence Berkeley National Laboratory, USA

M4H.1 • 16:30 (Invited)
Large Scale AI Systems with Photonic Connectivity, Larry Dennison[1]; *[1]NVIDIA Corp., USA.* Large scale AI systems are highly optimized and specialized for characteristics of their

workloads. The linkage from the AI workloads down to photonic interconnect is not readily apparent but is currently summarized as "use copper where you can, optical where you must". We explore how other attributes such as latency, channel error rates, packaging and power might cause increased photonic adoption.

M4H.2 • 17:00
Flexible Photonic Memory Pooling Architecture for Efficient Compute Resource Allocation, Zhenguo Wu[1], Keren Bergman[1]; *[1]Columbia Univ., USA.* We present a photonic memory pooling architecture and a co-designed optimization methodology for flexible allocation of compute, memory, and network resources. We demonstrate up to 5.4× to 7.5× improvements in DL training and inference time.

M4H.3 • 17:15
Mercury: A Reconfigurable Datacenter Network with Collaborative Optical Timeslot Switching and Optical Circuit Switching, Shi Feng[1], Jiawei Zhang[1], Huitao Zhou[1], Xingde Li[1], Yuefeng Ji[1]; *[1]Beijing Univ. of Posts and Telecomm, China.* We propose and experimentally demonstrate Mercury, a reconfigurable optical-switched network with collaborative optical timeslot and circuit switching paradigms. Experimental results show its nanosecond-granularity reconfiguration and model training acceleration effect through a real-time FPGA-based prototype.

M4H.4 • 17:30
Accelerating Collective Communications with Mutual Benefits of Optical Rackless DC and in-Network Computing, Weichi Wu[1], Xiaoliang Chen[1], Zhihuang Ma[1], Xuexia Xie[1], Ke Meng[2], Weiguang Wang[2], Zuqing Zhu[1]; *[1]Univ. of Science and Technology of China, China; [2]Huawei Inst. of Nanjing, China.* We propose a novel architecture to explore the mutual benefits of optical rackless data center (ORDC) and in-network computing for accelerating collective communications. It reduces job completion time of MapReduce clusters by 27.4% to 43.3% over traditional ORDC in experiments.

M4H.5 • 17:45
DRL-TPE: Learning to Optimize TPE of Optical Interconnects to Accelerate Hitless Reconfiguration of OCS-Based DCNs, Xiaoliang Chen[1], Wenbang Zheng[1,2], Shuoning Zhang[1], Xiaoyan Dong[1], Ke Meng[3], Zuqing Zhu[1]; *[1]Univ. of Science and Technology of China, China; [2]Sun Yat-Sen Univ., China; [3]Huawei Inst. of Nanjing, China.* We leverage deep reinforcement learning (DRL) to optimize the topology engineering of optical circuit switching based data-center networks, such that the hitless reconfiguration to the obtained target physical topology can be finished with the fewest stages. Simulations confirm the benefits of our proposal over the state-of-the-art.

M4H.6 • 18:00 (Invited)
Impact of Optical Circuit Switching on AI Clusters, Norman P. Jouppi[1]; *[1]Google LLC, USA.* Abstract not available

Tuesday, 01 April
08:00 -- 10:00
Esplanade Ballroom

Tu1A • Joint Plenary Session
Presider: Nicolas Fontaine; Nokia Bell Labs, USA and Fotini Karinou; Microsoft, UK and Elaine Wong; Univ. of Melbourne, Australia

DII (Diversity, Inclusion and Integration) of III-v Devices and Technologies in Photonics, Kei May Lau[1]; *[1]Hong Kong Univ of Science & Technology, Hong Kong.* We have taken various approaches and developed high-quality III-V on silicon by direct hetero-epitaxy, including blanket and selective growth. A novel lateral aspect ratio trapping (LART) technique is used to grow III-V lasers with embedded QWs and high-speed photodetectors on patterned commercial SOI substrates for integrated Si photonics.

Space-Based Optical Communications: Present Capabilities and Future Opportunities, Bryan S. Robinson[1]; *[1]MIT Lincoln Laboratory, USA.* Just a few years ago, free-space optical communication (FSOC) systems were considered by many to be too complex or expensive to offer any practical benefits. Today, there are thousands of FSOC terminals operating in space, enabling revolutionary space and terrestrial communications systems. We will review the history of FSOC development, discuss its present applications, and consider areas where future development will enable new communications capabilities near Earth, and beyond.

Scaling Data Centers Is in Conflict with Increasing Interface Speeds, Pradeep Sindhu[1]; *[1]Microsoft, USA.* This talk argues that the historical trend towards ever faster network port speeds in Ethernet networks is increasingly in conflict with building efficient, massive scale data centers. To support these data centers, the industry needs to fix port speed at a technology “sweet spot” of around 200Gbps and instead scale networks by increasing the number of ports (the radix) on NICs and switches.

14:00 -- 16:00
Room 207
Tu2D • Quantum and Classical Security

Tu2D.1 • 14:00
Quantum-Safe MACsec Connectivity to Public Cloud Providers in a Metropolitan Network Over Deployed Fiber, Obada Alia[1], Albert Huang[1], Randy Lai[1], Huan Luo[1], Joey Goh[1], Marco Pistoia[1], Charles Lim[1]; *[1]JP Morgan Chase, Singapore.* We successfully demonstrated a wire-rate 10 Gbps QKD-secured MACsec link between JPMorganChase datacenter and a major Cloud Service Provider (CSP) via dedicated network connection providing quantum-safe connectivity to the cloud without utilizing the public internet.

Tu2D.2 • 14:15
First Demonstration of 200 Gbps Regime Line-Rate Quantum-Secure MACsec Optical Links Using Commodity Hardware Offloads, Abraham Cano Aguilera[1,2], Carlos Rubio Garcia[1], Daniel C. Lawo[1,2], Idelfonso Tafur Monroy[1], José Luis Imaña Pascual[3], Juan José

Vegas Olmos[2]; *[1]Technical Univ. of Eindhoven, Netherlands; [2]NVIDIA, Israel; [3]Complutense Univ. of Madrid, Spain.* We demonstrate the first MACsec implementation at 196~Gbps over an end-to-end quantum-secure link using Quantum Key Distribution, Post-Quantum Cryptography, and Classical Cryptography with network offloads and hardware accelerators.

Tu2D.3 • 14:30
91.1 Gbit/s Quantum Resistant IPsec Programmable Encryptor, Carlos Rubio Garcia[1], Abraham Cano Aguilera[1], Juan José Vegas Olmos[2], Simon Rommel[1], Idelfonso Tafur Monroy[1]; *[1]Eindhoven Univ. of Technology, Netherlands; [2]NVIDIA, Israel.* We demonstrate the first DPU-based triple-hybrid IPsec tunnel that simultaneously integrates classical and post-quantum cryptography, and quantum key distribution, providing accelerated quantum-resistant communications operating at 91.1~Gbit/s line rate.

Tu2D.4 • 14:45
Bi-Directional Coexistence of C-Band Quantum Channel with Quantum-Safe IPsec DWDM Classical Channels in a Metropolitan Network, Obada Alia[1], Albert Huang[1], Marco Pistoia[1], Charles Lim[1]; *[1]JP Morgan Chase, Singapore.* We demonstrate the bi-directional coexistence of a quantum channel with service, key management system, management, and encrypted data channel all operating in the C-band in passive-only and active testbeds over 35km and 50km single-mode fibers.

Tu2D.5 • 15:00
Integration of Quantum Key Distribution in a 20-km 32-User Coherent Passive Optical Network with Single Feeder Fiber, Jing Wang[1], Brian J. Rollick[1], Zhensheng Jia[1], Bernardo A. Huberman[1]; *[1]CableLabs, USA.* For the first time, we demonstrated the integration of O-band polarization-encoding decoy-state BB84 QKD into a C-band 20-km single-feeder fiber 32-user coherent PON running at carrier-grade power levels without modifying existing PON infrastructures.

Tu2D.6 • 15:15
Latency of Multipartite Entanglement Distribution in a Quantum SDN Architecture, Anuj Gore[1], Alejandra Beghelli[1]; *[1]Univ. College London, UK.* We quantify the latency to distribute multipartite entanglement over a quantum SDN architecture. Results show that classical communication accounts for more than 85% of the delay, highlighting the need for efficient control plane design.

Tu2D.7 • 15:30 (Invited)
QKD Networks in China, Qiang Zhang[1]; *[1]Univ. of Science and Technology of China, China.* Quantum key distribution (QKD) promises information-theoretically secure communication, yet practical deployment has historically been hindered by channel loss and device imperfections. This talk will review the technological milestones and operational frameworks underpinning China’s QKD network.

14:00 -- 16:00
Room 208
Tu2E • Doped Fiber Lasers and Amplifiers I
Presider: John Ballato; Clemson Univ., USA

Tu2E.1 • 14:00 (Tutorial)
EDFAs: Ongoing Frontier of Practical Amplifier Development, Thomas Strasser[1]; *[1]Infinera Corp., USA.* EDFA technology has been key to economically scaling bandwidth in fiber networks for over 30 years. A frontier remains with key opportunities to evolve current EDFA applications to support future network needs.

Tu2E.2 • 15:00
Optimization of Gain Profile of Super-C Band EDFA Using Neural Network and Simplified Physical Models, Lixian Wang[1], Jiachuan Lin[1], Zhiping Jiang[1]; *[1]Huawei Technologies Canada, Canada.* Neural network models of EDFA work well in gain prediction but usually have limited access to amplifier's control parameters. Leveraging physical model can help in the fine-tuning and optimization of EDFA's operating point.

Tu2E.3 • 15:15
EDFA Gain Profile Prediction Under off-Target Channel add/Drop, Yang Lan[1], Lixian Wang[1], Zhiping Jiang[1]; *[1]Huawei Technologies Canada, Canada.* We propose a hybrid EDFA model to estimate gain profile under off-target channel add and drop events. Our experimental results show 0.05dB RMSE off-target prediction with on-target data only, significantly reducing sample requirements.

Tu2E.4 • 15:30
Validity of the McCumber Theory at Low Temperatures for Erbium Doped Alumino-Germanosilicate Fibers, Inga Rittner[1], Roland Spang[1], Peter M. Krummrich[1]; *[1]Chair for High Frequency Technology, TU Dortmund Univ., Germany.* We show experimental results indicating that the McCumber conversion between the absorption and emission cross section spectra holds at low temperatures. Measurement results at around 77 K of erbium-doped fiber probes are presented.

Tu2E.5 • 15:45
Impact of Fluctuations of Er-Doped Preforms Properties on the Performances of Multi-Core Amplifiers for Submarine Applications., Martin Deduytschaever[1], Maroun Bsaibes[1], Maryna Kudinova[3], Pierre Sillard[3], Jean-baptiste Trinel[3], Claire Autebert[2], Labroille Guillaume[2], Perrier Philippe[4], Bigot Laurent[1], Yves Quiquempois[1], Ravn Andresen Esben[1]; *[1]PhLAM-Université de Lille, France; [2]Ille-et-Vilaine, CAILABS, France; [3]Haisnes, Prysmian, France; [4]META, Malaysia.* This work reports the study of the impact of the fluctuations of the opto-geometrical and compositional properties of Erbium-doped preforms on the differential gain between channels in multi-core-Erbium-doped amplifiers applicable to submarine applications.

14:00 -- 16:00
Room 215
Tu2I • Coherent PON Optimization

Presider: Haipeng Zhang; CableLabs, USA

Tu2I.1 • 14:00 (Top-Scored)
200G Coherent TFDM-PON With Flexible Subcarrier Reception Using Simplified ONU and MHz DFB Laser, Xingang Huang[1], Yixiao Zhu[2], Xiansong Fang[3], Bo Liu[1], Xiatao Huang[1], Guangying Yang[2], Guoqiang Li[1], Ziheng Zhang[2], Yiming Zhong[1], Lina Man[2], Fan Zhang[3], Weisheng Hu[2]; *[1]ZTE Corporation, China; [2]Shanghai Jiao Tong Univ., China; [3]Peking Univ., China.* We propose a TFDM-PON with simplified ONU structure and subcarrier allocation design that allows flexible single/multiple subcarrier reception. At 25-km SSMF, >32.5-dB power budget for 200-Gb/s downstream is achieved with 512-symbol preamble and 1-MHz LO.

Tu2I.2 • 14:15
Low-Complexity PAPR Reduction Based on Partial Transmit Subcarrier Technology in 400G Coherent TFDM PON, Penghao Luo[1], An yan[1], Shuhong He[1], Yongzhu Hu[1], Zhongya Li[1], Junhao Zhao[1], Renle Zheng[1], Yingjun Zhou[1], Jianyang Shi[1], Nan Chi[1], Junwen Zhang[1]; *[1]Fudan Univ., China.* We propose and demonstrate a low-complexity downstream signal peak-to-average power ratio (PAPR) reduction scheme based on partial transmit subcarrier technology for 400G coherent time-and-frequency-division PON. Experimental results show our approach provides over 1dB power-budget improvement.

Tu2I.3 • 14:30 (Top-Scored)
Enhanced DC Leakage Tolerance for 200G Simplified Coherent TDM-PON in Upstream Burst-Mode Detection, An yan[1], Yongzhu Hu[1], Junhao Zhao[1], Penghao Luo[1], Shuhong He[1], Renle Zheng[1], Zhifeng Yue[1], Ziwei Li[1], Chao Shen[1], Jianyang Shi[1], Yingjun Zhou[1], Nan Chi[1], Junwen Zhang[1]; *[1]Fudan Univ., China.* We present improved DC-leakage tolerance for the 200G simplified coherent TDM-PON in upstream burst-mode detection, utilizing SCM signaling with flipped-frequency heterodyne detection, achieving 18-dB DC-leakage tolerance improvement at the N1 class loss budget.

Tu2I.4 • 14:45
Preamble Design for Online IQ Skew Estimation in Burst-Mode DSP for 400G Coherent TFDM-PON Upstream, Junhao Zhao[1], An yan[1], Yongzhu Hu[1], Zhongya Li[1], Aolong Sun[1], Boyu Dong[1], Penghao Luo[1], Sizhe Xing[1], Yingjun Zhou[1], Jianyang Shi[1], Chao Shen[1], Ziwei Li[1], Nan Chi[1], Junwen Zhang[1]; *[1]Fudan Univ., China.* We report a fast transceiver online IQ-skew estimation method with special designed preamble in upstream burst-mode DSP, achieving transceiver estimation errors within ±0.3 ps after average operation in the 400G coherent TFDM-PON upstream.

Tu2I.5 • 15:00
Low-Complexity 100G Burst-Mode TDMA-CPON Transmission Achieving 38 dB Link Budget, Gabriele Di Rosa[1], Ognjen Jovanovic[1], M. Ahmed Leghari[1], Martin Kuipers[2], Jim Zou[1], Jörg-Peter Elbers[1]; *[1]Adtran Networks SE, Germany; [2]Adtran Networks SE, Germany.* We experimentally demonstrate practical 100 Gbit/s burst-mode coherent transmission with >38 dB link budget without optical amplification. A novel ~17.1 ns DP-QPSK preamble guarantees DSP

convergence while enabling power-efficient modulation and reduced DAC requirements.

Tu2I.6 • 15:15

224 Gbit/s Coherent PON Downstream Using a Wavelength-Uncalibrated LO and Blind Locking During ONU Startup, Md Mosaddek Hossain Adib[1], Christoph Füllner[1], Sandip Das[1], Michae Straub[1], Laurens Breyne[1], Dora van Veen[1], Rene Bonk[1]; [1]*Nokia Bell Labs, Germany.* We experimentally demonstrate a novel blind LO-locking technique for 224 Gbit/s coherent PON downstream that is applied during ONU startup and allows using wavelength uncalibrated LO lasers in the ONU module.

Tu2I.7 • 15:30

Blind Channel Equalizer-Based Suppression of Interference from Non-Transmitting ONUs in Upstream Coherent PON, Wouter Lanneer[1], Kovendhan Vijayan[1], Robbe Van Rompaey[1], Robert Borkowski[1], Laurens Breyne[1]; [1]*Nokia Bell Labs, Belgium.* This work investigates the impact of narrowband interference from non-transmitting ONUs in coherent PON and proposes novel channel equalizer-based interference suppression. Experimental results demonstrate a 4 dB improvement of signal-to-interference-ratio margin compared to standard equalization.

Tu2I.8 • 15:45

Experimental Demonstration of APD-Based Simplified Coherent Receiver for 100Gbit/s/λ Coherent PON Downstream Transmission, Haiqiang WEI[1], Kemo Ran[2], Steven Zhong[2], Xiang Li[3], Chao Lu[1], Alan Pak Tao Lau[1], Kang Ping Zhong[1]; [1]*Photonics Research Inst., Department of Electrical and Electronic Engineering, The Hong Kong Polytechnic Univ., Hong Kong SAR, China, Hong Kong;* [2]*MACOM Technology Inc, China;* [3]*School of Mechanical Engineering and Electronic Information, China Univ. of Geosciences (Wuhan), China.* We experimentally demonstrated APD-based simplified coherent receiver using single photodiode for 100Gbit/s/λ coherent PON downstream transmissions with a 17.9dB reduction in LO power and a record link power budget of 33.1dB.

14:00 -- 16:00
Room 301
Tu2J • Modulator Structures with EML, Thin Film LN and Ring-Based
Presider: Liu Liu; Zhejiang Univ., China

Tu2J.1 • 14:00

A Wavelength Locking System of Microring Modulator for PAM4 Modulation Assisted by Bit-Error-Rate Searching, Yuchen Shi[1], Qiang Zhang[2], Gangqiang Zhou[2], Shengyu Fang[1], Shilan Zhou[1], Xinyu Wang[1], Naichang Pei[3], Hui Yu[2]; [1]*Zhejiang Univ., China;* [2]*Zhejiang Lab, China;* [3]*Southwest China Inst. of Electronic Technology, China.* We demonstrate a wavelength locking system of Microring Modulator for PAM4 Modulation, where the BER formula identifies the operating point. We achieve fast adaptive locking for 30 GBaud/s PAM4 signal within a full FSR.

Tu2J.2 • 14:15

413 Gbits/s PAM-6 O-Band CWDM Electroabsorption Modulated Lasers for 400G per Lane IM-DD Applications, Prashanth Bhasker[1], Sumeeta Arora[1], Alex Robertson[1], Tom McCaully[1], Adrian Ni[1], John Johnson[1]; [1]*Broadcom Inc, USA.* We report O-band EMLs with 90GHz BW at

55C. BTB PAM-4 (320 Gbits/s) and PAM-6 (413 Gbits/s) eyes are presented. 500m fiber transmission is demonstrated at 160GBd PAM-4 for CWDM channels 1270/1330.

Tu2J.3 • 14:30 (Invited)
High Speed EML and Assembly Techniques for GPU Cluster System, Mizuki Shirao[1], Takuma Fujita[1], Shinya Okuda[2], Asami Uchiyama[2], Takumi Nagamine[3], Abe Kenichi[4], Nobuo Ohata[1]; *[1]Information Technology R&D Center, Mitsubishi Electric Corporation, Japan; [2]High Frequency & Optical Device Works, Mitsubishi Electric Corp., Japan; [3]Manufacturijng Engineering Center, Mitsubishi Electric Corp., Japan; [4]Advanced Technology R & D Center, Mitsubishi Electric Corp., Japan.* We discussed a high-mesa EML and its assembly techniques for GPU cluster systems targeting 400 Gbps/lane optics. A highly efficient, high-speed EML beyond 100 GHz and novel assembling technique that eliminates wire bonding were demonstrated.

Tu2J.4 • 15:00
Dual-Band 390 Gbps High Coupling Efficiency Thin Film Lithium Niobate Modulator With 3-dB Bandwidth Exceeding 110 GHz, Yutong He[1], Hao Liu[1], Changzheng Sun[1,2], Bing Xiong[1], Zhibiao Hao[1], Lai Wang[1], Jian Wang[1], Yanjun Han[1], Hongtao Li[1], Lin Gan[1], Yi Luo[1]; *[1]Tsinghua Univ., China; [2]Beijing National Research Center for Information Science and Technology, China.* We present a low-loss and ultra-wideband thin-film lithium niobate modulator based on multifunctional benzocyclobutene platform, demonstrating a coupling loss of 0.54 dB/facet and up to 390 Gbps data rate in both C and O bands.

Tu2J.5 • 15:15
Ultra-Compact and High-Speed Topological Photonic Crystal Modulator Based on Thin Film Lithium Niobate, Yushan Liu[1], Guanyu Chen[1], Bangtong Ge[2], Mingjie Zou[3], Chunde Li[1], Yuxin Liang[2], Yu Yu[3], Hua Yu[1], Tao Zhu[1]; *[1]Chongqing Univ., China; [2]Chongqing United Microelectronics Center, China; [3]Huazhong Univ. of Science and Technology, China.* We demonstrate a topological photonic crystal modulator based on thin film lithium niobate. Its footprint is only 57.6 μm^2 with >120 GHz bandwidth. 70 Gb/s NRZ eye diagram is clearly open without using algorithm.

Tu2J.6 • 15:30
Monolithical Equalization-Modulation in Optical Transmitter for High-Rate Data Link, Yichen Wu[1], Bitao Shen[1], Luwen Xing[2], Yuansheng Tao[1], Zhangfeng Ge[3], Bowen Bai[1], Tiantian Li[4], Haowen Shu[1], Xingjun Wang[1]; *[1]School of Electronics, Peking Univ., China; [2]College of Engineering, Peking Univ., China; [3]Peking Univ. Yangtze Delta Inst. of Optoelectronics, China; [4]School of Electronic Engineering, Xi'an Univ. of Posts & Telecommunications, China.* We demonstrate a cascaded-MRR-based optical equalizer, offering efficient, precise reconfigurability for signal distortion correction. For-the-first-time, it was integrated into a silicon transmitter, delivering doubled bandwidth (60 GHz) and >3 dB SNR enhancement at 66GBaud.

Tu2J.7 • 15:45 (Top-Scored)
High-Speed 340 Gbps PAM4 and 450 Gbps PAM6 Operations of Narrow High-Mesa EML, Shinya Okuda[1], Asami Uchiyama[1], Toshiya Tsuji[1], Yohei Hokama[1], Koki Kihara[1], mizuki shirao[1], Takeshi Yamatoya[1], Yasuhiro Yamauchi[1]; *[1]MITSUBISHI ELECTRIC Corporation, Japan.* We successfully achieved 340 Gbps PAM4 and 450 Gbps PAM6 operations using a 106

GHz 3-dB bandwidth narrow high-mesa EML, indicating its potential for 300 Gbps and 400 Gbps transmissions with FEC.

14:00 -- 16:00
Room 304
Tu2K • Stable Lasers and Applications in Fiber Sensing
Presider: Mikael Mazur; Nokia Bell Labs, USA

Tu2K.1 • 14:00 (Top-Scored)
Modulation-Free Laser Stabilization with Extended Locking Range on a SiN Chip, Mohamad Hossein Idjadi[1], Farshid Ashtiani[1], Kwangwoong Kim[1]; [1]*Nokia Bell Labs, USA.* We demonstrate a modulation-free laser stabilization system using a cavity-coupled MZI with aided acquisition on a low-loss SiN chip, achieving more than an order-of-magnitude improvement in locking range and over 36 dB noise suppression.

Tu2K.2 • 14:15
Demonstration of MIMO-DFS Over 100km of Unamplified SSMF Link Using Active Laser Drift Stabilization and Optimized Probing Codes, Rajiv Boddeda[1], Christian Dorize[1], Pierre Brochard[2], Haik Mardoyan[1], Carina Castineiras[1], Jeremie Renaudier[1]; [1]*Nokia Bell Labs France, France;* [2]*Silentsys, France.* We estimate the laser frequency noise impact on coherent sensing using Distributed Fiber Sensing model. By stabilizing the laser in the estimated frequency zone, we demonstrate reduced noise floor over 100km using optimized probing codes.

Tu2K.3 • 14:30 (Invited)
Ultrastable Lasers with Compact and Portable Optical Reference Cavities, Franklyn Quinlan[1]; [1]*National Inst of Standards & Technology, USA.* Compact Fabry-Perot optical frequency references are reviewed, with emphasis on micromirror utilization and in-vacuum bonding. For a 1550 nm laser stabilized to a 9.7 mL cavity, the measured Allan deviation is 2.4×10^{-14} at 1 s.

Tu2K.4 • 15:00
Integrated Sensing and Communications Using External Cavity Laser with Laser Frequency Comb, Liwang LU[1], Chuang Xu[1], Jingchuan Wang[1], Cheng Chen[1], Chao Lu[1], Yaxi Yan[1], Alan Pak Tao Lau[1]; [1]*The HK Polytechnic Univ., Hong Kong.* We propose phase-based vibration sensing using external cavity lasers and frequency combs at coherent transmitters and receivers. Digital signal processing (DSP) eliminates laser phase noise recovered from multiple channels and enables small vibration detection.

Tu2K.5 • 15:15
Dual-Wavelength φ-OFDR Using a Hybrid-Integrated Laser Stabilized to an Integrated SiN Coil Resonator, Mohamad Hossein Idjadi[1], Stefano Grillanda[1], Nicolas K. Fontaine[1], Mikael Mazur[1], Kwangwoong Kim[1], Tzu-Yung Huang[1], Cristian Bolle[1], Rose Kopf[1], Mark Cappuzzo[1], Kaikai Liu[2], David Heim[2], Andrew S. Hunter[2], Karl Nelson[3], Daniel J. Blumenthal[2]; *[1]Nokia Bell Labs, USA; [2]Department of Computer and Electrical Engineering, Univ. of California at Santa Barbara, USA; [3]Honeywell Aerospace, USA.* We demonstrate dual-wavelength distributed acoustic sensing over 37 km of standard single-mode fiber using φ-OFDR, utilizing a scalable hybrid-integrated dual-wavelength laser chip frequency-locked to a high-Q integrated SiN coil resonator.

Tu2K.6 • 15:30 (Invited)
Frequency Dissemination with Fibers, Jochen Kronjaeger[1]; *[1]Physikalisch-Technische Bundesanstalt (PTB), Germany.* We present principles and applications of optical frequency dissemination in fibers, using different technologies, at the example of recent activities at Physikalisch-Technische Bundesanstalt (PTB).

14:00 -- 16:00
Rooms 201-202
Tu2A • Hybrid Satellite/Terrestrial Networks: Where Does the Fiber End, and Satellite Take Over? I
Presider: Oskars Ozolins; RISE Research Inst.s of Sweden AB, Latvia and Dirk Van Den Borne; Juniper Networks Inc., Germany

Tu2A.1 • 14:00 (Invited)
Optics in the Era of Ubiquitous Hybrid Data Networks, C. Randy Giles[1]; *[1]Optica, USA.* Abstract not available.

Tu2A.2 • 14:10 (Invited)
AIRBUS Program to Develop Cross-Atmospheric Optical Communications, Andres Catelo Garcia[1], Ludovic Blarre[1]; *[1]Airbus Defence and Space GmbH, Germany.* AIRBUS initiated a roadmap in 2018 to develop high speed cross atmospheric optical links. TELEO in-orbit demonstration is the first achievement, paving the way for feeder and massive data transfer applications for GEO satellites.

Tu2A.3 • 14:30 (Invited)
Title to be Announced, Jade Wang[1]; *[1]MIT Lincoln Laboratory, USA.* Abstract not available.

Tu2A.4 • 14:50 (Invited)
Where Does Fiber Technology Ends, and Specific Satellite Technology Takes Over?, Sébastien Bigo[1]; *[1]Nokia Bell Labs, France.* While terrestrial communication technologies, primarily coherent optics, can provide mature building blocks and economies of scale, to enable a new breed of satellites, they sometimes require adaptation to free space propagation, particularly in the atmosphere.

Tu2A.5 • 15:10 (Invited)
Title to be Announced, Achim Autenrieth[1]; *[1]Adtran Networks SE, Germany.* Abstract not available.

14:00 -- 16:00
Rooms 205-206
Tu2C • Summit on Optics for AI Datacenters
Presider: Thomas Greer; NVIDIA Corporation, USA

Tu2C.1 • 14:00 (Invited)
Forward-Looking Technologies for AI/ML Datacenter Clusters, Katharine E. Schmidtke[1,2]; *[1]Eribel Systems LLC, USA; [2]Electrical and Computer Engineering, Univ. of California, Santa Barbara, USA.* AI's largest models are scaling rapidly, doubling required total FLOPs every four months. This talk examines bottlenecks in interconnect bandwidth and photonic technologies to scale efficiently to 14.4TB/s by 2030.

Tu2C.2 • 14:30 (Invited)
LPO Technology: System Integration Insights, Progress, and Challenges, Yi Tang[1], Fabio Bottoni[1]; *[1]Cisco Systems Inc., USA.* By eliminating DSP/retimer functions, Linear Pluggable Optics modules offer reduced power, cost and latency. This paper explores the challenges associated with LPO system integration and examines industry progress towards achieving true plug-and-play functionality of LPO modules.

Tu2C.3 • 15:00 (Invited)
Translating AI/ML System Architecture Into Optical Requirements, Craig Thompson[1]; *[1]NVIDIA Corp., USA.* Abstract not available.

Tu2C.4 • 15:30 (Invited)
Silicon Photonics and Advanced 3-D Assembly for Short-Reach Optical Interconnects, Joris Van Campenhout[1], Filippo Ferraro[1], Andy Miller[1], Yoojin Ban[1]; *[1]IMEC, Belgium.* We lay out our vision towards >4Tbps/mm, <2pJ/bit wafer-level optical interconnects and discuss the enabling building blocks, including ultra-compact modulators, scaled DWDM filters, expanded-beam fiber couplers and hybrid EIC-PIC integration technologies.

14:00 -- 16:00
Rooms 209-210
Tu2F • Modulation and Coding
Presider: Georg Böcherer; Huawei Technologies Duesseldorf GmbH, Germany

Tu2F.1 • 14:00 (Invited)
On Optimal Probabilistically Shaped Constellations for Unamplified Optical Interconnects, Basak Ozaydin[1], Di Che[2], Vivian Xi Chen[2]; *[1]MIT Research Laboratory of Electronics, USA; [2]Nokia Bell Labs, USA.* We discuss a generalized method to determine the optimal probabilistically shaped constellation for a peak-power constraint system limited by transceiver impairments. We study the shaping gains under different system conditions and

their corresponding optimal distributions.

Tu2F.2 • 14:30
A Novel Flexible LUT-Based Hierarchical Distribution Matcher for Rate Adaptable Probabilistic Constellation Shaping, Zulin Liu[1], Yan Li[1], Jingwei Song[1], Kejia Xu[1], Yaning Sun[1], Jifang Qiu[1], Hongxiang Guo[1], Xiaobin Hong[1], Zhisheng Yang[1], Jian Wu[1]; *[1]Beijing Univ. of Posts & Telecom, China.* Based on the principle of HiDM, we propose a new LUT construction method that achieves low loss and low complexity rate adaptation under 16QAM and 64QAM modulation.

Tu2F.3 • 14:45 (Top-Scored)
Performance-Complexity-Latency Trade-Offs of Concatenated RS-SDBCH Codes, Alvin Y. Sukmadji[1], Frank R. Kschischang[1]; *[1]Univ. of Toronto, Canada.* Performance-complexity-latency trade-off curves for rate-0.88 concatenated outer Reed--Solomon codes and inner Chase-algorithm-based soft-decision Bose--Ray-Chaudhuri--Hocquenghem codes with PAM4 constellation using bit-interleaved coded modulation and multilevel coding coded modulation schemes over the AWGN channel are presented.

Tu2F.4 • 15:00 (Top-Scored)
A Novel PS-QAM Signaling with Iterative Decoding for Higher Spectral Efficiencies, Hussam G. Batshon[1], Gregory Raybon[1], Di Che[1], Vivian Xi Chen[1]; *[1]Nokia Bell Labs, USA.* We propose a novel multidimensional probabilistically shaped coded modulation scheme with iterative decoding, achieving up to 0.9dB SNR improvement over PS-QAM across 4 to 10bits/s/Hz. Experimental results confirm the performance of the proposed approach.

Tu2F.5 • 15:15
Impact of Line-Side and Client-Side Errors Using Iterative and Non-Iterative Decoding for Concatenated KP4-BCH FEC, Matthias Herrmann[1], Saleem Alreesh[1], Chris R. Fludger[1], Khoa Le Trung[1], Ingmar Land[1], Junho Cho[1], Han Sun[1], Robert Maher[1]; *[1]Infinera, Germany.* We analyze the performance of iterative and non-iterative decoding of concatenated KP4-BCH FEC. Client-side errors at the transmitter lead to discrepancies between BCH and RS decoders. Nevertheless, iterative decoding improves the tolerance to client-side errors.

Tu2F.6 • 15:30
Iterative Logistic Weight Based Chase Decoder for Open Forward Error Correction, Yifei Shen[1], Wenqing Song[1], Ludovic D. Blanc[1], Yuqing Ren[1], Alexios Balatsoukas-Stimming[2], Alex Alvarado[2], Andreas Burg[1]; *[1]EPFL, Switzerland; [2]Eindhoven Univ. of Technology, Netherlands.* We propose an iterative logistic weight based decoder for open forward error correction (oFEC) codes. Compared to Chase-Pyndiah decoding with 93 error patterns, our decoder achieves similar performance with lower complexity.

Tu2F.7 • 15:45
Cost-Gain Analysis of Sequence Selection for Nonlinearity Mitigation, Stella Civelli[1,2], Marco Secondini[2,3]; *[1]IEIIT, CNR, Italy; [2]Tecip Inst., Scuola Superiore Sant'Anna, Italy; [3]PNTLab, CNIT, Italy.* We propose a low-complexity sign-dependent metric for sequence selection and study the nonlinear shaping gain achievable for a given computational cost, establishing a benchmark for future research. Small gains are obtained with feasible complexity. Higher gains are achievable in principle, but with high complexity or a more sophisticated metric.

14:00 -- 16:00
Rooms 211-212
Tu2G • Filters, Multiplexers and Resonators
Presider: Keita Yamaguchi; NTT Corporation, Japan

Tu2G.1 • 14:00 (Invited)
Manufacturable Inverse Designed Si Photonic Devices, Alfred Cheung[1], Krishna Gadepalli[1], Jian Guan[1], Yang Meng[1], Jan Petykiewicz[2], Xavier Serey[1], Rhett Stucki[1], Lieven Verslegers[2], Jiahui Wang[1], Phil Watson[1], Ian Williamson[1], Yi-Kuei R. Wu[1]; *[1]Google X, USA; [2]Google LLC, USA.* We present an inverse designed silicon 4-channel CWDM demux with the variability across dies and wafers that shows good DFM (Design for manufacturability).

Tu2G.2 • 14:30
Ultra-Compact Silicon Rings with High Thermal Tuning Efficiency Demonstrated as an 8×400 GHz WDM Filter, Qingzhong Deng[1], Jeroen De Coster[1], Rafal Magdziak[1], Ahmed H. Bayoumi[1], Alaa Elshazly[1], Mehmet Oktay[1], Chiara Marchese[1], Guy Lepage[1], Javad Rahimi Vaskasi[1], Sadhishkumar Balakrishnan[1], Neha Singh[1], Dieter Bode[1], Marko Ersek Filipcic[1], Maumita Chakrabarti[1], Dimitrios Velenis[1], Peter Verheyen[1], Philippe Absil[1], Filippo Ferraro[1], Yoojin Ban[1], Joris Van Campenhout[1]; *[1]IMEC, Belgium.* This paper has renewed the lowest thermal tuning power for silicon rings with FSR≥3.2 THz to 4.34 mW/π. Moreover, an 8×400 GHz WDM filter is demonstrated with channel isolation ≥33.1 dB.

Tu2G.3 • 14:45
A High-Order Lattice Filter With Enhanced Passband and Roll-off for CWDM4 Applications, Min Teng[1], Hao Wu[1], Ning Cheng[1], Xuezhe Zheng[1]; *[1]Innolight Technology, China.* A silicon nitride high order lattice filter with a flat-top response is demonstrated for CWDM4 applications, exhibiting 1 dB insertion loss, a 17.9 nm 1dB bandwidth, and a sharp roll-off of 81% in BW1dB/ BW10dB.

Tu2G.4 • 15:00
Ultra-Narrow-Bandwidth Silicon Photonic Tunable Second-Order CROW Filter With Low Insertion Loss for Carrier-Extracted Self-Coherent (CESC) Detection, Haojie Zhu[1], Yuhao Fang[1], Yiwei Xie[2], William Shieh[1,3]; *[1]Westlake Univ., China; [2]Zhejiang Univ., China; [3]Westlake Inst. for Optoelectronics, China.* We demonstrate a silicon photonic tunable CROW filer with 1.26-GHz 3-dB bandwidth, 4.62-GHz 20-dB bandwidth, 4-dB insertion loss and 60-dB extinction ratio based on a 1-μm width ridge waveguide. Applied in the CESC system, achieving a 168.3 Gb/s transmission rate over 100-km SMF, the performance of this CROW filter is well verified.

Tu2G.5 • 15:15
Broadband Tunable Microwave Photonic Filter Utilizing Equivalent Chirped Sampled Bragg Gratings for Optical Frequency Division., Simeng Zhu[1], Mohanad Al-Rubaiee[1], Bocheng Yuan[1], Yizhe Fan[1], Yiming Sun[1], John Marsh[1], Lianping Hou[1]; *[1]Univeristy of Glasgow, UK.* We demonstrate an integrated dual-band microwave photonic filter using equivalent chirped four-phase-shifted Bragg gratings on an SOI platform. Optical frequency division from 100 GHz to 400 GHz is achieved with tunable microheaters and a mode-locked laser.

Tu2G.6 • 15:30

Dispersion-Engineered Resonator-Based Interleaver Co-Designed with Kerr Comb Source, Robert Parsons[1], Swarnava Sanyal[2], Michael Cullen[1], Yuyang Wang[1], Asher Novick[1], Xingchen Ji[1], Yoshitomo Okawachi[2], Xiang Meng[1], Michal Lipson[1,2], Alexander Gaeta[1,2], Keren Bergman[1]; *[1]Department of Electrical Engineering, Columbia Univ., USA; [2]Department of Applied Physics and Applied Mathematics, Columbia Univ., USA.* We demonstrate interleavers with ~30 dB crosstalk suppression and wide ≥60 nm optical bandwidth, utilizing dispersion-engineered resonators co-designed with normal-GVD Kerr comb sources. This scalable design supports ultra-broadband photonic interconnects.

Tu2G.7 • 15:45

7-Source×6-Mode Micro-Scale Photonic Lantern Multiplexer 3D-Printed on MM VCSEL Array, Yoav Dana[1], Ksenia Shukhin[1], Yehudit Garcia[1], Dan M. Marom[1]; *[1]Hebrew Univ. of Jerusalem, Israel.* We design, fabricate, and characterize a 300µm long 3D-printed photonic lantern mode multiplexer spanning 7×6=42 modes and demonstrate efficient power combining from a dense multimode VCSEL source array.

14:00 -- 16:00
Rooms 213-214
Tu2H • Optical Network Optimization and Routing
Presider: Jiawei Zhang; Beijing Univ. of Posts & Telecom, China

Tu2H.1 • 14:00

Robust Optimization of Filterless Optical Networks with Physical Layer Uncertainties, Mohammad Hosseini[1], Joao Pedro[1], Antonio Napoli[1]; *[1]Infinera GmbH, Germany.* We propose a robust optimization framework for filterless optical network design in the presence of different levels of physical layer uncertainties. We demonstrate the potential benefits of robustly optimized networks compared to traditional margin-based approaches.

Tu2H.2 • 14:15

Demonstration of Multigranular-Routing Layered Network With Impairment-Aware Modulation Format Selection, Hayato Yuasa[2], Takuma Kuno[1], Taisei Sekizuka[1], Yojiro Mori[3,1], Shih-Chun Lin[4], Motoharu Matsuura[5], Suresh Subramaniam[6], Wakako Maeda[7], Shigeyuki Yanagimachi[7], Hiroshi Hasegawa[1]; *[1]Nagoya Univ., Japan; [2]Nagoya Univ., Japan; [3]Toyota Technological Inst., Japan; [4]North Carolina State Univ., USA; [5]Univ. of Electro-communications, Japan; [6]The George Washington Univ., USA; [7]NEC corporation, Japan.* We demonstrate the validity of our multigranular-routing layered network architecture that adopts optical bypass. Network simulations show OXC cost reduction by 17% / 21%, while transmission experiments confirm a transmittable distance increase of 500 km.

Tu2H.3 • 14:30 (Invited)

Optimizing Energy Efficiency in Optical Transport Networks Through Autonomous AI-Assisted Control Operations, Ricardo Martínez[1], Carlos Hernandez-Chulde[1], Ramon Casellas[1], Ricard Vilalta[1], Raul Muñoz[1]; *[1]Centre Tecnològic Telecom de Catalunya, Spain.* This work explores Deep Reinforcement Learning to develop advanced RSMA policies that support autonomous control operations, optimizing the trade-off between network performance and energy efficiency in integrated packet and elastic optical networks.

Tu2H.4 • 15:00
Near-Real-Time Autonomous Multi-Path Flow Routing with Subflow Identification, Hailey Shakespear[1], Natalia Koneva[2], Sima Barzegar[1], Marc Ruiz[1], Alfonso Sánchez-Macián[2], Luis Velasco[1]; *[1]Universitat Politecnica de Catalunya, Spain; [2]Dept. Ing. Telematica, Universidad Carlos III de Madrid, Spain.* A distributed intelligence for autonomous near-real-time flow routing with subflow identification is proposed. Optimal subflow partitioning performed based on the subflow identification and the autonomously decided flow routing policy ensures continuous flow performance.

Tu2H.5 • 15:15
Dynamic Optimization in SDN-Enabled EONs With CV-QKD Coexistence, Carlos Hernandez-Chulde[1], Masab Iqbal[1], Michela Svaluto Moreolo[1], Ricard Vilalta[1], Raul Muñoz[1], Ramon Casellas[1], Ricardo Martínez[1]; *[1]Centre Tecnològic de Telecomunicacions de Catalunya (CTTC), Spain.* This paper presents dynamic spectrum allocation strategies to mitigate noise impact on quantum channels, reduce blocking probability for quantum and classical channels, and optimize spectrum utilization leveraging an SDN architecture for integrating CV-QKD in EONs.

Tu2H.6 • 15:30 (Top-Scored)
TrustOPT: Trusted Online Optimization for Autonomous Driving Optical Networks with Field-Trial Demonstration, Qizhi Qiu[1], Xiaomin Liu[1], Yihao Zhang[1], Lilin Yi[1], Weisheng Hu[1], Qunbi Zhuge[1]; *[1]Shanghai Jiao Tong Univ., China.* We propose a trusted optical power optimization strategy for ADON. Field trial experiments demonstrate reliable optimization while maintaining a 4-dB Q-factor margin. System performance remains above the threshold even with an initial 0.15-dB Q-factor margin.

Tu2H.7 • 15:45
Toward Trusted Optical Communications with Optical Physical Unclonable Functions and Blockchain, Luis Velasco[1], Stella Civelli[2], Pantea Nadimi Goki[3,4], Sima Barzegar[1], Marc Ruiz[1], Luca Poti[4,5]; *[1]Universitat Politecnica de Catalunya, Spain; [2]CNR-IEIIT, Italy; [3]Tecip Inst., Scuola Superiore Sant'Anna, Italy; [4]CNIT, Italy; [5]Universitas Mercatorum, Italy.* Trusted optical communications go beyond encryption and requires also the attestation of the integrity of the optical transponders. We propose optical identification and blockchain for the continuous remote attestation of optical systems with immutable traceability.

16:30 -- 18:30
Room 207
Tu3D • Practical Quantum Networks and Coexistence

Tu3D.1 • 16:30
Coexistence of Entanglement-Based Quantum Channels with DWDM Classical Channels Over Hollow Core Fiber in a Three Node Quantum Communication Network, Obada Alia[1], Marcus J. Clark[1], Sima Bahrani[1], Rui Wang[1], Gregory T. Jasion[2], Hesham Sakr[2], John R. Hayes[2], Periklis Petropoulos[2], Francesco Poletti[2], George T. Kanellos[1], John G. Rarity[1], Reza Nejabati[1], Siddarth K. Joshi[1], Dimitra Simeonidou[1]; *[1]Univ. of Bristol, UK; [2]Optoelectronics*

Research Centre, Univ. of Southampton, UK. We experimentally demonstrated quantum key distribution with average quantum bit error rate of 5.28% utilising entanglement-based quantum channels coexisting with 800Gbps classical traffic all operating in the C-band over 11.5km hollow core fiber in a three-node quantum network.

Tu3D.2 • 16:45
Coexistence Transmission of 33.4-Tb/s O-Band Coherent Classical Channels and a C-Band QKD Channel Over 80 km, Shohei Beppu[1], Daniel J. Elson[1], Shinya Murai[2], Akira Murakami[2], Hiroki Yamamuro[1], Yuta Wakayama[1], Noboru Yoshikane[1], Takehiro Tsuritani[1]; *[1]KDDI Research Inc., Japan; [2]Toshiba Digital Solutions Corp., Japan.* A record data transmission capacity of 33.4 Tb/s over 80 km is achieved in quantum-classical channel coexistence transmission by multiplexing 13.1-THz O-band coherent classical channels with a C-band DV-QKD channel.

Tu3D.3 • 17:00 (Tutorial)
Recent Progress in Practical Quantum Key Distribution, Davide Bacco[1]; *[1]Univ. of Florence, Italy.* In this tutorial I will discuss recent progress on quantum key distribution systems, from advanced modulation formats, to photonic integrated circuits. Additionally, I will showcase recent implementations of practical use cases within the European context.

Tu3D.4 • 18:00
Coexistence of Commercial CV-QKD in FOADM-Based Metro Networks with Full or Partial C-Band Utilization, Antonio Melgar[1], Masab Iqbal[2], Michela Svaluto Moreolo[2], Jose Manuel Rivas Moscoso[1], Jeison Tabares[3], Pablo Armingol[1], Borja Villanueva[3], Sebastian Etcheverry[3], Jesús Folgueira[1]; *[1]Telefónica CTIO, Spain; [2]CTTC/CERCA, Spain; [3]LuxQuanta Technologies S.L., Spain.* We assess the feasibility of deploying a commercial CV-QKD system over a 20 km amplified FOADM-based metro link, evaluating coexistence in both full and partial C-Band occupancy. Frequency allocation guidelines optimizing the performance of CV-QKD and classical channels are provided based on experiments and simulations.

Tu3D.5 • 18:15
Challenges and Solutions in Adapting Classical Infrastructure for Quantum Networks, Anouar Rahmouni[1], Ya-Shian Li-Baboud[1], Yicheng Shi[1], Pranish Shrestha[1], Mheni Merzouki[1], Abdella Battou[1], Oliver Slattery[1], Thomas Gerrits[1]; *[1]NIST, USA.* Quantum network protocols require qubit transmission at useful rates and fidelity, ideally leveraging existing optical fiber infrastructure. This work addresses challenges in adapting classical systems for qubits and proposes necessary upgrades for quantum network development.

16:30 -- 18:30
Room 208
Tu3E • Doped Fiber Lasers and Amplifiers II
Presider: Peter Dragic; Univ of Illinois at Urbana-Champaign, USA

Tu3E.1 • 16:30 (Invited)
Advances in Doped Fiber Amplifiers for Wideband Optical Communication Systems, Jayanta K. Sahu[1], Ziwei Zhai[1]; *[1]ORC, Univ. of Southampton, UK.* We present our recent work on wideband bismuth-doped and erbium-doped fiber amplifiers in various silica-

based glass hosts, spanning the O+E+S-bands and extended L-band, respectively, with the latest results on the amplifier gain, noise-figure, and bandwidth.

Tu3E.2 • 17:00
Study on Pump and Signal-Induced Polarization Dependent Gain in Bismuth-Doped Fiber for E/S Band Amplification, Lixian Wang[1], Aria Moaven[1], Sara Shafiei Alavijeh[1], Zhiping Jiang[1]; *[1]Huawei Technologies Canada, Canada.* Signal and pump-induced polarization dependent gains (PDGs) in germanosilicate bismuth-dope fiber are examined separately. PDG's wavelength dependency, its relation to the gain compression as well as the influence of the BAC subtypes are discussed.

Tu3E.3 • 17:15 (Top-Scored)
Dual-Stage E+S-Band Bismuth-Doped Fiber Amplifier with Over 100 nm Bandwidth and sub-5 dB Noise Figure, Shabnam Noor[1], Aleksandr Donodin[1], Sergei K. Turitsyn[1], Wladek Forysiak[1]; *[1]Aston Inst. of Photonic Technologies, Aston Univ., UK.* We present the first experimental demonstration of a dual-stage E+S-band bismuth-doped fiber amplifier with 104 nm maximum bandwidth (1384-1488nm), 47 dB maximum gain and 3.7 dB minimum noise figure.

Tu3E.4 • 17:30 (Invited)
Nonlinear Dynamics of Thulium-Doped Fiber Lasers, Shutao Xu[1], Timothy Lim[1], Michelle Y. Sander[1]; *[1]Boston Univ., USA.* Ultrafast thulium-doped fiber lasers that can generate different types of dissipative solitons in the same cavity are presented together with their unique transition and nonlinear dynamics, including soliton molecule formation.

Tu3E.5 • 18:00
Variable Temperature and Pump Power Semi-Analytical Gain Model for GFF-Embedded Single-Stage EDFAs, Andrea D Amico[1], Fatih Yaman[1], Daisuke Katsukura[2], Shinsuke Fujisawa[2], Eduardo Mateo[2], Takanori Inoue[2], Yoshihisa Inada[2]; *[1]NEC Laboratories America Inc., USA; [2]Submarine Network Division, NEC Corporation, Japan.* A simple and accurate semi-analytical model for predicting the gain of a single-stage erbium-doped fiber amplifier embedded with an unknown gain flattening filter is proposed for precise system equalization that is crucial for submarine systems.

Tu3E.6 • 18:15
Fabrication of Low Loss Telecom-Band Nanofiber Cavity with Deuterium-Oxygen Flame, Seitaro Horikawa[1,2], Masafumi Shimasaki[1], Hideki Konishi[1], Shinichi Sunami[1,3], Ryotaro Inoue[1], Takao Aoki[1,2], Akihisa Goban[1], Shinya Kato[1]; *[1]Nanofiber Quantum Technologies, Inc. (NanoQT), Japan; [2]Depertment of Applied Physics, Waseda Univ., Japan; [3]Clarendon Laboratory, Univ. of Oxford, UK.* We present the fabrication of a nanofiber cavity designed for an optical transition of Ytterbium in the telecom-band. By utilizing Deuterium-Oxygen flame, we significantly reduce Si-OH bond absorption, achieving a single-pass transmission rate of 99.6%.

16:30 -- 18:30
Room 215
Tu3I • Advanced Transmission Technologies
Presider: Dirk Van Den Borne; Juniper Networks Inc., Germany

Tu3I.1 • 16:30 (Invited)
Reliable Deployment and Operation of 400ZR Pluggable Optics for DCI at Hyperscale, Yawei Yin[1], Chuan Qin[1], Binbin Guan[1], Yishu Zhou[1], Rujia Zou[1], Avinash Pathak[1], Jeetesh Jain[1], Jamie Gaudette[1]; [1]*Microsoft Corp., USA.* The deployment and operation of optical 400ZR pluggable modules at hyperscale are reviewed in this paper. Our record shows that with standardized deployment and operation practices and proper monitoring, we can achieve reliable and high speed deployment as well as stable operation with low module failure rate and link flap/error rate in our cloud data center interconnect network.

Tu3I.2 • 17:00
800G WDM Transmission With 140-GBaud PCS-16QAM Transceiver Prototype and 150-GHz Channel Spacing on 2000-km SSMF With EDFA Only, Erwan Pincemin[1], Naveena Genay[1], Bertrand Le Guyader[1], Jin Wang[2]; [1]*Orange Innovation, France;* [2]*Huawei, China.* We report here a coherent 800G WDM transmission with 140-GBaud PCS DP-16QAM transceiver prototype and 150-GHz channel spacing on 2000-km (20x100-km) of SSMF with EDFA only. This is obtained thanks to an excellent ~21.2-dB ROSNR (in 0.1-nm) measured in back-to-back at the FEC threshold.

Tu3I.3 • 17:15
Hollow-Core Fiber Specifications for Competitive Deployment in Regio/Long-Haul Optical Networks., Bruno V. Araujo Correia[1], Joao Pedro[1,2], Nelson Costa[1]; [1]*Infinera, Unipessoal Lda, Portugal;* [2]*Instituto de Telecomunicações, Instituto Superior Técnico, Portugal.* Steady progress in hollow-core fiber (HCF) technology raises the prospect of wide-scale deployments. This paper characterizes the combination of fiber and optical amplifier specifications for HCF to achieve performance parity with commercial SSMF and PSCF.

Tu3I.4 • 17:30
Improving QoT Estimation Accuracy in Production Networks: A Data-Driven Approach to Address OLS Imperfections, Zhai Z. Qun[1], Liang Dou[1], Sai Chen[1], Huan Zhang[1], Yan He[2], Alan Pak Tao Lau[2], Yuanchao Su[1]; [1]*Alibaba, China;* [2]*The Hong Kong Polytechnic, Univ., China.* We explore QoT estimation across three phases of optical network planning. Utilizing deployed OCHs, we demonstrate that a data-driven approach enhances estimation precision by accounting OLS imperfections in the *Service Expansion Phase.*

Tu3I.5 • 17:45 (Invited)
Advanced Multi-Span Signal Monitoring Using Digital Coherent Receivers, Takeshi Hoshida[1], Ryu Shinzaki[1], Motohiko Eto[1], Kazuyuki Tajima[1], Kyosuke Sone[1], Setsuo Yoshida[1], Naoya Okada[1], Ichiro Yokokura[1], Atsushi Kanai[1], Junichi Sugiyama[1], Shoichiro Oda[1], Hisao Nakashima[1]; [1]*Fujitsu Ltd, Japan.* We present end-to-end monitoring techniques for wavelength paths that visualize optical parameters such as power, polarization-dependent loss and polarization fluctuation as functions of distance in multi-span transmission links with advanced signal processing in optical transceivers.

Tu3I.6 • 18:15

Multi-Span OSNR and GSNR Prediction Using Cascaded Learning, Zehao Wang[1,2], Giacomo Borraccini[2], Andrea D Amico[2], Yue-Kai Huang[2], Ting Wang[2], Daniel C. Kilper[4], Koji Asahi[3], Tingjun Chen[1]; *[1]Duke Univeristy, USA; [2]NEC Laboratories America, USA; [3]NEC Corporation, Japan; [4]CONNECT Centre, Ireland.* We implement a cascaded learning framework leveraging three different EDFA and fiber component models for OSNR and GSNR prediction, achieving MAEs of 0.20 and 0.14 dB over a 5-span network under dynamic channel loading.

16:30 -- 18:30
Room 301
Tu3J • Integarted Micro-Ring and Micro-Disk Modulators
Presider: Joyce Poon; Lightmatter, Canada

Tu3J.1 • 16:30

256-Gbps Whispering-Gallery Mode Enhanced Silicon Microring Modulator with a Free Spectral Range of 4.5 THz, Kaihang Lu[1], Hao Chen[1], Wu Zhou[1], Hon Ki Tsang[2], Yeyu Tong[1]; *[1]Hong Kong Univ of Sci & Tech (Guangzhou), China; [2]The Chinese Univ. of Hong Kong, Hong Kong.* We demonstrated a silicon microring modulator with an uncorrupted free spectral range of 4.5 THz. A single-lane data rate of 256 Gbps utilizing PAM-4 can be achieved, highlighting its potential for advancing high-bandwidth wavelength-division multiplexing communications.

Tu3J.2 • 16:45

180Gb/s High-Speed Electroabsorption Modulator (EAM) Integrated with DFB Laser Using Traveling-Wave Electrode for Bandwidth Enhancment, Yi-jen Chiu[1], Rih-You Chen[1], Bo-Hong Chen[1,2]; *[1]National Sun Yat-Sen Univ., Taiwan; [2]LandMark Optoelectronics, Taiwan.* We demonstrated a BH high-speed electroabsorption modulation laser (EML) with traveling wave electrode for decreasing microwave reflection, leading to bandwidth improvement. >20dB extinction ratio, >65GHz bandwidth, 110Gb/s NRZ and 180Gb/s PAM-4 eye diagrams was achieved.

Tu3J.3 • 17:00 (Invited)

Silicon Photonics Platform and Optical Memory, Yuan Yuan[1,2], Stanley Cheung[1,3], Yiwei Peng[1], Di Liang[4], Bassem Tossoun[1], Geza Kurczveil[1], Yingtao Hu[1], Wayne Sorin[1], Zhihong Huang[1], Xian Xiao[1], Antoine Descos[1], Sean Hooten[1], Jongseo Baek[1], Marco Fiorentino[1], Raymond G. Beausoleil[1]; *[1]Hewlett Packard Labs, Hewlett Packard Enterprise, USA; [2]Department of Electrical and Computer Engineering, Northeastern Univ., USA; [3]Department of Electrical & Computer Engineering, North Carolina State Univ., USA; [4]Electrical Engineering and Computer Science Department, Univ. of Michigan, USA.* We introduce a silicon photonics platform that maximally harnesses the potential of both the heterogeneous III-V material system and silicon, supporting a diverse range of high-performance optoelectronic devices, including lasers, optical amplifiers, modulators, photodetectors, and emerging non-volatile optical memories. This platform delivers a CMOS-compatible, wafer-level integration solution, offering enhanced functionality and expanded application potential.

Tu3J.4 • 17:30

Micro-Transfer Printed Membrane Laser and Electro-Absorption Modulator on Si Waveguide Integrated With Polymer Spot-Size Converter, Yoshiho Maeda[1,2], Tatsurou Hiraki[1,2], Takuma Aihara[1,2], Hiroya Homma[2], Takuro Fujii[1,2], Koji Takeda[1,2], Tomonari Sato[1,2], Yasutomo Ota[3,4], Satoshi Iwamoto[5], Yasuhiko Arakawa[4], Shinji Matsuo[2]; *[1]NTT Device Innovation Center, NTT Corporation, Japan; [2]NTT Device Technology Labs, NTT Corporation, Japan; [3]Department of Applied Physics and Physico-Informatics, Keio Univ., Japan; [4]Inst. for Nano Quantum Information Electronics, The Univ. of Tokyo, Japan; [5]Inst. of Industrial Science, The Univ. of Tokyo, Japan.* We demonstrate micro-transfer printing for integrating multiple III-V devices with different bandgaps on Si platforms. Membrane DFB lasers and EA modulators are fabricated on Si waveguides with polymer-based spot-size converters, modulating at 128 Gbit/s-NRZ signal.

Tu3J.5 • 17:45

Record 4 x 106 Gbps Transmission from a Directly Modulated Laser Array Using Photon-Photon Resonance, Gayatri Vasudevan Rajeswari[1], Martin Moehrle[1], Ariane Sigmund[1], Martin Schell[1]; *[1]Fraunhofer HHI, Germany.* We present the first non-membrane four channel DML array, with each channel capable of transmitting at 106 Gbps PAM4 and 72 Gbps NRZ in the O-band. The DMLs show a modulation bandwidth > 52 GHz by utilizing the PPR effect.

Tu3J.6 • 18:00

Monolithically Integrated Microring Transmitter and Receiver for High-Density 3D Co-Packaged Optics, Reza Baghdadi[1], Alexander Sludds[1], Carlos Dorta-Quinones[1], Shashank Gupta[1], Pietro Ciccarella[1], Bryce Gardiner[1], Joyce K. S. Poon[1], Darius Bunandar[1], Nicholas Harris[1]; *[1]Lightmatter, USA.* We report silicon microring transmitter and receiver with monolithically integrated driver and analog front end at up to 64Gbps NRZ. The total die area of the circuits is 0.006 mm^2, >10x smaller than prior reports.

Tu3J.7 • 18:15 (Top-Scored)

Compact WDM Coherent Transmitter Using Silicon Micro-Ring Modulators, Shuntaro Maeda[1], Takahiro Suganuma[1], Go Soma[1], Keita Hirashima[1], Takuya Okimoto[1], Yoshiaki Nakano[1], Takuo Tanemura[1]; *[1]The Univ. of Tokyo, Japan.* We present a compact silicon photonic WDM coherent transmitter chip, comprising 16 micro-ring modulators (MRMs). Transmission of 112-Gbps WDM coherent signal (28-Gbaud QPSK × 2λ) is demonstrated through wavelength-and-IQ-selective modulation provided by each MRM.

16:30 -- 18:30
Room 304
Tu3K • Modelling for Ultra-Wideband Transmission
Presider: Gabriel Charlet; Huawei Technologies France, France

Tu3K.1 • 16:30

Efficient Numerical Solver for Estimating Power Profiles in UWB Transmission Considering Signal and Pump Depletion, Inwoong Kim[1], Olga Vassilieva[1], Paparao Palacharla[1]; *[1]Fujitsu Network Communications Inc, USA.* We propose an efficient and accurate numerical solver for estimating power profiles in UWB transmission systems with arbitrary bidirectional signal and Raman pump configurations. A significant speedup and estimation error below 1 % is achieved.

Tu3K.2 • 16:45 (Invited)
Recent Advances in Real-Time Models for Multiband Transmission Systems, Pierluigi Poggiolini[1], Yanchao Jiang[1]; [1]*Politecnico di Torino, Italy.* Recent advances in real-time multiband system models have enabled detailed optimization of launch power spectra, Raman amplification and other key system parameters, achieving improved throughput and GSNR uniformity across diverse operating conditions.

Tu3K.3 • 17:15
Signal and Raman Pump Launch Power Optimization in a C+L+S+E System Using Fast Power Profile Estimation, Jad Sarkis[1], Yanchao Jiang[1], Stefano Piciaccia[2], Fabrizio Forghieri[2], Pierluigi Poggiolini[1]; [1]*Politecnico di Torino, Italy;* [2]*CISCO Photonics Italy srl, Italy.* We speed up signal and pump spatial power profile calculation with ISRS and backward Raman amplification, demonstrating a 40x computational efficiency increase in the optimization of a 1000km C+L+S+E link by means of a GN/EGN model closed-form.

Tu3K.4 • 17:30
Maximizing Throughput by Band-Wise Bidirectional SCLU Transmission with Lumped Amplification, Olga Vassilieva[1], Inwoong Kim[1], Hiroyuki Irie[2], Hisao Nakashima[2], Takeshi Hoshida[2], Paparao Palacharla[1]; [1]*Fujitsu Network Communications Inc, USA;* [2]*Fujitsu Limited, Japan.* We propose band-wise bidirectional SCLU transmission. By counterpropagating S- and U-band signals and optimizing launch powers, we achieve maximum throughput that is 1.5% lower compared to aggregate throughput of individual band transmission.

Tu3K.5 • 17:45 (Invited)
How Wide Can You Go? the Challenges and Breakthroughs in Designing Ultrawideband Optical Fibre Communications Systems and Networks, Polina Bayvel[1]; [1]*Univ. College London, UK.* This paper will review the challenges in extending the usable optical fibre bandwidth towards 60 THz and beyond, progress in ultrawideband transmission modelling and experiments, at different distance scales, and potential impact on optical network throughputs.

16:30 -- 18:30
Rooms 201-202
Tu3A • Hybrid Satellite/Terrestrial Networks: Where Does the Fiber End, and Satellite Take Over? II
Presider: Ting Wang; NEC Laboratories America Inc., USA and Jim Zou; Adtran, Germany

Tu3A.1 • 16:30 (Invited)
Title to be Announced, Katarzyna Balakier[1]; [1]*European Space Agency, UK.* Abstract not available.

Tu3A.2 • 16:50 (Invited)
NTT's Recent Activities Related to LEO Satellite Networks: Use-Cases and Network Technology, Katsuaki Higashimori[1]; [1]*NTT Corporation, Japan.* This presentation introduces NTT's recent activities toward future satellite optical communications. Some services using remote sensing data and IoT control, and the research for flexible topology control for complex

LEO satellite optical networks are presented.

Tu3A.3 • 17:10 (Invited)
Title to be Announced, Mustafa Cardakli[1]; [1]*Amazon, USA.* Abstract not available.

16:30 -- 18:30
Rooms 205-206
Tu3C • Novel Subsystem Concepts
Presider: Dario Pilori; Politecnico di Torino, Italy

Tu3C.1 • 16:30
Performance Limits of Spectro-Temporal Unitary Transformations for Coherent Modulation, Callum Deakin[1], Vivian Xi Chen[1]; [1]*Nokia Bell Labs, USA.* We analyse the performance limits of coherent modulation based on lossless unitary transformations, demonstrating that they can achieve high (>30 dB) SINAD and outperform conventional IQ modulators at equivalent transmitter laser powers.

Tu3C.2 • 16:45
Numerical Investigation of Modulo-Based Analog-to-Digital Conversion for PCS-64-QAM, Zhiwei Liang[1], Sebastian Randel[1], Sander Wahls[1]; [1]*Karlsruhe Inst. of Technology, Germany.* Recently, a novel signal processing method based on modulo operation has been proposed to avoid saturation and reduce quantization power consumption of ADC. We evaluate its suitability for a SSMF transmission system using PCS-64-QAM format.

Tu3C.3 • 17:00 (Invited)
Integrated Sensing and Communications for Metropolitan Environments, Yaxi Yan[1], Zhang Jingming[1], Yinghuan Li[1], Liwang LU[1], Jingchuan Wang[1], Kausthubh Chandramouli[1], Chao Lu[1], Alan Pak Tao Lau[1]; [1]*The Hong Kong Polytechnic Univ., Hong Kong.* We review our recent works on integrated sensing and communications and highlight smart city applications in metropolitan environments through deployed fibers across Hong Kong.

Tu3C.4 • 17:30 (Top-Scored)
Phase-Coherent DSP Over Space and Wavelength Using Synchronized Optical Frequency Combs for Short-Reach Networks, Daniele Orsuti[2,1], Benjamin J. Puttnam[2], Ruben S. Luis[2], Manuel Neves[3], Divya A. Shaji[4], Budsara Boriboon[2], Jun Sakaguchi[2], Cristian Antonelli[4], Paulo Monteiro[3], Fernando Guiomar[3], Luca Palmieri[1], Hideaki Furukawa[2]; [1]*Universita degli Studi di Padova, Italy;* [2]*Photonic Network System Lab, NICT, Japan;* [3]*Instituto de Telecomunicações, Univ. of Aveiro, Portugal;* [4]*Physical and Chemical Sciences, Univ. of L'Aquila, Italy.* We demonstrate shared DSP over space and wavelength for short-reach networks using seed-synchronized optical frequency combs. Using just 6 reference channels, carrier phase recovery of 3(cores) x 158 x 24.5-GBaud PDM-64QAM C-band channels is demonstrated with >40-Tb/s/core over 14.3-km MCF without dispersion or frequency-offset compensation.

Tu3C.5 • 17:45 (Top-Scored)
Real-Time Transmission of Coherent Pluggable-Based Super-Channels Over 1500-km with 6.06-b/s/Hz Spectral Efficiency Using Digital Subcarriers, Amir Rashidinejad[1], Atul

Mathur[2], Thomas Gerard[2], Jacqueline Sime[3], Sezer Erkilinc[4], Thomas Duthel[3], Aditya Kakkar[1], Jonathan Buset[2], Chris R. Fludger[3], Robert Maher[2]; *[1]Infinera Inc. Canada, Canada; [2]Infinera Corporation USA, USA; [3]Infinera GmbH, Germany; [4]Infinera Ltd. UK, UK.* We successfully demonstrate real-time post-FEC error-free transmission of tightly-packed super-channels over 1500-km using 400G coherent pluggables. A record spectral efficiency of 6.06-b/s/Hz is achieved by leveraging digital subcarriers.

Tu3C.6 • 18:00
Experimental Validation of Partitioned MIMO Equalizer With Low-Resolution Interface for Mitigation of Mode-Group Coupling in SDM Transmission Over 3-Mode Fiber, Nicolas Braig-Christophersen[1], Aymeric Arnould[1], Robert Elschner[1], Carsten Schmidt-Langhorst[1], Ruben S. Luis[2], Pamir Oezsuna[1], Kallyan Das[1], Juan Lautaro Moreno Morrone[1], Robert Emmerich[1], Kazuhiko Aikawa[3], Hideaki Furukawa[3], Georg Rademacher[4,1], Johannes K. Fischer[1], Colja Schubert[1], Ronald Freund[1,5]; *[1]Fraunhofer HHI, Germany; [2]NICT, Japan; [3]Fujikura Ltd, Japan; [4]Inst. of Electrical and Optical Communications Univ. of Stuttgart, Germany; [5]Technical Univ. of Berlin, Germany.* We propose partitioned MIMO equalization with low-resolution, quantized interface between sub-equalizers for few-mode fiber systems. Experiments up to DP-64QAM yield OSNR-penalties <0.2 dB for 2…4-bit interface resolutions compared to high-resolution MIMO, depending on the cardinality.

Tu3C.7 • 18:15
6-Dimensional Coherent Receiver with IQ Modulated LO, Yixiao Zhu[1], Xiansong Fang[2], Xiang Cai[2], Yimin Hu[1], Xian Zhou[3], Weisheng Hu[1], Fan Zhang[2]; *[1]Shanghai Jiao Tong Univ., China; [2]Peking Univ., China; [3]Univ. of Science and Technology Beijing, China.* We propose a 6-dimensional coherent receiver with IQ-modulated remote LO. We experimentally demonstrate single-channel 2.5-Tb/s line rate PS-256-QAM signal transmission over 25-km SSMF within 67.6-GHz electrical bandwidth, achieving net electrical spectral efficiency of 29.1 b/s/Hz.

16:30 -- 18:30
Rooms 209-210
Tu3F • Optical AI Evaluation and Sensing
Presider: Tomoyuki Kato; Fujitsu Ltd, Japan

Tu3F.1 • 16:30
Programmable in-Memory Photonic Computing With VCSEL-Controlled PCMs, Yi Guo[1], Xiaonan An[1], Hongxiang Guo[1], Cen Liao[2], Linkun Zhong[4], Bing Song[2], Jian Wu[1], Yanjun Liu[4], Wenjia Zhang[3]; *[1]Beijing Univ. of Posts and Telecommunications, China; [2]National Univ. of Defense Technology, China; [3]Shanghai Jiao Tong Univ., China; [4]Southern Univ. of Science and Technology, China.* We proposed a programmable in-memory photonic computing scheme, where large PCMs array was controlled by using spatial light from the VCSELs array. Experiment of edge detection verified its feasibility.

Tu3F.2 • 16:45
Scalable Photonic Complex-Valued Dot Product Engine, Hao Sun[1], Xinyi Zhu[1], Jose Azaña[1], Benjamin Crockett[1]; *[1]INRS-EMT, Canada.* We propose a photonic dot-product engine for large complex vectors (> 200 elements) using in-fiber temporal coherent interference, enabling fast computation speed (~ 364 GOPS/λ), and demonstrate its application for efficient

parallel image processing.

Tu3F.3 • 17:00
Hardware-in-the-Loop Training of a 4f Optical Correlator with Logarithmic Complexity Reduction for CNNs, Lorenzo Pes[1], Maryam Dehbashizadeh Chehreghan[1], Rick Luiken[1], Sander Stuijk[1], Ripalta Stabile[1], Federico Corradi[1]; [1]*Eindhoven Univ. of Technology, Netherlands.* This work evaluates a forward-only learning algorithm on the MNIST dataset with hardware-in-the-loop training of a 4f optical correlator, achieving 87.6 % accuracy with $O(n^2)$ complexity, compared to backpropagation, which achieves 88.8 % accuracy with $O(n^2 \log(n))$ complexity.

Tu3F.4 • 17:15
Efficient Photonic Convolution Accelerator with Kernels Loaded by Analog Signal, Wenting Jiao[1], Lin Wang[1], Yang Gao[1], Lei Zhang[1], Kun Yin[1], Tangjie Mu[1], Hui Yu[1]; [1]*Zhejiang LAB, China.* We present a photonic convolution accelerator based on modulator arrays on lithium niobate platform, which innovatively utilizes analog signals to load convolution kernels, allowing for significant increases in computational efficiency and integration level.

Tu3F.5 • 17:30
Integration of Distributed Sensing Into Optical Coherent Networks Through Non-Orthogonal Multiple Access, Jingchuan Wang[1], Liwang LU[1], Junwei Zhang[2], Alan Pak Tao Lau[1], Chao Lu[1]; [1]*The Hong Kong Polytechnic Univ., Hong Kong;* [2]*Sun Yat-sen Univ., China.* We introduce NOMA into the integrated distributed sensing and coherent communications. Using the same transmitter, high resolution and sensitive vibration sensing can be achieved over 10-km 60-GBaud 16-QAM transmission with negligible penalty.

Tu3F.6 • 17:45
Field-Trial of Real-Time Pulse-Based DAS and 400G Coherent DWDM Coexistence, Giuseppe Rizzelli Martella[2,1], Marco Fasano[3], Mariacristina Casasco[1], Andrea Madaschi[3], Ann Margareth Rosa Brusin[1], Paola Parolari[3], Roberto Gaudino[1], Pierpaolo Boffi[3]; [1]*Politecnico di Torino, Italy;* [2]*Photonext Center, Italy;* [3]*Politecnico di Milano, Italy.* We experimentally investigate on the coexistence over field-deployed metro fibers between pulse-based Distributed Acoustic Sensing (DAS) and 400G per wavelength coherent transmission on a 100GHz DWDM grid using commercially available instruments.

Tu3F.7 • 18:00 (Invited)
Novel Fiber Micro- and Nanostructures for Ultrasensitive Sensors and Photonic Devices, Yuliya Semenova[1]; [1]*Technological Univ. Dublin, Ireland.* We propose and experimentally investigate new approaches to tuning fiber-based microresonators and explore their applications in the sensing of microfluidic flows, micro displacement, and 2D force measurement.

16:30 -- 18:30
Rooms 211-212
Tu3G • Optical Interconnect Technologies
Presider: Janet Chen; NVIDIA Corporation, USA

Tu3G.1 • 16:30 (Invited)
TSMC in the Silicon Photonics Era - an Electrical Perspective, Mikael Sahrling[1], Shenggao Li[1], Frank Lee[1], Stefan Rush[1]; *[1]TSMC Technology Inc., USA.* TSMC is actively pursuing a Photonics Foundry Service to meet increased customer requests. The COUPE 3D packaging technology is a key part of this strategy since it enables a Photonics Die to be co-packaged with an Electric Die greatly reducing the interconnect signal integrity penalty between the two dies. This paper will present some of the work-in-progress to enable this breakthrough technology and highlight some aspects of the interconnect benefits between the two dies.

Tu3G.2 • 17:00
Intel 300mm Heterogeneously Integrated Silicon Photonics Technology: a Review of Recent Progress, Kejia Li[1], Richard Jones[1], Pegah Seddighian[1], Cesar Bartolo Perez[1], Leimeng Zhuang[1], Kadhair Al-hemyari[1], Naim Ahmed[1], Zhi Li[1], Hamed Shams-Mousavi[1], Giovanni Gilardi[1], Jeffrey Driscoll[1], Pierre Doussiere[1], Mahbub Satter[1], Jin Huang[1], Ahmadreza Farsaei[1], Aravind Krishnan[1], Karthik Narayanan[1], Felipe Vallini[1], Faraz Monifi[1], Tiehui Su[1], Hari Mahalingam[1], Boris Vulovic[1], David Mathine[1], Yuchun Zhou[1], Daniel Zhu[1], Saeed Fathololoumi[1], Wenhua Lin[1], Raghuram Narayan[1], Reece Defrees[2], Adam Bowles[2], Kelly Magruder[2], Harel Frish[2], Razi Dehghannasiri[2], Kiyoung Lee[2], Josh Keener[2], Shane Yerkes[2], Md Golam Faruk[2], Wenrui Wang[2], Himanshu Jasuja[2], George Ghiurcan[2], Mark Eaton[2], Paul Martin[2], Andrew Devine[2], Randal Appleton[2], Thang Hoang[1], Christian Malouin[1]; *[1]Integrated Photonics Solution, Intel Corporation, USA; [2]Silicon Photonics Development and Manufacturing, Intel Corporation, USA.* We summarize the recent advancements on Intel's heterogeneously integrated silicon photonics platform designed to enable wide-ranging applications addressing the continued expansion of datacenter connectivity.

Tu3G.3 • 17:15 (Invited)
High Speed Optical Interconnect Technologies for AI/ML Applications, Hideyuki Nasu[1]; *[1]Furukawa Electric Corp., Furukawa Electric Corp., Japan.* This paper introduces VCSEL-based ultra-compact optical transceivers under development in the NICT B5G BRIGHTEN project. A testing station employing an electrical pluggable interface is designed to evaluate a 100-Gb/s PAM4 x 16-channel SM VCSEL-based transceiver.

Tu3G.4 • 17:45
Simplified Coherent Transceiver Based on DFB Lasers and TFLN Chip for the Next Generation Coherent PON, Zifeng Chen[1], Xiangyang Dai[2], Can Liu[2], Yiming Zhang[1], Quanan Chen[2], Chun Jiang[2], Qiaoyin Lu[1], Weihua Guo[1,2]; *[1]Huahzhong Univ. of Science and Tecl, China; [2]Ori-Chip Optoelectronics Technology Co. Ltd., China.* A high-performance compact coherent-transceiver is demonstrated based on the monolithic TFLN chip integrated with modulator, wavelength-locker and BPDs. The LO and upstream DFB lasers realize a (30nm) ±85MHz frequency difference stability with the downstream laser.

Tu3G.5 • 18:00 (Invited)
Optical Interconnects for AI Computing Applications, Chongjin Xie[1]; [1]*PhotonicX AI, Singapore.* Cloud computing has driven the development of optical interconnects in the past decade and AI has becomes a new growth engine. We present past development, new requirements and discuss future challenges of optical interconnect technologies.

16:30 -- 18:30
Rooms 213-214
Tu3H • Programmable and Interferometric Photonics Processors
Presider: Angelina Totovic; Celestial AI, Greece

Tu3H.1 • 16:30 (Tutorial)
Recent Advances in Photonic Neural Networks Using Large-Scale Photonic Integrated Circuits, Guangwei Cong[1]; [1]*AIST, Japan.* Photonic Neural Networks (PNN) offer low-latency and low-power solutions for ML/AI computing. This tutorial presents an overview of PNNs utilizing large-scale photonic integrated circuits, including recent advances, remaining challenges, novel concepts and expectations.

Tu3H.2 • 17:30 (Top-Scored)
Silicon Photonic Neuromorphic Processor for 100-Gbaud/λ Optical Communications and Beyond, Benshan Wang[1], Qiarong Xiao[1], Tengji Xu[1], Li Fan[1], Shaojie Liu[1], Chaoran Huang[1]; [1]*The Chinese Univ. of Hong Kong, Hong Kong.* We demonstrate a programmable silicon photonic neuromorphic processor for real-time, all-optical distortion compensation of up to 100-Gbaud/λ PAM4 and OOK signals transmitted over 5 km of SMF at C-band, with latency and power consumption orders of magnitude lower than those of DSP chips.

Tu3H.3 • 17:45
Large-Scale Calibration-Free Mach–Zehnder Networks, Lijia Song[1], Xiaomin Jiao[1], Shihan Hong[1], Jin Xie[1], Huan Li[1], Daoxin Dai[1]; [1]*Zhejiang Univ., China.* We propose a calibration-free MZI and demonstrate its large-scale scalability with a 64×64 MZI. This robust methodology for suppressing random phase imbalance can be generalized for any essential phase-sensitive photonic integrated devices.

Wednesday, 02 April
08:00 -- 10:00
Room 207
W1D • Optical Signal Processing

Presider: Adonis Bogris; Univ. of West Attica, Greece

W1D.1 • 08:00

Optical General Matrix Multiplication Using Incoherent Light and Wavelength Multiplexing, Farshid Ashtiani[1], Mohamad Hossein Idjadi[1], Stefano Grillanda[1]; *[1]Nokia Bell Labs, USA.* We demonstrate an optical general matrix multiplication using incoherent light source and wavelength multiplexing to multiply two two-dimensional matrices with positive and negative elements and provide parallel readout of the output matrix, without hardware or time multiplexing.

W1D.2 • 08:15

Multitasking Parallel Chip-Scale Programmable Silicon Photonic Processor, Zihang Yang[1,2], Yunlong Li[1,2], Huajie Wan[1,2], Tiange Wu[1,2], Shuang Zheng[1,2], Minming Zhang[1,2]; *[1]School of Optical and Electronic Information, Huazhong uni of Science and Technology, China; [2]National Engineering Research Center for Next Generation Internet Access System, China.* We propose and fabricate a multitasking parallel chip-scale programmable silicon photonic processor, which is implemented by a WDM-compatible two-dimensional photonic waveguide mesh. Different wavelength-dependent topologies and functionalities are experimentally demonstrated by programming the mesh structure.

W1D.3 • 08:30 (Invited)

Light-Sound Interactions for Optical Computing and Quantum Applications, Birgit Stiller[1,2]; *[1]Max-Planck-Inst Physik des Lichts, Germany; [2]Inst. of Photonics, Leibniz Univ. Hannover, 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.

W1D.4 • 09:00

Optoelectronic Ising Machine-Based Maximum Likelihood MIMO Detection for Enhanced SDM Fiber-Optic Transmission, Yibin Wan[1], Zhenhua Li[1], Zihao Chen[1], Zhixian Zhou[1], Jie Liu[1], Siyuan Yu[1]; *[1]Sun Yat-sen Univ., China.* An optoelectronic Ising machine-based maximum likelihood MIMO detection is proposed and experimentally demonstrated in SDM fiber-optic communication systems, achieving a 16.6% net rate improvement than conventional MIMO DSP with tolerant iteration time and energy consumption.

W1D.5 • 09:15

Ultrafast All-Optical Matrix-Vector Multiplication Based on Four-Wave Mixing, Hao Liu[1], Kostas Sozos[2], Stavros Deligiannidis[2], Suttikarn Wantee[1], Charis Mesaritakis[3], Kyle R. Bottrill[1], Adonis Bogris[2], Periklis Petropoulos[1]; *[1]Optoelectronics Research Centre, Univ. of Southampton, SO17 1BJ, Southampton, UK, UK; [2]Dept. of Informatics and Computer Engineering, Univ. of West Attica, Aghiou Spiridonos, 12243, Egaleo, Athens, Greece, Greece; [3]Dept. of Biomedical Engineering, Univ. of West Attica, Aghiou Spiridonos, 12243, Egaleo, Athens, Greece, Greece.* We propose a nonlinear optical approach for ultra-fast, matrix-vector multiplications as required in machine-learning tasks. Optical multiplication is experimentally demonstrated, with less than 0.05% classification accuracy reduction compared to digital results on the MNIST dataset.

W1D.6 • 09:30
Parametric Time-Lens Array with Extended Temporal Aperture Enabling Gap-Free Real-Time Signal Processing, Manuel P. Fernández[2,1], Benjamin Crockett[1], Connor Rowe[1], Laureano Bulus[3], Pablo Costanzo[3], Jose Azaña[1]; *[1]Institut National de la Recherche Scientifique – Énergie Matériaux et Télécommunications (INRS–EMT), Canada; [2]Departamento de Ingeniería en Telecomunicaciones – Instituto Balseiro (UNCuyo-CNEA) & CONICET, Argentina.* We present a parametric time-lens array design that overcomes the trade-off between temporal aperture and repetition rate. By experimentally demonstrating overlapping factors >2, we show its potential for processing broadband signals in a gapless manner.

W1D.7 • 09:45
Dual Privacy Protection for Distributed Fiber Sensing with Disaggregated Inference and Fine-Tuning of Memory-Augmented Networks, Shaobo Han[1], Philip N. Ji[1], Ting Wang[1]; *[1]NEC Laboratories America Inc., USA.* We propose a memory-augmented model architecture with disaggregated computation infrastructure for fiber sensing event recognition. By leveraging geo-distributed computing resources in optical networks, this approach empowers end-users to customize models while ensuring dual privacy protection.

08:00 -- 10:00
Room 208
W1E • Datacenter Wavelength and Mode Multiplexing
Presider: Brandon Buscaino; Ciena Corporation, USA

W1E.1 • 08:00
Order-Preserving Channel Calibration of Kerr Comb–Driven Microresonator-Based DWDM Link, Yuyang Wang[1], Songli Wang[1], Swarnava Sanyal[1], Nathaniel Nauman[1], Robert Parsons[1], James Robinson[1], Maarten Hattink[1,2], Kaylx Jang[1], Asher Novick[1,2], Karl J. McNulty[1], Xiang Meng[1], Michal Lipson[1], Alexander Gaeta[1], Keren Bergman[1]; *[1]Columbia Univ., USA; [2]Xscape Photonics Inc., USA.* We experimentally validate a robust channel calibration algorithm for Kerr comb–driven microresonator-based DWDM links, which preserves the post-tuning resonator spectral order in the presence of resonance aliases within a comb spectrum spanning multiple resonator FSRs.

W1E.2 • 08:15
A 4λ× 50-Gb/s Si Photonic WDM Transmitter with Code-Based Wavelength Calibration and Locking, Daewon Rho[1], Jae-Koo Park[1,2], Yongjin Ji[1], Seung-Jae Yang[1], Woo-Young Choi[1]; *[1]Electric and Electronic Engineering, Yonsei Univ., Korea (the Republic of); [2]Memory Division, DRAM Design Teams, Samsung Electronics, Korea (the Republic of).* This paper presents a 4λ×50-Gb/s Si photonic WDM transmitter with four cascaded micro-ring modulators (MRMs), MRM drivers, and a heater controller. A code-based calibration and locking technique ensures optimal modulation performance through on-chip control.

W1E.3 • 08:30
Inter-Channel FWM Mitigation Using Low-Complexity Digital Pre-Compensation for O-Band IMDD Transmission, Ryosuke Matsumoto[1], Takayuki Kurosu[1], Satoshi Suda[1], Takeru Amano[1]; [1]*National Inst. of Advanced Industria, Japan.* We propose a low-complexity digital pre-compensation scheme to mitigate four-wave mixing in high-baud-rate IMDD systems. Efficient nonlinear compensation was demonstrated in the O-band 10-km WDM transmission using 4-ch.×112-Gb/s PAM-4 channels with a dense 200-GHz spacing.

W1E.4 • 08:45
Demonstration of the WDM Performance of a SiP Polarization Compensator and Modulator Operating at 300 Gbps in the O-Band Over 2 km, Aleksandar Nikic[1], Weijia Li[1], Charles St. Arnault[1], Santiago Bernal[1], Benton Qiu[1], Essam Berikaa[1], Yixiang Hu[1], Zixian Wei[1], Jinsong Zhang[1], Kaibo Zhang[1], Alessandra Bigongiari[2], Fabio Cavaliere[2], Antonio D'Errico[2], Luca Giorgi[2], Stephane Lessard[2], Roberto Sabella[2], Stefano Stracca[2], David Plant[1]; [1]*McGill Univ., Canada;* [2]*Ericsson, Italy.* We characterize the O-band WDM performance of a SiP polarization compensator, and then demonstrate 2 km PAM4 transmission at net 300 Gbps in a remote multi-carrier laser application.

W1E.5 • 09:00 (Top-Scored)
Experimental Demonstration of 2×112Gbit/s PM-PAM4 IM/DD System Using TFLN Polarization Controller, Juntao Cao[1], Haiqiang Wei[1], Changjian Guo[2], Chao Lu[1], Alan Pak Tao Lau[1], Kang Ping Zhong[1]; [1]*The Hong Kong Polytechnic Univ., Hong Kong;* [2]*South China Normal Univ., China.* We experimentally demonstrated 224Gbit/s PM-PAM4 intensity modulation-direct detection (IM/DD) transmission system by using a thin-film lithium niobate (TFLN) polarization controller. A record polarization tracking speed of 2krad/s is achieved.

W1E.6 • 09:15
CD-Mitigation with Spatial Mode Dispersion for 120-GBaud PAM4 Degenerate-Mode-Group MDM Transmission Over 10-km Weakly-Coupled FMF, Yu Yang[2], Gang Qiao[1], Honglin Ji[2], Mingqing Zuo[1], Zhaopeng Xu[2], Tonghui Ji[2], Lulu Liu[2], Shangcheng Wang[2], Baolong Zhu[1], Chengbin Long[1], Jiarui Zhang[1], Lei Shen[3], Jie Luo[3], Weisheng Hu[2], Juhao Li[1,2]; [1]*Peking Univ., China;* [2]*Pengcheng Laboratory, China;* [3]*Yangtze Optical Fiber and Cable Joint Stock Limited Company, China.* We theoretically find the spatial mode dispersion is beneficial to the CD mitigation in degenerate-mode-group (DMG) IMDD transmission and experimentally demonstrate 120-GBaud 4-DMG PAM4 transmission in the C-band over 10-km weakly-coupled FMF using FFE only.

08:00 -- 10:00
Room 215
W1I • Waveguide Devices Based on Nonlinearities
Presider: Yi Sun; OFS Fitel LLC, USA

W1I.1 • 08:00 (Invited)
Flexible and Addressable 2nd Order Nonlinearities in Microresonators, Camille-Sophie Brès[1]; [1]*École Polytechnique Fédérale de Lausanne, Switzerland.* I will discuss how optical and electrical poling of silicon nitride microresonators makes the platform an emerging candidate for $\chi^{(2)}$ integrated photonics, both for light conversion on-chip and linear electro-optic effect . I will

show results of a monolithic modulator and how we address engineering constraints typically faced in ring resonators when aiming for broadband second harmonic generation.

W1I.2 • 08:30
9-THz Wideband PPLN-Based Wavelength Converter for Simultaneous Conversion of C+L-Band WDM Signal to Full S-Band, Shunya Konno[1], Shimpei Shimizu[2], Masashi Abe[1], Takushi Kazama[1,2], Koji Enbutsu[1], Takahiro Kashiwazaki[1], Masanori Nakamura[2], Takayuki Kobayashi[2], Yutaka Miyamoto[2], Takeshi Umeki[1,2]; *[1]NTT Device Technology Laboratories, Japan; [2]NTT Network Innovation Laboratories, Japan.* We developed a wideband PPLN-based wavelength convertor with conversion efficiency of >−2 dB over 9-THz full S-band. We demonstrated 100-km fiber transmission with the full-S-band transmitter combining the wavelength converter and the C+L-band WDM system.

W1I.3 • 08:45
Phase-Preserving Amplitude Regeneration in a Mamyshev Regenerator with Group-Delay-Managed Nonlinear Medium and mid-Stage Optical Phase Conjugation, Cheng Guo[1], Hamed Rabbani[1], Mohammad Awwad[1], Youichi Akasaka[2], Paparao Palacharla[2], Ryuichi Sugizaki[3], Shigehiro Takasaka[3], Michael Vasilyev[1]; *[1]Department of Electrical Engineering, Univ. of Texas at Arlington, USA; [2]Advanced Technology Labs, Fujitsu Network Communications, USA; [3]Furukawa Electric Company Ltd., Japan.* We experimentally demonstrate phase-preserving amplitude regeneration of RZ-QPSK signal by placing an optical phase conjugator between two Mamyshev regenerator stages using a group-delay-managed nonlinear medium, with intensity noise suppressed 1.6 times.

W1I.4 • 09:00
Nonlinearity-Mediated Spectral Control of Light Using Pulsed Pumps Processed by Tunable Talbot Effect, Zijian Li[1], Geyang Wang[1], Chen Ding[1], Qiarong Xiao[1], Qijie Xie[1], Chaoran Huang[1], Lian-Kuan Chen[1], Chester Shu[1]; *[1]The Chinese Univ. of Hong Kong, Hong Kong.* We present spectral control of a continuous-wave light source through Kerr interactions with dual pulsed pumps processed via tunable temporal Talbot effect, enabling new-band frequency comb generation on flexible grids for short-reach communication.

W1I.5 • 09:15 (Top-Scored)
Electrically-Tunable and Power-Efficient Silicon Nitride Optical Parametric Oscillator, Jiaqi Li[1], Yanfeng Zhang[1], Siyuan Yu[1]; *[1]Sun Yat-Sen Univ., China.* We present an integrated silicon nitride optical parametric oscillator that achieves a broad signal/idler tuning range (>5 THz) and high power conversion efficiency (>25%), utilizing an electrically reconfigurable photonic crystal micro-ring resonator.

W1I.6 • 09:30 (Invited)
Advances in on-Chip Optical Amplifiers, Tobias J. Kippenberg[1]; *[1]École Polytechnique Fédérale de Lausanne, Switzerland.* Abstract not available

08:00 -- 10:00
Room 301
W1J • Long-Distance and CV-QKD

W1J.1 • 08:00

Long-Distance Discrete-Modulated Continuous-Variable Quantum Key Distribution Over 126.56 km of Fiber, Yan Pan[1], Mingze Wu[2], Wang Heng[1], Jun h. Li[2], Yun Shao[1], Yang Li[1], Wei Huang[1], Song Yu[2], Yichen Zhang[2], Bingjie Xu[1]; *[1]National Key Laboratory of Security Communication, Inst. of Southwestern Communication, China; [2]State Key Laboratory of Information Photonics and Optical Communications, Beijing Univ. of Posts and Telecommunications, China.* Employing an advanced security analysis method, we experimentally demonstrated a local local oscillator continuous-variable quantum key distribution system over 126.56km of single mode fiber with probabilistic shaped 16QAM, achieving a secret key rate of 169.37kbps.

W1J.2 • 08:15

Demonstration of Co-Transmission of Quantum Key Distribution and Classical Signal With High Launch Power Across 125 km Few-Mode Fiber, Lei Shen[3,2], Siwei Wang[1,2], Bing Han[1,2], Guofeng Yan[1,2], Dawei Lyu[1,2], Zhang Xi[1,2], Zhongyang Wang[1,2], Ziyi Tang[1,2], Yuchen Zhang[1,2], Qianke Wang[1,2], Shuo Xu[3], Li Zhang[3], Lei Zhang[3,2], Jun Chu[3], Jie Luo[3,2], Jinwei Zeng[1,2], Jun Liu[1,2], Jian Wang[1,2]; *[1]Wuhan National Laboratory for Optoelectronics and School of Optical and Electronic Information, Huazhong Univ. of Science and Technology, China; [2]Optics Valley Laboratory, China; [3]State Key Laboratory of Optical Fiber and Cable Manufacture technology, China.* We have successfully implemented 125 km quantum-classical co-transmission using few-mode fiber by optimizing system configurations and isolation, achieving 2.1% quantum bit-error-rate and 100 Gbit/s classical transmission with 16 dBm launch power.

W1J.3 • 08:30

Experimental Demonstration of 150 km Four-Core Fiber Co-Transmission of Quantum and Classical Signals Enabled by Wavelength and Space Division Multiplexing, Lei Shen[3,2], Siwei Wang[1,2], Bing Han[1,2], Guofeng Yan[1,2], Dawei Lyu[1,2], Zhongyang Wang[1,2], Ziyi Tang[1,2], Qianke Wang[1,2], Kang Li[1,2], Shuo Xu[3], Li Zhang[3], Lei Zhang[3,2], Jun Chu[3], Jie Luo[3,2], jinwei zeng[1,2], Jun Liu[1,2], Jian Wang[1,2]; *[1]Wuhan National Laboratory for Optoelectronics and School of Optical and Electronic Information, Huazhong Univ. of Science and Technology, China; [2]Optics Valley Laboratory, China; [3]State Key Laboratory of Optical Fiber and Cable Manufacture technology, China.* We have realized 150 km co-transmission of 40 GBaud quadrature phase shift keying signal and quantum signal, improving channel isolation through wavelength-division and space-division multiplexing, achieving quantum bit-error-rate of only 1.15%.

W1J.4 • 08:45

High-Performance Multi-Carrier Continuous-Variable Quantum key Distribution, Wang Heng[1], Ting Ye[1], Yan Pan[1], Yun Shao[1], Yaodi Pi[1], Tao Zhang[1], Ao Sun[1], Lifeng Fu[1], Yang Li[1], Wei Huang[1], Bingjie Xu[1]; *[1]Inst. of Southwestern Communication, China.* We experimentally demonstrate a high-performance multi-carrier CV-QKD system with asymptotic SKRs of 1819.32Mbps@5km, 1078.48Mbps@10km, 374.19Mbps@25km, 112.96Mbps@50km, 34.63Mbps@75km and 12.58Mbps@100km, marking the first CV-QKD achieving Gbps SKR within 10km and ten Mbps SKR over 100km.

W1J.5 • 09:00

Generalizing Nonlocal Dispersion Cancelation for Robust Quantum Communications, Benjamin G. Crockett[1], Hao Yu[1,2], Nicola Montaut[1], Stefania Sciara[1], Mario Chemnitz[1,3], Sai Tak CHU[5], Brent E. Little[4], David J. Moss[6], Zhiming Wang[2], Jose Azaña[1], Roberto Morandotti[1]; *[1]INRS, Canada; [2]Shimmer Center, Tianfu Jinagxi Laboratory, China; [3]Leibniz Inst. of Photonic Technology, Germany; [4]QXP Technology Inc., China; [5]City Univ. of Hong Kong, China; [6]Swinburne Univ. of Technology, Australia.* We present a framework describing dispersion's impact on time-bin entangled photon pairs, identifying a new regime resilient to dispersion. This low-loss approach enables secure communication across dispersive links, without using lossy dispersion-compensating elements.

W1J.6 • 09:15

Improving End-to-end Key Security in Trusted Node-Based QKD Networks with Secret Sharing, Mario Wenning[1,2], Jonas Berl[1,3], Tobias Fehenberger[1], Carmen Mas Machuca[4]; *[1]Adva Network Security GmbH, Germany; [2]Chair of Communication Networks, Technical Univ. of Munich, Germany; [3]Communications Engineering Lab, Karlsruhe Inst. of Technology, Germany; [4]Chair of Communication Networks, Univ. of the Bundeswehr Munich, Germany.* We develop an optimized key routing scheme that applies secret sharing in a meshed, trusted-node-based QKD network. Each threshold increment improves end-to-end key security by at least six nines, with cost increases below 57 %.

W1J.7 • 09:30 (Invited)

Quantum key Distribution with Ultra Long-Distance Fiber, Zhen-Qiang Yin[1], Shuang Wang[1], Wei Chen[1], Zheng-Fu Han[1]; *[1]Univ. of Science and Technology of China, China.* Quantum key distribution can offer unconditionally secure keys between distant peers. With the theoretical development of twin-field protocols and relevant experimental techniques, its fiber channel distance can be extended to around 1000km, enabling intercity key distributions.

08:00 -- 10:00
Room 304
W1K • Modelling and Nonlinearity Mitigation/Compensation
Presider: Olga Vassilieva; Fujitsu Network Communications Inc, USA

W1K.1 • 08:00

Accounting for Temporal Energy Correlations in the Enhanced Gaussian Noise Model, Kaiquan Wu[1], Gabriele Liga[1], Marco Secondini[2], Alex Alvarado[1]; *[1]Eindohoven Univ. of Technology, Netherlands; [2]TeCIP Inst., Scuola Superiore Sant'Anna, Italy.* We incorporate the temporal symbol energy correlations into the enhanced Gaussian noise model. The new analytical model exhibits an SNR prediction error within 0.11 dB across various shaping blocklengths and distances.

W1K.2 • 08:15

Predicting Nonlinear Interference for Short-Blocklength 4D Probabilistic Shaping, Jingxin Deng[1], Bin Chen[1], Zhiwei Liang[1], Yi Lei[1], Gabriele Liga[2]; *[1]School of Computer Science and Information Engineering, Hefei Univ. of Technology, China; [2]Department of Electrical*

Engineering, Eindhoven Univ. of Technology, Netherlands. We derive a heuristic nonlinear interference model for 4D probabilistic shaping considering the polarization and time correlation of the 4D symbols. We demonstrate an average SNR prediction gap from split-step Fourier simulations of 0.15dB.

W1K.3 • 08:30
Optical Line System Physical Digital Model Calibration Using a Differential Algorithm, Giacomo Borraccini[1], Yue-Kai Huang[1], Andrea D Amico[1], Ezra Ip[1], Ting Wang[1], Koji Asahi[2]; *[1]NEC Laboratories America Inc., USA; [2]NEC Corporation, Japan.* A differential algorithm is proposed to calibrate the physical digital model of an optical line system from scratch at the commissioning phase, using minimal measurements and maximizing signal and OSNR estimation accuracy.

W1K.4 • 08:45
A Fast and Accurate EDFA Model for the Optimization of Power-Efficient SDM Subsea Transmission Systems, Aymeric Arnould[1], Ronald Freund[1,2], Georg Rademacher[1,3]; *[1]Fraunhofer-Institut for Telecommunications, Heinrich-Hertz-Institut, HHI, Germany; [2]Technical Univ. of Berlin, Germany; [3]Inst. for Electrical and Optical Communications, Univ. of Stuttgart, Germany.* Based on the semi-analytical extended Saleh model, we propose a method with a limited complexity increase to accurately include the impact of EDFA physics in multi-parameter optimizations of power-efficient regimes for SDM subsea transmissions.

W1K.5 • 09:00
Nonlinearity Cancellation Based on Optimized First Order Perturbative Kernels, Alex Alvarado[1], Astrid Barreiro[1], Gabriele Liga[1]; *[1]Technische Universiteit Eindhoven, Netherlands.* The potential offered by interference cancellation based on optimized regular perturbation kernels of the Manakov equation is studied. Theoretical gains of up to 2.5 dB in effective SNR are demonstrated.

W1K.6 • 09:15
Joint Pre- and Post-Learned Perturbation Nonlinearity Compensation Optimization for Long-Haul Optical Fiber Transmission Based on End-to-end Deep Learning, Lyu Li[1], Zekun Niu[1], Junzhe Xiao[1], Weisheng Hu[1], Lilin Yi[1]; *[1]Shanghaijiaotong Univ., China.* We propose a joint pre- and post-learned perturbation nonlinearity compensation (LPNC) by using end-to-end deep learning. The experiment shows a 0.6 dB gain is validated in the 21-channel 64QAM 60 GBaud 800km transmission fiber link.

W1K.7 • 09:30
Impact of Baud Rate and Transmission Distance on Nonlinearity Compensation Using Optical Frequency Combs, Ronit S. Sohanpal[1], Eric Sillekens[1], Jiaqian Yang[1], Mindaugus Jarmolovicius[1], Romulo Aparecido de Paula Junior[1], Yijia Cai[1], Zhixin Liu[1], Robert I. Killey[1], Polina Bayvel[1]; *[1]Univ. College London, UK.* We experimentally investigate the nonlinearity compensation performance of frequency combs and independent lasers sources at 15 and 49.5 GBd up to 7796 km, observing 0.5 dB gain using combs over unsynchronised laser sources.

W1K.8 • 09:45
Mitigation of Coherent Nonlinear Noise Accumulation in Transmission Across Cascaded SOAs, Hartmut Hafermann[1], Loig Godard[1], Xiaohui Zhao[1], Abel Lorences-Riesgo[1], Zhenzhen

Zhang[1], Romain Brenot[1], Yann Frignac[1], Gabriel Charlet[1]; [1]*Optical Communication Technology Lab, Huawei Technologies France, France.* It is shown experimentally and in simulations that nonlinear noise of cascaded semiconductor optical amplifiers accumulates coherently. Noise correlations degrade nonlinear SNR by up to 3 dB. They are found negligible after few kilometers of fiber and are reduced by up to 2 dB through polarization mixing.

08:00 -- 10:00
Rooms 201-202
W1A • Network Evolution and AI
Presider: Ashwin Gumaste; Indian Inst. of Technology Bombay, India

W1A.1 • 08:00 (Invited)
Embracing the AI Era: Optical Network Evolution to Scale the Backbone, Ligia Maria Moreira Zorello[1]; [1]*Meta Platforms Technologies UK Ltd, UK.* The rapid growth of AI is driving significant changes in Meta's network infrastructure. Exponential traffic growth in the backbone network requires a scalable optical backbone network that meets quality of service for all services. We are adopting a point-to-point network topology combined with C+L-band line system and ZR+ pluggables. The combination of these technologies enables simplifying the design, improving the deployment and enhancing the performance and efficiency of the network.

W1A.2 • 08:30
Polarization-Independent Optical-Carrier-Distribution Scheme for Metro-Access Converged DC Interconnects, Ritsuki Hamagami[1], Masamichi Fujiwara[1], Shin Kaneko[1], Junichi Kani[1], Tomoaki Yoshida[1]; [1]*NTT Access Network Service Systems Laboratories, NTT Corporation, Japan.* A novel optical-carrier-distribution scheme with which dual sub-carriers are externally distributed to a coherent transceiver consisting of an EA modulator and dual-polarization diversity heterodyne receiver is proposed. Its polarization-independent characteristics were demonstrated through transmission experiments.

W1A.3 • 08:45
Timeslot-Compactness-Aware Routing Wavelength and Timeslot Assignment Strategy for Distributed AI Training in a Multi-Granularity All-Optical Metro Spine-Leaf Network, Shaoxiong Feng[1], Jiawei Zhang[1], Zhiqun Gu[1], Bojun Zhang[1], Yuefeng Ji[1]; [1]*Beijing Univ. of Posts and Telecommunications, China.* To accommodate the traffic flow from distributed AI training, we propose a timeslot-compactness-aware routing, wavelength and timeslot assignment strategy in a multi-granularity all-optical metro spine-leaf network, which achieves 6.58% less blocking, 14.7% more wavelength efficiency.

W1A.4 • 09:00
Multi-Agent Design for LLM-Assisted Network Management, Hussein Zaid[1], Pooyan Safari[1], Behnam Shariati[1], Aydin Jafari[1], Mihail Balanici[1], Johannes K. Fischer[1]; [1]*Fraunhofer Inst. for Telecommunicati, Germany.* We propose a network automation solution using pre-trained LLMs and advanced prompt engineering that ensures NDA confidentiality compliance. Our method achieves a 96.7% success rate in executing user intent into network operations without model fine-tuning.

W1A.5 • 09:15 (Invited)

Generative AI Roll Out for Transport Networks, Raghu Valisammagari[1,2]; [1]*Nework Systems, Verizon Communications Inc., USA;* [2]*Swiss School of Business and Management, Switzerland.* Abstract not available

08:00 -- 10:00
Rooms 205-206
W1C • Submarine and Field Trials
Presider: Jean-christophe Antona; Alcatel Submarine Networks Inc., France

W1C.1 • 08:00 (Invited)

Technologies and Challenges for Pb/s Submarine Cable Deployment, Pascal Pecci[1], Elizabeth Rivera Hartling[2], Matthew Mitchell[2]; [1]*Meta France, France;* [2]*Meta, USA.* While with SDM we had a consensus to increase capacity of subsea cable, with Pb/s cable solutions are diverging and we have 3 candidates. We will evaluate the challenges associated to them. Who will win?

W1C.2 • 08:30

Trans-Atlantic Record Deployment Achieving 24 Tb/s Capacity Enabled Through Probabilistic Shaping and FEC Gain Sharing, Siddharth Varughese[1], Domaniç Lavery[1], Marc Stephens[1], Han Sun[1], Pierre Mertz[1]; [1]*Infinera Corp., USA.* Deployed capacity of 24 Tb/s is reported on a transatlantic SDM cable enabled through highly granular PS signalling and two-wave FEC gain sharing. Reported datarates demonstrate >30% total cable capacity improvements over previous transatlantic demonstrations.

W1C.3 • 08:45 (Invited)

Physics Based vs ML-Based Digital Twins of Submarine Networks, Juliana Tiburcio de Araujo[1], Alexis Carbo Meseguer[1], Jean-christophe Antona[1]; [1]*Alcatel Submarine Networks Inc., France.* We investigate digital twin approaches to predict subsea link spectrum evolutions and QoT to facilitate spectrum sharing. We focus on a 0.5dB RMSE hybrid model with low complexity and reduced data training set.

W1C.4 • 09:15 (Top-Scored)

Field Trial of Real-Time 128Tb/s Co-Frequency Co-Time Full-Duplex Transmission Over Deployed 20km AR-HCFs in Urban Duct Network, Dawei Ge[1], Siyuan Liu[2,1], Peng Li[3], Qiang Guo[4], Yifan Xiong[5], Mingqing Zuo[1], Dong Wang[1], Shoufei Gao[6,5], Dechao Zhang[1], Da Liu[7], Yingying Wang[6,5], Lei Zhang[3], Wei Ding[6,5], Jie Luo[3], Hongqiang Zou[7], Han Li[1], Zhangyuan Chen[2], Xiaodong Duan[1]; [1]*China Mobile Research Inst., China;* [2]*State Key Laboratory of Advanced Optical Communication Systems and Networks, Peking Univ., China;* [3]*State Key Laboratory of Optical Fiber and Cable Manufacture Technology, YOFC, China;* [4]*B&P Lab, Huawei Technology Co., Ltd., China;* [5]*Linfiber Technology (Nantong) Co., Ltd., China;* [6]*Inst. of Photonics Technology and College of Physics & Optoelectronic Engineering, Jinan Univ., China;* [7]*China Mobile Communications Corporation Group Co., Ltd.,, China.* We report the first real-time 128Tb/s co-frequency co-time full-duplex transmission over the first deployed 20km AR-HCFs in complex urban duct network in China by leveraging extremely low distributed Rayleigh backscattering of AR-HCF.

W1C.5 • 09:30

Real-Time 1.6-Tbps Transmission Over 10 km for 6G Fronthaul in Co-Packaged Optics Radio Access Networks Using Eye-Safe Standard-Single-Mode-Fiber-Fed Remote Laser Sources, Son T. Le[1], Guilhem de Valicourt[1], Peter Pupalaikis[1], Randy Giles[1], Marco Lamponi[1], Lukas Elsinger[1], Shawn Liu[1], Brett Sawyer[1], Jon Proesel[1], Eugene Ho[1], Karen Liu[1], Zhiqi Zhu[1], Steve Corteselli[1], Laurent Alloin[1], Chris Daunt[1], Mark Ferriss[1], Behzad Rahmani[1], Fred Warning[1], Ashok Bruno[1], Siamak Abbaslou[1], Mehdi Zaman[1], Zeyu Pan[1], George Fischer[1], Gannon Reichert[1], Jon George[1], Utku Alakusu[1], Jeb Binkey[1], Isaac Martinez[1], Karel Van Acoleyen[1], Faezeh Fesharaki[1], Susanne Paul[1], Vaishnavi Karra[1], Tu Nguyen[1], Nikitha Machineni[1], Andrew Sullivan[1], Daniel Assumpcao[1], Peter Winzer[1], Fabio Cavaliere[2], Luca Giorgi[2], Alessandra Bigongiari[2], Antonio Tartaglia[2], Antonio D'Errico[2], Stefano Stracca[2], Roberto Sabella[2]; *[1]Nubis Communications, USA; [2]Ericsson, Italy.* We demonstrate real-time 16x100-Gbps full-duplex 10-km transmission using a high-density, low-power, fully-packaged optical engine. Remote laser light is supplied via standard single-mode fiber without the need for active polarization management and with an eye-safety shutoff.

W1C.6 • 09:45

Operator Trial of Quadruple PON Coexistence With 100G-PON, 50G-PON, 25GS-PON and XGS-PON, Robert Borkowski[1], Kovendhan Vijayan[1], Suresh Chandrasekaran[2], John Valdez[3], Erwin Wardojo[3], Srimadhaven Thirumurthy[4], Vincent Houtsma[1], Christoph Füllner[5], Dora van Veen[1], Michae Straub[5], Rene Bonk[5], Chris Edwards[4], Jochen Maes[6]; *[1]Nokia Bell Labs, USA; [2]Fixed Networks, Nokia, USA; [3]Frontier Communications, USA; [4]Fixed Networks, Nokia, USA; [5]Nokia Bell Labs, Germany; [6]Nokia Bell Labs, Belgium.* We present North American operator trial involving world's first simultaneous operation of four PON technologies: 100G-PON, 50G-PON, 25GS-PON and XGS-PON over a field-deployed 11-km-long fiber. We report correct operation of all systems in the trial.

08:00 -- 10:00
Rooms 209-210
W1F • High-Speed Direct-Detection PON
Presider: Yuanqiu Luo; Futurewei Technologies Inc, USA

W1F.1 • 08:00

Dual-Wavelength 200Gb/s IM/DD 40km Transmission With 34dB Link Budget for Very High Speed PON, Ricardo Rosales[1], Xin Chen[2], Samir Rihani[2], Daniel Drysdale[2], Richard Cronin[2], Thomas Tilbury[2], Haibo Wang[2], Pantelis Aivaliotis[2], Giuseppe Talli[1], Maxim Kuschnerov[1]; *[1]Huawei Technologies Duesseldorf GmbH, Germany; [2]Huawei Technologies Research and Development Ltd., UK.* We demonstrate a potential low-cost implementation of a dual-wavelength 200Gb/s NRZ-based system reaching 34dB (40km) and 36dB (20km) link budgets enabled by EMLs with a shared SOA, regardless of both negative CD and Tx chirp.

W1F.2 • 08:15

First 100G NRZ-OOK PON Demonstration With >31 dB Loss Budget and Coexistence Study Over Field-Deployed Fiber, Christoph Füllner[1], Dora van Veen[1], Michae Straub[1], Michiel Verplaetse[1], Robert Borkowski[1], Wouter Lanneer[1], Yannick Lefevre[1], Vincent Houtsma[1], Rene Bonk[1], Peter Desmet[2], Colin Wu[3], Jochen Maes[1]; *[1]Nokia Bell labs, Germany; [2]Nokia Network Infrastructure Fixed Networks, Belgium; [3]Nokia Network Infrastructure Fixed Networks,*

Australia. We perform a live demo of 100G NRZ-OOK PON downstream coexisting with XGS and 25GS PON over field-deployed fiber in Australia. We achieve a loss budget of >31 dB using pre-amplified reception, advanced equalization, and soft-input FEC decoding.

W1F.3 • 08:30
Enhanced Support Vector Machine Based Signal Recovery in Bandwidth-Limited 50-100 Gbit/s Flexible DS-PON, Liyan Wu[1], Yanlu Huang[1], Kai Jin[1], Shangya Han[1], Kun Xu[1], Yanni Ou[1]; [1]*Beijing U. of Posts & Telecom, China.* We proposed an adaptive signal recovery algorithm with reduced complexity based on the SVM principle for flexible downstream PON. Experimental results indicate a record-high link power budget of 24 dB for bandwidth-limited 100 Gbit/s direct-detection transmission@1E-3.

W1F.4 • 08:45
LUT-Assisted Clock Data Recovery and Equalization for Burst-Mode 50-100 Gbit/s Bandwidth-Limited Flexible PON, Yanlu Huang[1], Liyan Wu[1], Shangya Han[1], Kai Jin[1], Kun Xu[1], Yanni Ou[1]; [1]*Beijing U. of Posts & Telecommunication, China.* We demonstrated LUT-assisted CDR and equalization for burst-mode 50-100 Gbit/s bandwidth-limited PON, achieving signal recovery under large 100 ppm frequency offsets and 0.5 UI phase mismatch using reduced 50ns preambles, with 0.3dB sensitivity penalty only.

W1F.5 • 09:00
Performances of Cost-Effective 50G ONU With Analog FFE and HI-FEC, Dylan Chevalier[1,2], Luiz Anet Neto[3], Gael Simon[1], Pascal Scalart[4], Lucas Inglès[3], Jeremy Potet[1], Georges Gaillard[1,3], Philippe Chanclou[1], Laurent Bramerie[2], Michel Joindot[2], Mathilde Gay[2], Monique Thual[2]; [1]*Orange Labs, France;* [2]*Institut FOTON, France;* [3]*IMT Atlantique, France;* [4]*IRISA, France.* We propose a cost-effective 50G ONU reception scheme leveraging analog FFE and Hard-Input-FEC, achieving +3.8 dB of coding gain with analog FFE. This implementation reduces costs at ONUs compared to regular SI-FEC+DSP ones.

W1F.6 • 09:15
An Experimental Analysis of 50G-PON LDPC, Luiz Anet Neto[1,2], Dylan Chevalier[3], Gael Simon[3], Lucas Inglés[1,2], Jeremy Potet[3], Georges Gaillard[3], Philippe Chanclou[3], Ramesh Pyndiah[1,2]; [1]*IMT Atlantique, France;* [2]*Lab-STICC CNRS UMR 6285, France;* [3]*Orange Innovation, France.* We experimentally assess the impacts of different LDPC decoding parameters with both soft- and hard-inputs in 50G-PON. We also derive the mean number of decoder iterations per received optical power over 25 km SSMF.

08:00 -- 10:00
Rooms 211-212
W1G • Light-Source, QD and Comb
Presider: Wei Shi; Université Laval, Canada

W1G.1 • 08:00
Feedback-Controlled Frequency Comb in Quantum Dot Lasers, Wenlu Wang[1], Shihao Ding[2], Zihao Wang[3,4], Ting Wang[3,4], Bo Yang[3,4], Jianjun Zhang[3,4], Xiaochuan Xu[1], Heming Huang[5], Frédéric Grillot[5], Jianan Duan[1]; [1]*National Key Laboratory of Laser Spatial Information, School of Integrated Circuits, Harbin Inst. of Technology, China;* [2]*College of Integrated Circuits and Optoelectronic Chips, Shenzhen Technology Univ., China;* [3]*Beijing National Laboratory for*

Condensed Matter Physics, Inst. of Physics, Chinese Academy of Sciences, China; [4]Center of Materials Science and Optoelectronic Engineering, Univ. of Chinese Academy of Sciences, China; [5]Telecom Paris, Institut Polytechnique de Paris, France. In this work, a fourth-order 100 GHz colliding-pulse mode-locked quantum dot laser was used to achieve dynamic control over frequency-modulated combs and amplitude-modulated combs and pulse width reduction through external optical feedback.

W1G.2 • 08:15
Ultra-Stable Broadband Comb Laser with Tunable Free Spectral Range, Bahareh Marzban[1], Tobias Blatter[1], Lucius Miller[1], Laurenz Kulmer[1], Killian Keller[1], Mathieu Bertrand[1], Alexander Dikopoltsev[1], Giacomo Scallari[1], Juerg Leuthold[1], Jerome Faist[1]; *[1]ETH Zurich, Switzerland.* We demonstrate a novel broadband 1.6THz comb that enables dynamic adjustment of the repetition rate up to 17 GHz, achieving exceptional stability with a 1Hz RF linewidth and supporting data transmission up to 64GBaud QPSK.

W1G.3 • 08:30 (Invited)
Multi-Wavelength Quantum Dot Comb Lasers, Alan Y. Liu[1], Michael Davenport[1], Justin Norman[1], Szilard Szoke[1], Kaiyin Feng[1], Boju Gai[1], Michael Belt[1], Yujie Xia[1], Brian Koch[1]; *[1]Quintessent Inc., USA.* Scalable and reliable interconnect solutions are needed to meet the demands of AI clusters and accelerated datacenters. Quintessent is developing efficient and reliable multiwavelength quantum dot lasers for low cost, high bandwidth density DWDM sources.

W1G.4 • 09:00
Flat-top Electro-Optic Frequency Comb Using a Single Modulator and Drive on Thin-Film Lithium Niobate, Gengxin Chen[1], Ziliang Ruan[1], Liu Liu[1]; *[1]Zhejiang Univ., China.* We demonstrate a flat-top electro-optic frequency comb using a single modulator on the thin-film lithium niobate, featuring low optical loss and wide optical bandwidth. A double-pass configuration with similar comb performance is also introduced.

W1G.5 • 09:15
Widely Tunable InP-on-Silicon Lasers Based on the Micro-Transfer Printing of Double-Ridge Coupons, Yang Liu[1], Chen Ye[1], Laurens Bogaert[1], Emadreza Soltanian[1], Evangelia Delli[1], Guy Lepage[2], Peter Verheyen[2], Joris Van Campenhout[2], Günther Roelkens[1], Jing Zhang[1]; *[1]Gent Univ., Belgium; [2]IMEC, Belgium.* We demonstrate the micro-transfer printing of III-V double-ridge active devices onto silicon photonics, realizing an integrated tunable laser with over 45 nm tuning range and 5 mW waveguide-coupled output power.

W1G.6 • 09:30
Tunable Quantum Dot Lasers Monolithically Integrated with Silicon Photonics Rings and DBR Gratings, Rosalyn Koscica[1], Alec Skipper[2], Bei Shi[2,3], Kaiyin Feng[2], Andrew Netherton[2], Gerald Leake[4], David Harame[4], Jonathan Klamkin[2,3], John E. Bowers[1,2]; *[1]Materials Department, Univ. of California Santa Barbara, USA; [2]Inst. for Energy Efficiency, Univ. of California Santa Barbara, USA; [3]Aeluma, Inc., USA; [4]RF SUNY Polytechnic Inst., USA.* O-band quantum dot lasers are monolithically integrated on silicon photonics using MOCVD/MBE growth and a facet fill approach to reduce waveguide coupling loss below 6 dB. Lasers achieve ring resonator coupling and single-mode lasing.

W1G.7 • 09:45
High-Power and Narrow Linewidth SOA-Integrated DFB Laser for 400-mW Class External Laser Sources, Daisuke Inoue[2,1], Konosuke Aoyama[2], Takashi Matsui[2], Shinya Iizaka[2], Shigenori Toyoshima[2], Shinsuke Yanagida[2], Kotaro Hoshino[2], Naoki Fujiwara[1], Daisei Shoji[2], Harold Kamisugi[2]; *[1]Sumitomo Electric Industries, LTD., Japan; [2]Sumitomo Electric Device Innovations, Inc., Japan.* We demonstrate an over 500 mW (at 45°C) operation of 1.3 μm SOA-integrated DFB laser with reduced thermal resistance. The device exhibits single-mode operation with SMSR of over 50dB and narrow linewidth below 200 kHz.

08:00 -- 10:00
Rooms 213-214
W1H • Optical Wireless Communication (OWC)
Presider: Bernhard Schrenk; Austrian Institute of Technology, Austria

W1H.1 • 08:00 (Invited)
Beam-Steered Optical Wireless Communication, Eduward Tangdiongga[1]; *[1]Technische Universiteit Eindhoven, Netherlands.* Optical wireless communication employing narrow but steerable laser beams is an emerging technology to realize high-capacity indoor communications, given robust beam pointing and advanced transceivers. We discuss a prototype system and present results from a typical indoor wireless link.

W1H.2 • 08:30
Reconfigurable Networks for Indoor Optical Wireless Communications Using Polarization-Controlled Dual-Function Metasurfaces, Xinda Yan[1], Zhiyu Chen[1], Jianou Huang[1,2], Eduward Tangdiongga[1]; *[1]Eindhoven Univ. of Technology, Netherlands; [2]Hangzhou Wenmi Xinguang Technology Development Co., Ltd, China.* We designed and fabricated metasurfaces acting as a Dammann vortex grating or a mirror at two orthogonal polarizations. The metasurface concurrently supports both optical MUX/DEMUX and routing, paving the way for reconfigurable indoor OWC networks.

W1H.3 • 08:45
Auto-Aligned Optical Wireless Communication System with Wide Field and Ultra-low Loss, Jin T. Mei[1], Haoran Fang[1], Haoran Xiao[1], Yansheng Zou[1], Yifei Zhu[1], Jiacheng Yan[1], Xiaoxiao Dai[1], Qi Yang[1], Chen Liu[1]; *[1]School of Optical and Electronic Information, Huazhong Univ. of Science and Technology, China.* We introduce an auto-aligned optical wireless communication system by measuring and compensating for lateral and angular misalignments between transceivers, achieving a maximum link loss of 5.7 dB within a full-angle field of 70° × 45°.

W1H.4 • 09:00 (Tutorial)
Future Perspectives on Optical Wireless Communication – Optical Beam Shaping, Multiple Access and Integration, Chi-Wai Chow[1]; *[1]National Yang Ming Chiao Tung Univ., Taiwan.* The tutorial covers the recent advances and future perspectives in optical-wireless-communication (OWC) technology, from devices, systems to applications. Particular focuses will be placed on optical beam shaping, beam steering, and photonic integration.

10:30 -- 12:30
Room 303
W2A • Posters Session I

W2A.1
Wafer Scale TFLN Platform Exhibiting 0.1 dB/cm Single Mode Propagation Loss, Liming Lv[1], Bingzhou Hong[1], Shaobo Fang[2], Ruoyu Shen[2], Yunkai Yu[2], Ying Wang[1], Yue Zhou[1], Haiwen Cai[1,3], Wei Chu[1]; *[1]Zhangjiang Lab, China; [2]School of Information Science and Technology, Fudan Univ., China; [3]Shanghai Shanghai Inst. of Optics and Fine Mechanics, Chinese Academy of Sciences, China.* Wafer scale thin film lithium niobate platform was demonstrated based on deep ultraviolet photolithography. The average single mode propagation loss is 0.23 dB/cm at 1550 nm with standard deviation of 0.07 dB/cm. A 0.1 dB/cm level single mode propagation loss was measured at 1576 nm.

W2A.2
Enhancement of RF Performance of 128-Gbaud Lumped EML Submodule Utilizing LC Resonance With Capacitive Wire-Bonding Pad, Seokjun Yun[1,2], Young-Tak Han[1], Dong-Hoon Lee[1], Dong-Hyo Lee[1], Seo-Young Lee[1], Young-Kyu Choi[1], Jang-Uk Shin[1], Sang-Ho Park[1], Hoon Kim[2], Yongsoon Baek[1]; *[1]Photonics/Wireless Devices Research Division, Electronics and Telecommunications Research Inst., Korea (the Republic of); [2]School of Electrical Engineering, Korea Advanced Inst. of Science and Technology, Korea (the Republic of).* We report on a high-bandwidth (>67 GHz) lumped EML submodule obtained by utilizing an LC resonance effect in conjunction with a capacitive wire-bonding pad for enhanced RF performances, enabling 128-Gbaud PAM-4 and PAM-6 operations experimentally.

W2A.3
Silicon Photonics for Harsh Environments, Jan Troska[1], Daniele Alfiero[1,2], Sophie Baron[1], Mateusz Baszczyk[1], Stefan Biereigel[1], Stephane Detraz[1], Adam Klekotko[1], Szymon Kulis[1], Francesco Martina[1], Paulo Moreira[1], Lauri Olanterä[1], Carmelo Scarcella[1], Christophe Sigaud[1], Csaba Soos[1]; *[1]CERN, Switzerland; [2]Univ. of Birmingham, UK.* We report the qualification of Silicon Photonics technology for deployment in the low temperature and high radiation environments of high energy physics experiments. This work is also applicable to satellite communications systems.

W2A.4
Underwater Visible Optical Wireless Broadcasting Communications Enabled by Beam-Steering Liquid Crystal Metasurface, Chao Yang[1], Zichen Liu[2], Yuhan Gong[1], Mian Wu[1], Ming Luo[1], Lin Wu[1], Chao Li[2], Xi Xiao[3], Zhixue He[2], Jin Tao[1], Shaohua Yu[2]; *[1]CICT, China; [2]Peng Cheng Laboratory, China; [3]National Information Optoelectronics Innovation Center, China.* Assisted by a liquid crystal metasurface enabling 3×3 beam-steering with 3°×3° field-of-view, 2.7-Gb/s OOK point-to-multi-point low-cost and high-efficiency optical wireless communication over 2.5-meter water tank at 532-nm is successfully demonstrated employing only linear equalization.

W2A.5
An 8-Channel Optical Selective Switch for Polarization and Wavelength Multiplexed Optical Fiber Networks, Zengqi Chen[1], Wu Zhou[1], Yeyu Tong[1]; *[1]Hong Kong Univ of Sci & Tech (Guangzhou), China.* We present an 8-channel chip-based selective switch designed for

polarization- and wavelength-multiplexed fiber communication systems. The compact photonic chip, measuring 1.3×0.48mm^2, is fully reconfigurable and can handle randomly polarized light from optical fibers.

W2A.6
Withdrawn

W2A.7
Progress Towards Standardized Thin Film Lithium Niobate (TFLN) Photonic Integrated Circuits (PICs), Hamed Sattari[1], Alberto Della Torre[1], Arno Mettraux[1], Dorian Herle[1], Homa Zarebidaki[1], Jacopo Leo[1], Florian Dubois[1], Ivan Prieto[1], Olivier Dubochet[1], Michel Despont[1]; *[1]Centre Suisse d'Electronique et de Micro, Switzerland.* We present advancements in our TFLN PIC foundry, highlighting waveguides, modulators, and edge couplers, alongside platform standardization. Multiple technology nodes support a range of functionalities, promising for robust building blocks for improved performance and scalability.

W2A.8
Advancements in LPCVD SiN Waveguides: Achieving 3 dB/m Propagation Loss on 200 mm Wafers, Onur Ozdemir[1], Tangla D. Kongnyuy[1], Nga P. Pham[1], Roelof Jansen[1], Mathias Prost[1], Joost Brouckaert[1], Philippe Helin[1]; *[1]imec, Belgium.* We demonstrate low-loss LPCVD silicon nitride waveguides on 200 mm wafers with propagation losses reaching as low as 3 dB/m at 1550 nm; with combined improvements in fabrication process; enhancing the current silicon nitride platform of imec.

W2A.9
Asymmetric Bridged Coupler-Based Polarization Beam Splitter on Thin-Film Lithium Niobate Platform, Yu He[1], Yuhan Du[1], Zijian Pu[1], Hua Zhong[1], Yikai Su[1]; *[1]Shanghai Jiao Tong Univ., China.* We demonstrate a compact polarization beam splitter on an *x*-cut thin-film lithium niobate platform. The device exhibits polarization extinction ratios exceeding 9.16 dB and insertion losses below 1.77 dB in a 60-nm operation wavelength range.

W2A.10
Photonic Crystal Fiber Metalens With Planar Chiral Units for Arbitrary Polarization Focusing, Yue Wang[1], Jiaqi Qu[1], Li Wang[1], Chengwei Qiu[2], Changyuan Yu[1]; *[1]Department of Electrical and Electronic Engineering, the Hong Kong Polytechnic Univ., Hong Kong; [2]Department of Electrical and Computer Engineering, National Univ. of Singapore, Singapore.* We propose a photonic crystal fiber metalens using planar chiral units. These chiral units introduce a new degree of freedom for metasurface, enabling arbitrary polarization focusing through integration with the Pancharatnam-Berry (PB) phase.

W2A.11
Efficient Resonance Seeking Algorithm for High-Order Ring-Assisted Mach-Zehnder Interferometer Calibration, Qishen Liang[1], Zichao Zhao[1], Haoran Ma[1], Bin Zhang[1,2], Yuehai Wang[1], Jianyi Yang[1]; *[1]Zhejiang Univ., China; [2]Zhejiang Lab, China.* We propose an efficient calibration algorithm for high-order RMZIs and experimentally demonstrate it with a fabricated RMZI chip. This approach achieves <4° phase error within 20 iterations, which verifies its feasibility in DWDM application.

W2A.12

A Spot-Size-Converter for O-Band Standard Single Mode Fiber with Sub-Decibel Coupling Loss, Min Teng[1], Hao Wu[1], Ruiqiong Yang[1], Xiangwei Zeng[1], Feng Wang[1], Ning Cheng[1], Xuezhe Zheng[1]; [1]*Innolight Technology, China.* An O-band SiN edge coupler for standard single-mode fiber coupling without undercut is proposed. It experimentally demonstrates a 0.8 dB/facet worst-case fiber coupling loss and -31 dB back reflection over the entire O band.

W2A.13

Experimental Verification of LR-8 Silicon-Nanowire-Based Optical Demultiplexer for 400 GbE and Beyond in MDCs, 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).* We present LR-8 silicon-nanowire-based flat-topped demultiplexer for high-bandwidth interconnects. By band rejection filtering based on discrete path length control and integrated extra filters, we experimentally demonstrated non-periodic flat-topped LR-8 spectra for the first time.

W2A.14

Dispersion Engineering of Integrated Si3N4 Fabry-Perot Bragg Gratings, Masoud Heidari[1], Yang Zhang[1], Mario Dagenais[1]; [1]*Univ. of Maryland, USA.* This study demonstrates that optimizing the grating design of Fabry-Perot Bragg Gratings can offset material and waveguide dispersion, ensuring a constant free spectral range (FSR) across modes, which is important for many applications.

W2A.15

Silicon 6.4 Tb/s Micro-Ring Modulator Array Chip with Wavelength Multiplexed and Port Multiplexed for Optical Interconnect, Gangqiang Zhou[1], Chi Lu[1], Penghui Xia[1], Liangjun Lu[2], Qiang Zhang[1], Wanshu Xiong[1], Na Zhang[1], Kun Yin[1], Hui Yu[1]; [1]*Zhejiang Lab, China;* [2]*Shanghai Jiao Tong Univ., China.* We demonstrate a silicon micro-ring modulator array chip with eight-wavelength multiplexed and four-port multiplexed. All micro-ring modulators can support 100 Gb/s OOK /PAM4 modulation and 200 Gb/s PAM4 modulation. The total transmit data rate can be 6.4 Tb/s.

W2A.16

Strong Bandwidth Enhancement of Zn-Diffusion Single-Mode 850 nm VCSEL Transmission Over Graded-Index Single-Mode Fiber, Zhe-Wei Hsu[1], Xin Chen[2], Jian-Wei Tung[1], Chia-Hsuan Wang[2], Dong Hao[2], Po-Jui Lai[1], Adil Muhammad[1], Ming-Jun Li[2], Jin-Wei Shi[1]; [1]*National Central Univ., Taiwan;* [2]*Corning Incorporated, USA.* Strong O-E bandwidth enhancement (26 to 31GHz) of single-mode 850nm Zn-diffusion VCSEL via 1km graded-index single-mode fiber transmission is demonstrated. Error-free 48Gbit/sec transmission is achieved under low bias current as 4 mA without using equalizers.

W2A.17

Ultrafast Waveguide MUTC Photodiode Targeting Over 200 GBaud Applications at 1310 nm and 1550 nm, Linze Li[1], Tianyu Long[1], Zhouze Zhang[1], Luyu Wang[1], Baile Chen[1]; [1]*School of Information Science and Technology, ShanghaiTech Univ., China.* We demonstrate a waveguide integrated modified uni-traveling carrier (MUTC) photodiode designed for optical interconnects exceeding 200 Gbaud. It features an ultra-wide bandwith over 170 GHz, with responsivities of 0.52 A/W at 1550 nm and 0.35 A/W at 1310 nm.

W2A.18

Uniform Monolithically Integrated Silicon Photonics Optical Receiver Chip for CWDM4, Jin Xie[1], Hengzhen Cao[1], Yuluan Xiang[1], Dajian Liu[1], Daoxin Dai[1]; *[1]Zhejiang Univ., China.* We proposed a monolithic high-speed optical receiver chip for CWDM4. It integrates an edge coupler, 4-channel add-drop optical filters based on cascaded CMWGs with gradually changing triangular tooth waveguide width and Ge/Si APDs. This design is fabricated by commercial 180-nm SOI CMOS technology, and exhibited outstanding uniformity.

W2A.19

Low-Noise Hybrid Three-Five/Si_3N_4 Laser with a Fast Wavelength Switching Range of 21 nm, Yilin Wu[1], Shuai shao[1], Sigang Yang[1], Hongwei Chen[1], Minghua Chen[1]; *[1]Tsinghua Univ., China.* We report a hybrid integrated three-five/Si_3N_4 laser achieving a record 21.35-nm wavelength switching range in the C-band with a switching time below 4 μs, and its intrinsic linewidth reaches a sub-10-Hz level.

W2A.20

Highly Efficient EML With SOA for 50G PON Application, Yifan Jiang[1], Wolfgang Parz[1], Yee Low[1], Nathan Bickel[1], Kemo Ran[1], Eva Huang[1], Luke Dewalt[1], Robert Boeck[1]; *[1]MACOM Technology Solutions, USA.* An efficient SOA-integrated EML is developed and demonstrated for 50G PON OLT downstream application. This EML uses identical epitaxial layers for laser, electoral-absorption modulator (EAM), and SOA sections, which greatly simplifies fabrication complexity and cost.

W2A.21

Tapered-Hybrid Bend, Interior-Ridge Modulator and Filter Supporting Tbps-Scale Links, Kaylx Jang[1], Asher Novick[2,1], Robert Parsons[1], Keren Bergman[1]; *[1]Columbia Univ., USA; [2]Xscape Photonics, USA.* We demonstrate a novel interior-ridge modulator and filter based off a tapered-hybrid bend capable of Tbps-scale DWDM links, enabled by an FSR=37.5 nm, ILoff=0.025 dB, and 1.3 nm/mW filter thermal tuning efficiency.

W2A.22

Lifetime Model for Enabling Reliable InGaAs/GaAs Nano-Ridge Lasers Monolithically Integrated on 300 mm Silicon, Ping-Yi Hsieh[1,2], Artemisia Tsiara[2], Barry O'Sullivan[2], Sara El Akel[3], Huseyin Sar[2], Debi P. Panda[2], Peter Swekis[2], Didit Yudistira[2], Bernardette Kunert[2], Joris Van Campenhout[2], Ingrid De Wolf[1,2]; *[1]KU Leuven, Belgium; [2]IMEC, Belgium; [3]Grenoble INP - Phelma, France.* A lifetime model is presented to study the diffusion-driven gradual degradation and the recombination-enhanced rapid failure in monolithic InGaAs/GaAs-on-Si nano-ridge lasers induced by high current density at p-contacts. Design guidelines are provided for improving reliability.

W2A.23

Programmable Microring Modulators with High Extinction Ratio and Tunable Quality Factor, Hamed Shams Mousavi[1], Saeed Fathololoumi[1], Paul Martin[1], Calvin Ma[1], Kelly Magruder[2], Adam Bowles[2], Jeffrey Driscoll[1]; *[1]Integrated Photonics Solutions, Intel Corporation, USA; [2]Silicon Photonics Development and Manufacturing, Intel Corporation, USA.* We present a novel programmable microring modulator with forward-biased PIN segment to compensate for fabrication variability. We show repeatable extinction ratios >30dB and the ability to reliably target loaded quality factors for controlling modulator bandwidth.

W2A.24
1.5 Terabit/s IM/DD Transmission with Kerr Soliton Frequency Comb for DCI Application, Lakshmi Narayanan Venkatasubramani[1], Ahmed Galib Reza[1], Cagri Ozdilek[2], Timofey Shpakovsky[2], Maxim Karpov[2], John D. Jost[2], Liam P. Barry[1]; *[1]Dublin City Univ., Ireland; [2]Enlightra, Switzerland.* We experimentally demonstrate 1.575 Terabit/s aggregated transmission rate with 75 Gb/s/λ on-off keying signal employing a dissipative Kerr soliton optical frequency comb. The system is scalable to provide multi-Terabit/s optical interconnects.

W2A.25
Electro-Optically Tuned Multi-Channel Interference Laser with Rear-Emission for Rapid Wavelength Switching, Jiajun Lou[1], Quanan Chen[2], Zifeng Chen[1], Qiaoyin Lu[1], Weihua Guo[1]; *[1]Huazhong Univ. of Science and Technology, China; [2]NingBo Ori-Chip Optoelectronics Tech. Co. LTD, China.* Monolithic multi-channel interference widely-tunable lasers with an integrated rear-emission structure for fast wavelength switching have been developed. The laser demonstrates a tuning-range >48nm, output power >40mW, ~50% improvement in slope-efficiency and a wavelength switching-time <100ns.

W2A.26
Integrated Compact Optical Vortex Beam Modulators, Huajie Wan[1], Kang Li[1], Yunlong Li[1], Shuang Zheng[1], Jian Wang[1], Minming Zhang[1]; *[1]Huazhong uni of Science and Technology, China.* We demonstrate the first silicon integrated compact modulators capable of generating a vortex beam carrying adjustable orbital angular momentum with a EO bandwidth of 27 GHz, a smallest radius of 4.75 micrometers.

W2A.27
Temperature Effect on the Correlation Between Cores in a 7-Core Fiber, Yifan Liu[1,2], Mikael Mazur[3], Lauren Dallachiesa[3], Nazanin Hoghooghi[2], Takuma Nakamura[1,2], Franklyn Quinlan[1,2], Nicolas K. Fontaine[3]; *[1]Department of Physics, Univerisity of Colorado Boulder, USA; [2]Time and Frequency Division, National Inst. of Standards and Technology, USA; [3]Nokia Bell Labs, USA.* We investigate the change in phase correlations between individual cores of a 40 km-long 7-core optical fiber under continuously varying temperatures, showing that relative path length changes among most cores are less than 10^{-8}/°C.

W2A.28
Ultra-Wideband and Low DMG Four-Mode-Group TDFA Based on Hybrid-Mode Pumping, Chaoya Shan[1], Hu Zhang[1], Jiaqi Wang[1], Nan Cui[1], Lixia Xi[1], Xiaoguang Zhang[1]; *[1]Beijing Univ. of Posts and Telecomm, China.* We propose a four-mode-group thulium-doped fiber amplifier (TDFA) operating within the 1720-2000 nm waveband with a differential mode gain (DMG) below 3.7 dB by implementing hybrid-mode pumping scheme and particle swarm optimization.

W2A.29
Low-Loss Photonic Circuits Fabricated on Antimony Trisulphide on Thin-Film Lithium Niobate Towards Nonlinear-Optic Applications, Yaqi Liu[1], Tian Shu[1], Lutong Cai[1], Lin Zhang[1]; *[1]Tianjin Univ., China.* We demonstrate low-loss waveguide (0.9 dB/cm) with strong

nonlinearity of n2 = 5.11 × 10-14 cm2/W fabricated on antimony trisulphide on thin-film lithium niobate. The group velocity dispersion is theoretically investigated.

W2A.30
Detection of Fiber Macro-Bending Anomalous Events in Operator Networks, Petros Ramantanis[2], Sébastien Bigo[2], Fabien Boitier[2], Armen Aghasaryan[2], Camille Delezoide[2], Matteo Lonardi[1], Patricia Layec[2], Allain Legacy[1], Sylvain Chenard[1], Eliana Vercelli[1], Giovanni Bellotti[1]; *[1]Nokia Corporation, France; [2]Nokia Bell Labs, France.* We experimentally measure the specific spectral signature of strong fiber bending and propose a metric to detect strong bending events. Leveraging telemetry from a production network we report short-lived anomalies which exhibit the aforementioned signature.

W2A.31
Experimental Validation of GOSNR Estimation Using Polarization-Resolved Optical Spectrum Analysis on Metro and Long-Haul WDM Links, Steven Searcy[1], Gang He[2], Sorin Tibuleac[1]; *[1]Adtran, USA; [2]EXFO, Canada.* We perform diverse experimental validation of an optical spectrum analysis GOSNR estimation method, showing good agreement (typically within 0.5 dB) relative to the conventional transceiver-based method over metro and long-haul distances and two fiber types.

W2A.32
Exploring Telemetry Collection Interval and Continuity in a Six-Month Study of a Pan-European Network, Kaida Kaeval[1], Torm Järvelill[1], Jasper Müller[2], Marko Tikas[3]; *[1]Tallinn Univ. of Technology, Estonia; [2]Adtran, Germany; [3]Tele2 Estonia AS, Estonia.* Reliable telemetry data is the key to unlocking machine learning-based network observability. This paper discusses the collection design, content, and continuity based on a 6-month-long data collection in a live network from the operator`s perspective.

W2A.33
Beyond 50 Gbps Vehicle Optical Network Utilizing WDM Visible Light Transmission in Multi-Mode Fiber Backbone, Yunkai Wang[1], Xinyi Liu[1], Xianhao Lin[1], Jifan Cai[1], Fujie Li[1], Zhilan Lu[1], Yiqi Huang[1], Haibo Yu[1], Jiabin Ye[1], Yingjun Zhou[1], Nan Chi[1]; *[1]Fudan Univ., China.* We present a new approach for intra-vehicle network utilizing gratings and WDM transmission over a 5m MMF link. Neural network is employed for post equalization to achieve 50.26 Gbps using five different wavelengths.

W2A.34
Machine Learning for QoT Estimation to Adapt to Non-Uniform or Unknown Parameters, Jinming Chen[1], Maite Brandt-Pearce[1]; *[1]Univ. of Virginia, USA.* When faced with unknown and non-uniform physical parameters in networks, we employ a DNN to predict the OSNR by incorporating them into input features, enhancing the prediction accuracy of existing models by over 1.5 dB.

W2A.35
Control and Monitoring of IPoWDM Networks with Pluggable EDFAs, Andrea Sgambelluri[1], Francesco Paolucci[2], Bashar Ali[2], Piero Castoldi[1], Filippo Cugini[2]; *[1]Scuola Superiore Sant'Anna, Italy; [2]CNIT, Italy.* An innovative control and monitoring system operating within IPoWDM nodes equipped with pluggable EDFAs is demonstrated. The system enables effective correlation of

monitored data and fast transmission parameter adaptation without requiring complex control plane interactions.

W2A.36
Photonic Chip with Embedded Data Center Fabric, Jose Castro[1], Bulent Kose[1], Robert Reid[1], Yu Huang[1], Brett Lane[1], Simon Gross[2], Michael Withford[2]; [1]*Panduit Corp, USA;* [2]*Modular Photonics, Australia.* We demonstrate 3D direct laser-written photonic integrated circuits for deployment of folded CLOS topologies in data center networks. Optical characterization includes losses, crosstalk, spectral responses, and traffic at 400Gbps.

W2A.37
Integrated Optoelectronic Ising Machine Based on Silicon Photonics, Ziyao Zhang[1], Guanyu Chen[1], Yuan Gao[2], Wujie Fu[2], Soon Thor Lim[3], Anil Prabhakar[4], Aaron Danner[2], Tao Zhu[1]; [1]*Chongqing Univ., China;* [2]*National Univ. of Singapore, Singapore;* [3]*Inst. of High Performance Computing, A*STAR, Singapore;* [4]*Indian Inst. of Technology Madras, India.* We demonstrate an integrated optoelectronic Ising machine for combinatorial optimization problems by integrating silicon modulators and germanium photodetectors. A 100-spin MAXCUT problem with square lattice graph is successfully solved by the proposed Ising chip.

W2A.38
Photonic Three-Dimensional Tensor Convolution Operation Based on Time-Wavelength Interleaved Frequency Synthesis Technology, Jiayuan Guo[1], Wenjia Zhang[1], Jiang Yue[1], Jiangbing Du[1], Zuyuan He[1]; [1]*Shanghai Jiao Tong Univ., China.* We propose an integrated photonic three-dimensional tensor convolution accelerator by time-wavelength interleaved frequency synthesis technology, achieving the extraction of three-dimensional CT edge information with 1K resolution @15 FPS and a PSNR of 24 dB.

W2A.39
Single-Shot Matrix-Matrix Multiplication Optical Processor for Deep Learning, Chao Luan[1], Ronald Davis[1], Dirk R. Englund[1], Ryan Hamerly[1]; [1]*RLE, MIT, USA.* We demonstrate a space-wavelength-time multiplexed optical tensor processor based on the chromatic dispersion of free-space diffraction grating. Parallel matrix-matrix multiplication with 64 MACs/shot and 8-bits precision over 7 wavelengths was demonstrated for accurate image classification.

W2A.40
Photonic KAN: a Kolmogorov-Arnold Network Inspired Efficient Neuromorphic Accelerator, Yiwei Peng[1], Sean Hooten[1], Xinling Yu[1], Thomas V. Vaerenbergh[1], Yuan Yuan[1], Xian Xiao[1], Bassem Tossoun[1], Stanley Cheung[1], Marco Fiorentino[1], Raymond G. Beausoleil[1]; [1]*Hewlett Packard Enterprise, USA.* We propose Photonic Kolmogorov-Arnold Networks, leveraging optical nonlinear transfer functions along edges. It achieves 2300× reduction in footprint-energy efficiency, alongside a 7× reduction in latency compared to previous photonic accelerators.

W2A.41
PipSwitch: A Circuit Switch Using Programmable Integrated Photonics, Eric Ding[1], Rachee Singh[1]; [1]*Cornelll Univ., USA.* We present an optical circuit switch design on programmable integrated photonics (PIPs). Our solution finds the correct and optimal set of

matchings that provides all-to-all network connectivity and demonstrates scalability to 32 ports.

W2A.42
Enabling Scalable Photonic Tensor Cores with Polarization-Domain Photonic Computing, Amin Shafiee[1], Linhong Chen[2], Sudeep Pasricha[1], Jie Yao[2], Mahdi Nikdast[1]; *[1]Colorado State Univ., USA; [2]Department of Materials Science and Engineerin, Univ. of California at Berkeley, USA.* We present a silicon-photonic tensor core using 2D ferroelectric materials to enable wavelength- and polarization domain computing. Results, based on experimentally characterized material properties, show up to 83% improvement in computation accuracy compared to coherent networks.

W2A.43
Optically Interconnected Disaggregated Datacenters in Support of ML/AI Applications: A Failure Analysis, Albert Pagès[1], Fernando Agraz[1], Salvatore Spadaro[1]; *[1]Universitat Politècnica de Catalunya, Spain.* Disaggregated datacenters are promising solutions for executing ML applications. One crucial aspect is the application resilience against infrastructure failures. We analyze application affectation and disruption rates in front of various failure patterns.

W2A.44
Digital Twin-Enabled Optical Network Channel Power Management by WSS and Booster Auto-Adjustment, Chenyu Sun[1,2], Xin Yang[4], Gabriel Charlet[1], Photios A. Stavrou[3], Yvan Pointurier[1]; *[1]Optical Communication Technologiy Lab, Paris Research Center, Huawei Technologies France SASU, France; [2]Sorbonne Univ., France; [3]Communication Systems Department, EURECOM, France; [4]Politecnico di Milano, Italy.* With a digital twin implementing a multi-step lookahead mechanism, we experimentally demonstrate how to increase WSS adjustment margin budget for enhanced power management in optical networks.

W2A.45
Optimization of Router Cost and Consumption in a Point-to-Multipoint Metro-Core Architecture, Polizois Soumplis[3,1], Konstantinos Christodoulopoulos[3,4], Panagiotis Kokkinos[3,5], Marco Quagliotti[6], Andrea Di Giglio[6], Antonio Napoli[7], Mohammad Hosseini[7], Konstantinos Yiannopoulos[3,2], Emmanuel Varvarigos[3,1]; *[1]Electrical and Computer Engineering, National Technical Univ. of Athens, Greece; [2]Informatics and Telecommunications, Univ. of the Peloponnese, Greece; [3]Inst. of Communications and Computer Systems, Greece; [4]Informatics and Telecommunications, National and Kapodistrian Univ. of Athens, Greece; [5]Digital Systems, Univ. of the Peloponnese, Greece; [6]TIM-Telecom Italia S.p.A., Italy; [7]Infinera, Germany.* We study the router cost and power consumption in a light-tree based architecture with coherent point-to-multipoint (P2MP) transceivers. Significant savings are expected compared to existing P2MP approaches due to router consolidation deeper in the metro-core.

W2A.46
Quantifying the Operational Benefits of Deep Learning Based Dynamic Traffic Prediction Using Real-World Dataset, Dimitris Uzunidis[1], Christos Christofidis[1], Ivan De Francesca[2], Jose Manuel Rivas Moscoso[2], David Larrabeiti[3], Josep Maria Fàbrega[4], Dan M. Marom[5], Ioannis Tomkos[1]; *[1]Univ. of Patras, Greece; [2]Telefónica, Spain; [3]Universidad Carlos III de Madrid, Spain; [4]Centre Tecnologic de Telecomunicacions de Catalunya, Spain; [5]Hebrew Univ. of Jerusalem, Israel.* A convolutional neural network is trained using real-world data, for dynamic prediction of the required transceivers supporting 6G X-haul, leading to 20% and 16% lower

average transceiver utilization over static and semi-static cases, respectively.

W2A.47

A Parallel Multi-Grid High-Degree OXC Node Architecture Based on Partial-WSS in a Scaling Multi-Fiber Network, Bojun Zhang[1], Jiawei Zhang[1], Zeshan Chang[2], Ruishan Chen[2], Zhiqun Gu[1], Ruikun Wang[1], Yongcheng Li[3], Yuefeng Ji[1]; *[1]Beijing Univ. of Posts and Telecommunications, China; [2]Huawei Technologies Co., Ltd., China; [3]Soochow Univ., China.* We propose a parallel multi-grid OXC node architecture based on partial-WSS to achieve the high-degree non-blocking connectivity in a scaling multi-fiber optical network, which reduces 70% bandwidth blocking ratio and 71.4% port counts of WSS.

W2A.48

Optical Transport Network Optimization Supporting Integrated Sensing and Communication Services, Markos Anastasopoulos[1], Jesus Gutierrez Teran[2], Anna Tzanakaki[1]; *[1]National and Kapodistrian Univ. of Athens, Greece; [2]IHP, Germany.* This paper proposes and experimentally validates an architecture exploiting an optical transport network interconnecting Radio Access Network and core domains, to facilitate joint support of sensing and communication services in accordance with the 6G vision.

W2A.49

Energy-Efficient Routing Based on Satellite-Ground Station Coordination in LEO Optical Satellite Networks, Cui Zijian[1]; *[1]Beijing Univ. of Posts and Telecommunications, China.* A collaborative energy-efficient routing algorithm reduces excessive power consumption of satellites in shadow regions in LEO optical networks, decreasing life consumption of heavily loaded satellites by 29.7% compared to conventional methods.

W2A.50

Autonomous Blocking Method Addressing Rogue User Terminals by Exploiting Photonic Gateway in Metro/Access Converged All-Photonics Network, Shin Kaneko[1], Yasutaka Kimura[1], Junichi Kani[1], Tomoaki Yoshida[1]; *[1]NTT Corporation, Japan.* We propose an autonomous method that blocks incorrect wavelengths from customer premises to metro/access-converged all-photonics network without adding special components, and demonstrate detection and shutdown in 18s, which is sufficiently short for initial optical-path setup.

W2A.51

200 Gb/s/λ OOK PON Within Only 50 GHz Bandwidth Enabled by Spectrum Compression Filter Achieving 32 dB Power Budget, Chao Yang[2], Chao Li[1], Yuhan Gong[2], Ming Luo[2], Jin Tao[2], Zichen Liu[1], Zhixue He[1]; *[1]Pengcheng Laboratory, China; [2]China Information Communication Technologies Group Corporation, China.* Supported by spectrum compression filter with 50 GHz effective bandwidth, 200 Gb/s OOK PON downstream transmission is successfully demonstrated with 32 dB power budget, achieving a low-cost, high-speed, high-performance solution for optical access network.

W2A.52

Fiber-WiFi Coordinated Seamless Handover and Resource Allocation for Immersive XR Collaborations Over FTTR-B, Sourav Mondal[1], Elaine Wong[1]; *[1]The Univ. of Melbourne, Australia.* We propose the first resource allocation scheme that harnesses predictive bandwidth allocation for Fiber-To-The-Room-Business networks with seamless Fiber-WiFi coordinated handover for immersive XR collaborations while meeting 8K frame quality and ≤15 msec end-to-end frame latency.

W2A.53

Silicon Photonics-Based Waveband Routing for Flexible Functional Splits, Takahiro Kodama[1], Ryosuke Matsumoto[2], Kazuhiro Ikeda[2], Shu Namiki[2]; *[1]Kagawa Univ., Japan; [2]National Inst. of Advanced Industrial Science and Technology, Japan.* We propose to exploit silicon photonics-based waveband routing for realizing flexible functional splits on the physical layer to maximize the performance at low-energy consumption. Key functions of waveband pass-through and add/drop were experimentally demonstrated.

W2A.54

Polarization Based Fiber Optic Sensing and Monitoring in Real-Time IM-DD Based PON, Dora van Veen[1], Kovendhan Vijayan[1], Robert Borkowski[1], Vincent Houtsma[1]; *[1]Nokia Corporation, USA.* We propose a low-complexity scheme to enable polarization sensing in IM-DD based PON. We performed a detailed real-time validation of the performance for fiber infrastructure monitoring and environmental sensing use-cases.

W2A.55

First Field Trial of FTTR Wi-Fi Inter-Domain Roaming Collaboration Based on Proposed Native Management and Control Architecture, Jinglong Zhu[1], Junwei Li[1], Shan Zhang[1], Yu Zhang[2], Leiya Hu[1], Dechao Zhang[1]; *[1]China Mobile Research Inst., China; [2]Huawei Technologies Co., Ltd, China.* We firstly propose native management and control architecture of FTTR Wi-Fi inter-domain seamless roaming, based on which a field trial is demonstrated and the results show the performance of roaming promoting more than 100%.

W2A.56

Soil Salinity Monitoring Using Active Sensing in Distributed Fiber Optic Sensors, Steven Binder[1], Mable Fok[1]; *[1]The Univ. of Georgia, USA.* Soil salinity content is monitored by embedding a distributed fiber optic sensor underneath soil and actively sensing an acoustic signal's propagation properties. The system can distinguish soil salinity levels from 0 dS/m to 8 dS/m.

W2A.57 Motion Reconstruction of an Inchworm Inspired Soft Robotic Climber Using Fiber Optic Sensors and Neural Network, Mei Yang[1], Dongliang Guo[2], Sheng Li[2], Steven Binder[1], Cole Sterck[1], Mable Fok[1]; *[1]The Univ. of Georgia, USA; [2]Univ. of Virginia, USA.* An inchworm-inspired soft robotic climber with embedded Fiber Bragg Grating (FBG) sensors has been designed and experimentally studied. Real-time motion reconstruction of the climber is achieved using FBG and Long Short-Term Memory (LSTM) neural networks.

14:00 -- 16:00
Room 207
W3D • Photonics Enabled High Performance Computing
Presider: Mahdi Nikdast; Colorado State Univ., USA

W3D.1 • 14:00 (Invited)
Photonic Fabric for Memory and Compute Disaggregation, Subal Sahni[1], Ankur Aggarwal[1], Nadav Bergstein[1], Trung Diep[1], Jing Ding[1], Andrew Gimlett[1], Ravi Mahatme[1], Parmanand Mishra[1], Sujit Ramachandra[1], Matteo Staffaroni[1], Angelina Totovic[1], Saurabh Vats[1], Phil Winterbottom[1], Waleed Younis[1], Shifeng Yu[1], David Lazovsky[1]; *[1]Celestial AI, USA.* Photonic Fabric Appliance offers a pathway to bypass the bounded memory to compute ratio found in commercially available GPUs, offering improvements in throughput, energy efficiency and latency, laying the foundation for future-proof AI hardware.

W3D.2 • 14:30
Scalable and Calibration-Free Microring Circuits Programming with Over 9-Bit Precision, Shaojie Liu[1], Tengji Xu[1], Benshan Wang[1], Dongliang Wang[1], Qiarong Xiao[1], Chaoran Huang[1]; *[1]The Chinese Univ. of Hong Kong, Hong Kong.* We propose a method to program large-scale MRR circuits with minimum calibration. We experimentally achieve over 9-bit precision on a large-scale MRR array and demonstrate a photonic eigenvector and eigenvalue solver with errors of 10^{-4}.

W3D.3 • 14:45
Photonic 4D-Convolution Tensor Core Based on Micro-Ring Mesh Architecture, Jiang Yue[1], Wenjia Zhang[1], Han Wang[1], Jiayuan Guo[1], Jiangbing Du[1], Zuyuan He[1]; *[1]Shanghai Jiao Tong Univ., China.* We propose a 4D-photonic convolution tensor core leveraged by the micro-ring mesh that enabling parallel batch processing and parallel multi-kernel computation. The equivalent computing power is up to 2.24 Tera-operations per second (TOPs) per second with over 90% recognition accuracy.

W3D.4 • 15:00
Experimental Demonstration of an Optical Neural PDE Solver via on-Chip PINN Training, Yequan Zhao[1,2], Xian Xiao[1], Antoine Descos[1], Yuan Yuan[1], Xinling Yu[1,2], Geza Kurczveil[1], Marco Fiorentino[1], Zheng Zhang[2], Raymond G. Beausoleil[1]; *[1]Hewlett Packard Enterprise, USA; [2]Univ. of California, Santa Barbara, USA.* Partial differential equation (PDE) is an important math tool in science and engineering. This paper experimentally demonstrates an optical neural PDE solver by leveraging the back-propagation-free on-photonic-chip training of physics-informed neural networks.

W3D.5 • 15:15
Photonic Analog-to-Digital Architecture for Accelerating Multiply-Accumulate Operations, Nathaniel J. Nauman[1], James Robinson[1], Yuyang Wang[1], Kaylx Jang[1], Xiang Meng[1], Keren Bergman[1]; *[1]Columbia Univ., USA.* We demonstrate a 3-bit photonic analog-to-digital architecture to accelerate multiply-accumulate operations, achieving a ±300mV buffer for 50mV steps within a 350mV range. This architecture enhances energy efficiency for near-memory computation while maintaining full digital precision.

W3D.6 • 15:30 (Invited)

In-Memory Optical Computing with Non-Volatile Silicon Photonic Memory, Bassem Tossoun[1], Di Liang[2], Stanley Cheung[1], Yuan Yuan[1], Xian Xiao[1], Yanir London[1], Bin Shi[1], Thomas V. Vaerenbergh[1], Geza Kurczveil[1], Marco Fiorentino[1], Raymond G. Beausoleil[1]; [1]*Hewlett Packard Labs, Hewlett Packard Enterprise, USA;* [2]*Electrical and Computer Engineering, Univ. of Michigan, USA.* Research in non-volatile memory on silicon photonic integrated circuits is advancing rapidly. We explore recent progress in this emerging area and discuss their applications within programmable PICs for machine learning, artificial intelligence, and quantum computing.

14:00 -- 16:00

Room 208

W3E • Optical Performance Monitoring and Longitudinal Power Monitoring

Presider: Ezra Ip; NEC Laboratories America Inc., USA

W3E.1 • 14:00

Demonstration of Linear and Nonlinear SNR Estimation Using a Commercial Transponder, Vinod Bajaj[1], Fred Buchali[2], Fabien Boitier[1], Petros Ramantanis[1], Vahid Aref[2], Patricia Layec[1]; [1]*Nokia Bell Labs, France;* [2]*Nokia Solutions and Networks, Germany.* We demonstrate linear and nonlinear SNR estimation over a commercial 130 Gbaud coherent transponder by using received signal features. The obtained linear and nonlinear SNR estimation error were within 0.7 dB and 1.3 dB, respectively.

W3E.2 • 14:15

Enhanced Fault Diagnosis Framework by Critical Time Data Capture, Qingyi Guo[1], Choloong Hahn[1], Junho Chang[1], Zhiping Jiang[1]; [1]*Huawei Technologies Canada, Canada.* The fault diagnosis framework is enhanced to guarantee the capture of signal waveform at the critical time. We demonstrate the identification and localization of sub-microsecond fault induced by OTDR.

W3E.3 • 14:30

Visualizing Longitudinal Evolution of Forward- and Backward-Raman-Amplified Power and Gain, Runa Kaneko[1], Takeo Sasai[1], Masanori Nakamura[1], Fukutaro Hamaoka[1], Etsushi Yamazaki[1]; [1]*NTT Network Innovation Laboratories, Japan.* We experimentally demonstrated fiber-longitudinal power monitoring (LPM) in the signal transmission using forward- and backward-pumped distributed Raman amplifiers. LPM visualized the effect of anomaly loss in the link on the longitudinal Raman gain.

W3E.4 • 14:45

SNR of Fiber-Longitudinal Power Monitor, Takeo Sasai[1,2], Etsushi Yamazaki[1], Sze Y. Set[2], Shinji Yamashita[2]; [1]*NTT, Japan;* [2]*The Univ. of Tokyo, Japan.* We present and experimentally validate analytical results on the accuracy of fiber-longitudinal power monitor at arbitrary positions. The power-profile SNR is shown to quantify the accuracy and determine the detectable limit of loss events.

W3E.5 • 15:00

Implementation Penalties for Nonlinear Interference Estimation with Linear Least Squares Longitudinal Power Monitoring, Lorenzo Andrenacci[1], Antonino Nespola[2], Stefano Straullu[2], Yanchao Jiang[1], Stefano Piciaccia[3], Gabriella Bosco[1], Dario Pilori[1]; *[1]Politecnico di Torino, Italy; [2]LINKS Foundation, Italy; [3]CISCO Phtononics, Italy.* We investigate the practical implementation penalty of using hard-decided symbols to generate the reference signal in linear least squares longitudinal power monitoring for nonlinear interference estimation, both numerically and over a 17x65-km experimental setup.

W3E.6 • 15:15

Mitigation of Power Offset Induced by Hard-Decision-Error in Fiber Longitudinal Power Profile Estimation, Yingjie Jiang[1], Du Tang[1], Ji Luo[2], Yu Chen[2], Bofang Zheng[2], Yaojun Qiao[1]; *[1]State Key Laboratory of Information Photonics and Optical Communications, Beijing Univ. of Posts and Telecommunications, China; [2]B&P Laboratory, Huawei Technologies Co. Ltd., China.* We propose a fiber-nonlinearity distribution weighting-based scheme to mitigate the power offset induced by hard-decision (HD) error in least-square PPE. Experimental results demonstrate that the proposed method is as accurate as using transmitter-side (Tx) data.

W3E.7 • 15:30

Impact of BER on Longitudinal Power Profile Estimation and its Correction, Junho Chang[1], Choloong Hahn[1], Qingyi Guo[1], Zhiping Jiang[1]; *[1]Huawei Technologies Canada, Canada.* We investigate the accuracy degradation of the longitudinal power profile estimation due to erroneous retrieval of reference signals in high-BER regions. A correction formula for the BER-induced power offset is derived and experimentally verified.

W3E.8 • 15:45

A Multi-Stage Method for Least-Square Based Longitudinal Power Profile Computation, Fabien Boitier[1], Alessandro Pacini[2,1], Alix A. May[1], Patricia Layec[1]; *[1]Nokia Bell Labs, France; [2]Scuola Superiore Sant'Anna, Italy.* We propose a multi-stage computation for longitudinal power monitoring reducing the memory footprint compared to linear least square approach. We demonstrate a power accuracy penalty lower than 0.1dB over more than 85% of link.

14:00 -- 16:00
Room 215
W3I • Radio-over-Fiber (RoF) Transmission
Presider: Simon Rommel; Technische Universiteit Eindhoven, Netherlands

W3I.1 • 14:00

Ultra-low Phase Noise Photonic-Generated Millimeter Wave to Overcome the Capacity Limitation in Electronic D-Band (110-170 GHz) Signal Generation, Zichuan Zhou[1], Amany Kassem[1], Izzat Darwazeh[1], Zhixin Liu[1]; *[1]Univ. College London, UK.* We lock ultra-low-noise lasers to generate a 153-GHz millimeter-wave carrier with a record-low integrated (10Hz-10MHz) jitter of 14fs, outperforming a conventional electronic multiplier-based signal generator, resulting in >6dB sensitivity enhancement using 10GBaud 64QAM.

W3I.2 • 14:15

Simplified FR3-Band Radio Signal Transmission with Data-Seeded Wideband Photonic RF Carrier Generation, Bernhard Schrenk[1]; [1]*Austrian Inst. of Technology, Austria.* Full-octave RF generation from 7.5-15GHz with up to 12-fold frequency enhancement of a fronthauled 1.25Gb/s data harmonic is demonstrated. Upper mid-band radio transmission is accomplished without BER penalty when compared to local RF synthesis.

W3I.3 • 14:30

Demonstration of Fiber-THz Mobile Fronthaul System Over a 200 m SIMO Wireless Link Employing Phase Matching and MRC Technology, Zhifeng Xie[2], Bingchang Hua[1], Yuancheng Cai[1], Xiaoguang Yang[2], Weidong Tong[2], Zhigang Xin[2], Junjie Ding[1], Jiao Zhang[2,1], Mingzheng Lei[1], Yucong Zou[1], Xingyu Chen[1], Min Zhu[2,1], Jianjun Yu[1,2]; [1]*Purple Mountain Laboratories, China;* [2]*Southeast Univ., China.* We successfully demonstrated 32-Gbaud 4QAM signal transmission over a 200m wireless SIMO link in the fiber-terahertz mobile fronthaul system at J-Band, achieving 2.5 dB SNR gain based on phase matching and MRC technology.

W3I.4 • 14:45 (Invited)

Toward 6G: Analog Fronthaul Solutions for Mobile Networks, Rafael Puerta[1,2], Tianyu Jiang[2], Kristaps Rubuls[3], Dan Li[2], Mahdieh Joharifar[2], Armands Ostrovskis[3], Fabio Pittala[4], Markus Gruen[4], Hadrien Louchet[4], Anders Djupsjöbacka[5], Richard Schatz[2], Toms Salgals[3], Sandis Spolitis[3], Vjaceslavs Bobrovs[3], Oskars Ozolins[5,3], Xiaodan Pang[2,5]; [1]*Ericsson Research, Ericsson, Sweden;* [2]*Applied Physics, KTH Royal Inst. of Technology, Sweden;* [3]*Riga Technical Univ., Latvia;* [4]*Keysight Technologies, Germany;* [5]*RISE Research Inst.s of Sweden, Sweden.* This paper explores photonic-based analog fronthaul solutions for 6G, highlighting their effectiveness in meeting the RF requirements of standards, supporting future distributed-MIMO networks, and providing insights into prospective solutions for radios in potential 6G bands.

W3I.5 • 15:15

Continuous and Capacity-Approaching Scaling Between SNR and Spectral Efficiency Enabled by FDM Fractional-Order Digital-Analog RoF, Yicheng Xu[1], Yixiao Zhu[1], Mengfan Fu[1], Xi Chen[1], Yongxin Sun[1], Weisheng Hu[1], Qunbi Zhuge[1]; [1]*Shanghai Jiao Tong Univ., China.* We propose and experimentally demonstrate a frequency-division-multiplexing fractional-order digital-analog RoF with continuous and capacity-approaching scaling between SNR and spectral efficiency. ~2 dB SNR gain per 0.25 increment in bandwidth ratio is shown in the experiment.

W3I.6 • 15:30

Demonstration of Bidirectional W-Band Seamless Fiber-Wireless Integrated System Based on Full Photonic Up- & Down-Conversions at Fiber Optic Network Side, Boyu Dong[1], Yinjun Liu[1], Zhongya Li[1], Sizhe Xing[1], Aolong Sun[1], Junhao Zhao[1], Yaxuan Li[1], Junlian Jia[1], Jianyang Shi[1], Yingjun Zhou[1], Ziwei Li[1], Chao Shen[1], Nan Chi[1], Junwen Zhang[1]; [1]*Fudan Univ., China.* We propose and demonstrate a bidirectional W-band seamless fiber-wireless integrated system, utilizing all-optical up-&down-conversions at fiber optic network side, achieving the access data rates of 45.2 and 128 Gbps in UL and DL, respectively.

W3I.7 • 15:45
Fading-Free 2.58-Tb/s/λ CPRI-Equivalent Rate Analog IFoF Fronthaul Over 10-km Fiber Using TFLN DDMZM, Yixiao Zhu[1,3], Xiansong Fang[2], Lingjun Zhou[2,3], Junbo Zhu[3], Yunchen Li[3], Yimin Hu[1], Zhixue He[3], Lei Wang[3], Weisheng Hu[1,3], Ke Li[3], Fan Zhang[2,3]; [1]*Shanghai Jiao Tong Univ., China;* [2]*Peking Univ., China;* [3]*Pengcheng Laboratory, China.* We demonstrate fading-free analog IFoF fronthaul with pre-dispersion compensation based on high-bandwidth and low-V_π thin-film $LiNbO_3$ dual-drive Mach-Zehnder modulator. We achieve 3.32-Tb/λ and 2.58-Tb/s/λ CPRI-equivalent rates at BTB and 10-km fiber with SNR exceeding 21.9dB.

14:00 -- 16:00
Room 301
W3J • Sensing and Protection in Access Networks
Presider: Paul Wright; British Telecommunications, UK

W3J.1 • 14:00
Coherent OFDR-Based Individual Fiber Identification and Event Detection Over a 21-km Passive Optical Distribution Network With a 1:32 Split, Lauren Dallachiesa[1], Mikael Mazur[1], Patrick Iannone[1], Nicolas K. Fontaine[1], Roland Ryf[1], Ellsworth Burrows[1], David T. Neilson[1]; [1]*Nokia Bell Labs, USA.* We demonstrate a real-time polarization-resolved coherent OFDR system for fiber identification and event detection in a 1:32 split PON, leveraging Rayleigh signatures to uniquely identify distribution fibers and events enabling monitoring beyond the passive splitter.

W3J.2 • 14:15 (Invited)
Accelerating Distributed Fiber Optic Sensing (DFOS) Ecosystem Development in Metro and Access Networks, Jun Shan Wey[1]; [1]*Verizon Communications Inc, USA.* While DFOS promises to greatly enhance optical network infrastructure OAM and create future new business opportunities, the industry ecosystem is still in its early stages. We review the ecosystem landscape and discuss standards development progress.

W3J.3 • 14:45
Wavelength and Code Orthogonality Based Distributed Acoustic Sensing Over a Passive Optical Network, Pallab K. Choudhury[1], Elie Awwad[1]; [1]*Télécom Paris, IP Paris, France.* We present a wavelength and code orthogonality based DFOS enabling simultaneous sensing of all paths of a splitter-based passive optical network. Strain sensitivity of $80nm_{pp}$ is measured with no penalty on coexisting 10Gb/s downstream transmission.

W3J.4 • 15:00
DSP-Assisted in-Vivo Health Monitoring for ≥ 50G PON, Christoph Füllner[1], Anuj K. Yadav[2], Rene Bonk[1]; [1]*Nokia Bell labs, Germany;* [2]*École Polytechnique Fédérale de Lausanne, Switzerland.* We propose a novel in-vivo health monitoring concept for PON exploiting digital signal processing. We investigate the correlation between potential PON fault scenarios and the digitally derived link quality parameters.

W3J.5 • 15:15

Enhancing Operational Security of Human-to-Machine Applications Through Concept Drift Detection, Xiangyu Yu[1], Carlos Natalino[2], Paolo Monti[2], Lena Wosinska[2], Sourav Mondal[1], Yuxiao Wang[1], Elaine Wong[1]; *[1]Univ. of Melbourne, Australia; [2]Chalmers Univ. of Technology, Sweden.* We propose a novel concept drift detection framework to detect and mitigate malicious traffic for human-to-machine applications in fiber-wireless access networks, reducing uplink latency by up to 98 % and enhancing its operational security.

W3J.6 • 15:30

Chaotic Digital Filter-Based Physical Layer Security in Seamlessly Converged Fiber-MmWave Access Networks, Jiaxiang He[1], Luis Vallejo[1], Wei Jin[1], Roger P. Giddings[1], Jianming Tang[1]; *[1]Bangor Univ., UK.* Chaotic digital filter-based physical-layer security is experimentally demonstrated, for the first time, over 25km fiber, 5m mmWave-converged networks with free-running laser/envelope detection-based mmWave generation/detection, transmitting 1.67Gb/s encrypted signals continuously without O-E-O conversions and extensive DSPs.

W3J.7 • 15:45

650 nm LED Integrated in PON Optical Sub Assembly for Future PON Management, Jeremy Potet[1], Georges Gaillard[1], Fabienne Saliou[1], Gael Simon[1], Aude Rodriguez[1], Dylan Chevalier[1], Philippe Chanclou[1]; *[1]Orange, France.* A 50 MBit/s link based on a 650 nm LED emitter integrated in a PON optical subassembly is proposed. Transmission through up to 5 km of single mode fiber is demonstrated. Use cases like PON troubleshooting or PtP management are discussed.

14:00 -- 16:00
Room 304
W3K • Specialty Fiber Devices I

Presider: Atsushi Nakamura; NTT, Japan

W3K.1 • 14:00 (Invited)

Practical Wavelength Conversion Techniques Using Highly Nonlinear Fibers, Shigehiro Takasaka[1], Ryuichi Sugizaki[1], Masanori Takahashi[1]; *[1]Furukawa Electric Co., Ltd., Japan.* We review wavelength conversion techniques using highly nonlinear fibers toward practical applications. Dispersion stable HNLFs show wideband wavelength conversion over C-band. Suppression techniques on stimulated Brillouin scattering increases conversion efficiency more than 0 dB.

W3K.2 • 14:30

Experimental Comparison of S-Band Doped Fiber Amplifier, Lumped and Distributed Raman Amplifiers in a Long-Haul Coherent Transmission, Dini Pratiwi[1], Mingming Tan[1], Pratim Hazarika[1], Aleksandr Donodin[1], Ian Phillips[1], Wladek Forysiak[1]; *[1]Aston Univ., UK.* We compare S-band long-haul transmission of 30GBaud DP-16-QAM WDM signals using TDFA, distributed Raman and three types lumped Raman amplifiers over 1050km SSMF. Distributed Raman amplifier performed the best, followed by TDFA and lumped Raman.

W3K.3 • 14:45
Role of Dispersion Slope in Fiber Optical Parametric Amplifiers, Vladimir Gordienko[1], Andrew D. Ellis[1], Nick Doran[1]; [1]*Aston Univ., UK.* We demonstrate that employment of gain fibers with low dispersion slope in fiber optical parametric amplifiers reduces the incurred error vector magnitude by up to 4.9 dB via mitigation of the impact of the pump phase modulation.

W3K.4 • 15:00
FOPA Performance Limitations Due to Pump Phase Modulation, Mariia Bastamova[1], Vladimir Gordienko[1], Stylianos Sygletos[1], Mingming Tan[1], Aleksandr Donodin[1], Nick Doran[1], Andrew D. Ellis[1]; [1]*Aston Univ., UK.* Pump phase modulation, employed to mitigate stimulated Brillouin scattering in fiber optical parametric amplifiers (FOPAs), is a key source of signal degradation. We demonstrate significant potential to overcome this limitation and enable high-performance FOPA operation as an inline amplifier.

W3K.5 • 15:15
High-Isolation and Low-Crosstalk Optical-Circulator-Based 2-Core Fan-out Device, Yuta Wakayama[1], Asumi Kaya[2], Ikuya Saji[2], Shohei Beppu[1], Kosuke Komatsu[1], Daiki Soma[1], Taketoshi Takahata[2], Tetsuya Kobayashi[2], Lidia Galdino[3], Kevin Bennett[3], Sergejs Makovejs[3], Noboru Yoshikane[1], Takehiro Tsuritani[1]; [1]*KDDI Research, Japan;* [2]*Optoquest, Japan;* [3]*Corning, USA.* We consolidate an optical circulator and a 2-core fiber fan-out into a single device, achieving an insertion loss of 0.8 dB, with isolation exceeding 50 dB and inter-core crosstalk remaining below −65 dB.

W3K.6 • 15:30 (Invited)
Advanced Infrared Fiber Lasers and Amplifiers: Circumnavigating the Earth with All-Optical Unregenerated Lightwave Transmission, Robert E. Tench[1,2], Keith Petrillo[3]; [1]*RET and Associates LLC, USA;* [2]*Principal Fiber Laser Scientist, Fibertek Inc., USA;* [3]*Fibertek, USA.* We present recent designs for novel infrared fiber amplifiers in all-optical unregenerated DWDM transmission systems circumnavigating the Earth with satellite free-space and subsea fiber lightwave technologies. Practical architectures and timelines for deployment of these novel amplifiers and systems are discussed.

14:00 -- 16:00
Rooms 201-202
W3A • Advanced Packaging and Integrated Optics for Scale-Up AI interconnects I
Presider: Juthika Basak; Advanced Micro Devices Inc, USA

W3A.1 • 14:05 (Invited)
“The Copper Behind Blackwell”: Understanding Today's Copper Scale-up Networks, Karl Bois[1]; [1]*NVIDIA Corporation, USA.* This presentation will delve into leading-edge copper scale-up architectures. The historical trend of bandwidth in NVIDIA GPUs and all-to-all GPU domain will be discussed. A scale-up copper architecture utilizing state-of-the-art signaling at 200 Gbit/s per differential pair will be presented, specifically the GB200 NVL 72 rack-scale design. The discussion will cover its constitutive components, including GB200 compute nodes, NVLink switch trays, and copper cable backplane cartridges.

W3A.2 • 14:30 (Invited)
The Paradigm Shift: Bringing Optics to AI, Vivek Raghuraman[1]; [1]*Mixx Technologies, USA.* AI scale-up requires high-density interconnects matching the D2D interface bandwidth. By doubling bandwidth yearly, packaging architecture changes have become unsustainable. Silicon photonics enables scaling while maintaining consistency in packaging, providing a reliable platform for generations.

W3A.3 • 14:50 (Invited)
Optical Solutions for Scale Up, Julie Sheridan Eng[1]; [1]*Coherent Corp, USA.* This talk will review optical solutions for scale up, including shortwave multi-mode VCSEL-based solutions, and Silicon Photonics-based solutions including InP lasers. The state of the art including strengths and weaknesses of each path will be reviewed.

W3A.4 • 15:10 (Invited)
Integrated Versus External Laser Sources in Pluggable and Co-Packaged Optics Applications, Sylvie Menezo[1]; [1]*SCINTIL Photonics, SCINTIL Photonics, France.* We will evaluate the advantages and disadvantages of integrated laser sources on silicon: performance, power consumption, thermal aspects, ease/cost of implementation will be discussed for pluggable and co-packaged optics applications.

14:00 -- 16:00
Rooms 205-206
W3C • Multi-Core Fibers
Presider: Takashi Matsui; NTT Corporation, Japan

W3C.1 • 14:00 (Invited)
Fabrication of Multicore Fibers from Large-Scale Preforms, Kay Schuster[1], Tobias Tiess[1], Michael Lorenz[1], Martin Böttcher[1]; [1]*Heraeus Comvance, Germany.* We present the scaled-up fabrication of multicore fibers (MCF) based on the drilling of large cladding cylinders. Several MCF samples are discussed with batch sizes up to 2000 fiber-km of MCF and excellent axial conformity.

W3C.2 • 14:30 (Top-Scored)
16-Core MCF With Standard-Coating-Diameter for 1,600 Gbps Data Center Communication, Shota Kajikawa[1], Ryota Kaji[1], Katsuhiro Takenaga[1], Takuya Oda[1], Kentaro Ichii[1]; [1]*Fujikura Ltd., Japan.* 16-core multicore fiber with standard-coating-diameter offers a simple connectivity and a high-density optical solution for 1,600 Gbps data center communication to address the increasing bandwidth demand for generative artificial intelligence.

W3C.3 • 14:45
Macro- and Micro-Bending Performances of Uncoupled 200 µm-Coated Multi-Core Fibers, Yuki Kawaguchi[1], Hirotaka Sakuma[1], Tetsuya Haruna[1], Tetsuya Hayashi[1], Takemi Hasegawa[1]; [1]*Sumitomo Electric Industries, Ltd, Japan.* We investigate bending performances of 200µm-coated multi-core fibers and show the bending losses were equivalent to those of single-core fibers and the crosstalk induced by wire-mesh micro-bending was as low as -52dB@100 km in counter-propagation.

W3C.4 • 15:00

Dual-Comb-Enabled Locating and Assessment of Splicing Points in Heterogeneous Multicore Fiber, Chen Cheng[1], Mingming Zhang[1], Zichen Qian[1], Junda Chen[1], Can Zhao[1], Ming Tang[1]; [1]*Huazhong Univ. of Science and tech., China.* We propose a dual-comb-enabled method for precise splicing point measurement in heterogeneous multicore fibers, achieving 3.34-m spatial resolution with 10-MHz receiving bandwidth, providing an efficient tool for future MCF splicing quality assessment concerning XT.

W3C.5 • 15:15

Locating Excess Mode-Dependent Loss in Coupled Multi-Core Fibers Based on Coherent OTDR, Jumpei Hayakawa[1], Atsushi Nakamura[1], Shingo Ohno[1], Kunihiro Toge[1]; [1]*NTT, Japan.* We propose and experimentally demonstrate a novel method based on coherent optical time domain reflectometry for locating excess mode-dependent loss in coupled multi-core fibers for the first time.

W3C.6 • 15:30

Single Spectrum Cutoff Wavelength Measurement Method for Multicore Fibers, Elaine S. Chou[1], Takemi Hasegawa[1], Tetsuya Hayashi[1]; [1]*Optical Communications Laboratory, Sumitomo Electric Industries, Ltd., Japan.* We propose a simplified cutoff wavelength measurement method for multicore fibers, which derives an upper bound on the maximum cutoff wavelength among the cores from a single spectral attenuation measurement employing full-mode, full-core excitation.

W3C.7 • 15:45

N × 106.25 Gb/s PAM4 Transmission Using Multicore Graded-Index Plastic Optical Fiber, Yasuhiro Koike[1], Kenta Muramoto[1]; [1]*Keio Photonics Research Inst., Keio Univ., Japan.* Multicore graded-index plastic optical fibers fabricated through a single-step extrusion process are presented, demonstrating PAM4 transmission at up to 106.25 Gb/s per channel with multimode VCSELs for large-capacity parallel optical interconnects.

14:00 -- 16:00
Rooms 209-210
W3F • Switches and Control of Photonic Circuits
Presider: Takako Hirokawa; GlobalFoundries, USA

W3F.1 • 14:00

Silicon 4×4×8λ Space-and-Wavelength Selective Optical Switch with Resonant Phase Shifters, Rui Ma[1], Lingzhi Luo[1], Chunhui Yao[1], Jing Zhang[2], Minjia Chen[1], Peng Bao[1], Günther Roelkens[2], Richard Penty[1], Qixiang Cheng[1], Tongyun Li[1]; [1]*Univ. of Cambridge, UK;* [2]*Ghent Univ.-imec, Belgium.* A silicon 4×4×8λ space-and-wavelength selective optical switch in a modified dilated Banyan topology is demonstrated with Mach–Zehnder interferometers and resonant phase shifters. All 128 routing channels exhibit >30dB extinction ratio and > 60GHz passband.

W3F.2 • 14:15 (Top-Scored)

Broadband and Low-Crosstalk 2×2 Electro-Optic Switch via Micro-Transfer Printing TFLN on Si_3N_4, Jinwei Su[1], Wei Gao[1], Zekun Cui[1], Liangjun Lu[1,2], Kan Wu[1], Jianping Chen[1,2], Linjie

Zhou[1,2]; [1]*Shanghai Jiao Tong Univ., China;* [2]*SJTU-Pinghu Inst. of Intelligent-Optoelectronics, China.* We demonstrate a 2×2 electro-optic switch based on cascaded 1×2 MZIs via micro-transfer printing TFLN on the Si_3N_4, showing a 3-dB bandwidth of >100 nm, crosstalk of <-45 dB, and response time of <3 ns.

W3F.3 • 14:30 (Tutorial)
Controlling Broadband and Resonant PICs with Many Components, Francesco Morichetti[1]; [1]*Politecnico di Milano, Italy.* This tutorial provides an overview of the main building blocks for complex PICs and introduces tools for automated calibration and feedback control of reconfigurable PICs. Applications in optical communications, sensing and computing are illustrated.

W3F.4 • 15:30
Input and Output Port-Adjacent Silicon Photonics PILOSS Switch for Wafer-Scale Optical Interconnections, Siim Heinsalu[1], Ryotaro Konoike[1], Keijiro Suzuki[1], Kazuhiro Ikeda[1]; [1]*National Inst. of Advanced Industria, Japan.* We propose a novel optical switch topology that dramatically simplifies the rewiring of optical waveguides to connect multiple xPU chiplets for future optical substrates. The topology was successfully demonstrated with an 8 × 8 switch.

W3F.5 • 15:45
Dilated Crosspoint 4×4×4λ Optical Switch, Ziyao Zhang[1], Bohao Sun[1], Minjia Chen[1], Rui Ma[1], Richard Penty[1], Qixiang Cheng[1], Tongyun Li[1]; [1]*Univ. of Cambridge, UK.* We propose and demonstrate a novel dilated crosspoint 4×4×4λ space-and-wavelength selective switch. Experimental results reveal that the switch achieves an insertion loss ranging from 2.3dB to 8.6dB and crosstalk levels in between -35.3dB and -59.7dB.

14:00 -- 16:00
Rooms 211-212
W3G • Imaging and Shape Sensing
Presider: Abel Lorences-Riesgo; Huawei Technologies, France

W3G.1 • 14:00 (Invited)
Subsurface Monitoring and Imaging Based on DAS, Ettore Biondi[1,2], Jiaxuan Li[1], Elijah Bird[1], Zhongwen Zhan[1]; [1]*Seismological Laboratory, California Inst. of Technology, USA;* [2]*Geophysics Department, Stanford Univ., USA.* We demonstrate how distributed acoustic sensing arrays deployed on existing urban telecommunication fiber can be used to perform high-resolution subsurface imaging of the Los Angeles basin by leveraging local and regional natural seismicity present in Southern California.

W3G.2 • 14:30
Fiber Shape Sensing Using a Single-Core Standard Single-Mode Fiber, Pedro Tovar[1], Jiachuan Lin[1], Zhiping Jiang[1]; [1]*Huawei Technologies Canada Co., Ltd., Canada.* This work presents the first technique for fiber shape sensing using one single-core standard single-mode fiber. Experiments identified circular loops, straight paths, and spools. Potential applications are expected in fiber slack detection and manhole localization.

W3G.3 • 14:45
Ultra-Broadband High-Speed Wavelength-Swept DFB Laser Array and Precision Fiber Bragg Grating Sensor Interrogation System, Yaqiang Fan[1], Pan Dai[1], Zhenxing Sun[1], Yuan Lv[1], Wei Yuan[1], Haolin Xia[1], Jingxuan Zhang[1], Junwei Dong[1], Jihong Xu[1], Feng Wang[1], Xiangfei Chen[1]; *[1]Nanjing Univ., China.* A robust, ultra-broadband high-speed wavelength-swept DFB laser array with 60 nm range and 82.7 kHz speed enables high-precision FBG sensor interrogation, stable even in challenging environments, with potential for extensive applications in optical sensing technologies.

W3G.4 • 15:00
Ultra-Weak Fiber Bragg Grating (UWFBG) Array With 7,560 Gratings for High-Resolution Distributed Sensing, Zhengqi Sun[1], Xiangpeng Xiao[1], Yuejuan Lv[1], Hai Liu[1], Ke Ai[1], Qizhen Sun[1,2], Zhijun Yan[1,2]; *[1]Huazhong Univ. of Science and Technology, China; [2]Huazhong Univ. of Science and Technology, China.* We present a wavelength division multiplexing UWFBG array including 7,560 FBGs with 8 mm grating length and interval interrogated by OFDR. The measuring range and precision are up to 5,200 με and 1.1 pm, respectively.

W3G.5 • 15:15
Twist-Compensation and Self-Calibration Method for High Accuracy DFBG-Based Shape Sensing, Weiliang Zhao[1], Zhijun Yan[1], Xiangpeng Xiao[1]; *[1]Huazhong Univ. of Science and Techn, China.* We proposed a twist-compensation and self-calibration method for high accuracy DFBG-based shape sensing. The method reduces the maximum reconstruction error of 2D and 3D shapes from 1.20% and 5.78% to 0.29% and 2.87%, respectively.

W3G.6 • 15:30
Double-Effect Off-Axis Ring Bragg Gratings Inscribed by Femtosecond Laser for Curvature and Temperature Sensing, Chao He[1], JiaMing Wu[1], Xuewen Shu[1]; *[1]Huazhong Unversity of Science and Techno, China.* We demonstrate a novel curvature and temperature sensor based on a off-axis ring fibre Bragg grating inscribed by femtosecond laser. The curvature and temperature sensitivity are 1.587 nm/m^{-1} and -60 pm/°C, respectively.

W3G.7 • 15:45
Enhancing φ-OFDR Sensing Distance and Accuracy Based on Synchronous Equal Frequency Resampling, Tianle Chen[1], Zhou Xu[1], Guijiang Yang[1], Lei Tu[1], Liang Wang[1], Ming Tang[1]; *[1]Huazhong Univ. of Sci. & Tech., China.* Synchronous equal frequency resampling is proposed to simultaneously compensate both the random laser frequency sweep range and sweep nonlinearity. The strain RMSE is reduced by 16 times with sensing distance extended to 70 m.

14:00 -- 16:00
Rooms 213-214
W3H • Coherent and Direct Detect Transmission Technologies
Presider: Frank Chang; Source Photonics, USA and Molly Piels; OpenLight Photonics, USA

W3H.1 • 14:00 (Top-Scored)
A SiP O-Band Transmitter Implementing Polarization Compensation Enabling Remote Operation of the Carrier Laser, Aleksandar Nikic[1], Weijia Li[1], Charles St. Arnault[1], Santiago

Bernal[1], Benton Qiu[1], Essam Berikaa[1], Kaibo Zhang[1], Luhua Xu[4], Max Zhang[2], Ian Plant[3], Alessandra Bigongiari[5], Fabio Cavaliere[5], Antonio D'Errico[5], Luca Giorgi[5], Stephane Lessard[5], Roberto Sabella[5], Stefano Stracca[5], David Plant[1]; [1]*McGill Univ., Canada;* [2]*College Brebeuf, Canada;* [3]*Vanier College, Canada;* [4]*CMC Microsystems, Canada;* [5]*Ericsson, Italy.* We demonstrate a SiP O-band transmitter, compensating for any injected laser SOP, achieving 100/178 Gbps PAM4/PAM8 performance below Hard-Decision and Soft-Decision FEC thresholds, with the carrier laser located 1 km away on SSMF.

W3H.2 • 14:15
Silicon Photonics DWDM Transmitter with Heterogeneously Integrated Multiwavelength DFB Laser and SOA, Songtao Liu[1], Ranjeet Kumar[1], Xinru Wu[1], Xiaoxi Wang[1], Duanni Huang[1], Guan-lin Su[1], Junyi Gao[1], Haisheng Rong[1]; [1]*Intel Corporation, USA.* We present a four-channel silicon photonics DWDM transmitter powered by a single heterogeneously integrated multiwavelength DFB laser and SOA, enabling simultaneous four-channel operation at 26 Gbps per channel, scalable to 53 Gbps per channel.

W3H.3 • 14:30
60 Tb/s Silicon Photonic Transmission Link Based on Ultrahigh-Coherence Microcomb, Xuguang Zhang[1], Zixuan Zhou[1], Yijun Guo[1], Minxue Zhuang[1], Warren Jin[2], Bitao Shen[1], Yujun Chen[1], Jiahui Huang[1], Zihan Tao[1], Ming Jin[1], Ruixuan Chen[1], Zhangfeng Ge[3], Zhou Fang[4], Ning Zhang[4], Yadong Liu[4], Pengfei Cai[4], Weiwei Hu[1], Haowen Shu[1], Dong Pan[4], John E. Bowers[2], Xingjun Wang[1], Lin Chang[1]; [1]*Peking Univ., China;* [2]*Univ. of California Santa Barbara, USA;* [3]*Peking Univ. Yangtze Delta Inst. of Optoelectronics, China;* [4]*SiFotonics Technologies Co., Ltd., China.* We realize a silicon photonic transmission link with an aggregate data rate exceeding 60 Tb/s and reduce the phase-related DSP consumption by 99.99999% using a self-injection locked microcomb as the light source.

W3H.4 • 14:45
25Gb/s Offset-QAM-4 Optical Transmitter Using Micro-Ring Modulators, Dan Sturm[1]; [1]*Electrical and Computer Engineering, Univ. of Washington, USA.* Ultra-low power and compact QAM transmitters using MRMs can become an ultimate solution for 400Gb/800Gb data-rates for CPO applications. Here, we demonstrate an MRM-based optical transmitter achieving 25Gb/s QAM-4 in GlobalFoundries silicon photonics.

W3H.5 • 15:00 (Invited)
Plasmonics for Communication: Enabling 200 GBd Transmitters Through Co-Integration, Ueli Koch[1], David Moor[1], Manuel Kohli[1], Yuriy Fedoryshyn[1], Michael Möller[2], Juerg Leuthold[1]; [1]*ETH Zurich, Switzerland;* [2]*Saarland Univ., Germany.* Co-integration of photonic platforms with electronics plays a key role to unlock Terabaud communication. Plasmonic solutions offer critical features like high-speed, compactness, and compatibility with multiple technologies. Latest progress towards next-generation interconnects is presented here.

W3H.6 • 15:30 (Invited)
Advances in High Baud Rate Low Power IM/DD Transmission, David Plant[1]; [1]*McGill Univ., Canada.* Abstract: We review recent progress in high baud rate IM/DD transmission for intra- and inter- data center interconnects. We compare several transmitter technologies including thin film lithium niobate and BTO modulators as well as EMLs.

16:30 -- 18:30
Room 207
W4D • Novel Photonic Computing and Switching Paradigms
Presider: Shu Namiki; Natl Inst of Adv Industrial Sci & Tech, Japan

W4D.1 • 16:30 (Invited)
Analog Optical Computing for Sustainable AI and Beyond, Francesca Parmigiani[1], Hitesh Ballani[1], Grace Brennan[1], Burcu Canakci[1], Jiaqi Chu[1], James Clegg[1], Daniel Cletheroe[1], Fabian Falk[1], Christos Gkantsidis[1], Jannes Gladrow[1], Kirill Kalinin[1], Doug Kelly[1], Heiner Kremer[1], Greg O'Shea[1], Lucinda Pickup[1], Babak Rahmani[1], Ant Rowstron[1]; *[1]Microsoft Research Cambridge, UK.* I will introduce the Analog Optical Computer, which, through co-design of applications and integrated 3D hardware, has the potential to accelerate by >100-fold machine learning tasks and real-world optimization problems, like medical imaging and financial transactions.

W4D.2 • 17:00
A Time-Space-Wavelength Multiplexed AWGR-Based Photonic Tensor Core Using WDM SiGe EAM Array Chiplets, Antonios Prapas[1], Miltiadis M. Pegios[1], Apostolis Tsakyridis[1], Stefanos Kovaios[1], Odysseas Asimopoulos[1], Christos Pappas[1], Theodoros Moschos[1], Manos Kirtas[1], Nikolaos Passalis[1], Konstantinos Vyrsokinos[1], Anastasios Tefas[1], Nikos Pleros[1]; *[1]Aristotle Univ. of Thessaloniki, Greece.* We demonstrate experimentally an 8×8 AWGR-based photonic accelerator that leverages a SiGe EAM array chiplet as its computational core. The experimental implementation of a MNIST classifier at 20 Gbaud revealed a Cohen’s kappa-score of 0.7421.

W4D.3 • 17:15
Demonstration of Tunable and Reconfigurable All-Optical Matrix-Vector Multiplication Using Nonlinear Wave Mixing, Wing Ko[1], Abdulrahman Alhaddad[1], Amir Minoofar[1], Hongkun Lian[1], Huibin Zhou[1], Muralekrishnan Ramakrishnan[1], Zile Jiang[1], Xinzhou Su[1], Moshe Tur[2], Jonathan Habif[1], Alan Willner[1]; *[1]Univ. of Southern California, USA; [2]Tel Aviv Univ., Israel.* We experimentally demonstrate an all-optical matrix-vector multiplication approach for encoded analog data using nonlinear wave mixing. We show the multiplication of matrices (m×4) with vectors (4×1) at 3 and 5 GSa/s with ~5 bit precision.

W4D.4 • 17:30
167Gbps 1×16 Programmable Visible Light Optical Switching for Data Center Optical Interconnects, Fujie Li[1], Haoyu Zhang[1], Zhilan Lu[1], Yiqi Huang[1], Wenqing Niu[1], Chao Shen[1], Junwen Zhang[1], Yingjun Zhou[1], Nan Chi[1]; *[1]Fudan Univ., China.* We propose a flexible data center interconnect technology, achieving 1×1 to 1×16 optical switching through 4×4 array receiver. Experiments demonstrate a single-channel communication rate of 10.48 Gbps, with a total system throughput of 167 Gbps.

W4D.5 • 17:45
Optical AllReduce: Ready to Eliminate Intra-DC in-Cast Vulnerability for Deep Learning Training, Yuepeng Wu[1], Cen Wang[2], Hongxiang Guo[1], Yuta Wakayama[2], Qiuyan Li[1], Noboru Yoshikane[2], Takehiro Tsuritani[2], Jian Wu[1]; *[1]BUPT, China; [2]Photonics Division, KDDI Research, Japan.* We present an in-network optical AllReduce that eliminates in-cast problems in

distributed training. Physical-layer experiments and large-scale evaluations verify the advantages of maximum 20x bandwidth compression, 50% equipment savings, and 22x faster communications in training.

W4D.6 • 18:00 (Invited)
Photonic Computing and Switching Using Generic and Membrane InP Photonic Integration, Ripalta Stabile[1]; [1]*Technische Universiteit Eindhoven, Netherlands.* The investigation of scalable deep photonic neural networks via extensive modeling and experiments is shown using generic InP photonic integrated matrices. More compact InP Membrane on Silicon technology is proposed for next-generation switching and computing.

16:30 -- 18:30
Room 215
W4H • Machine Learning DSP
Presider: Gabriele Liga; Technische Universiteit Eindhoven, Netherlands

W4H.1 • 16:30 (Invited)
Recent Advances on Machine Learning-Aided DSP for Short-Reach and Long-Haul Optical Communications, Laurent Schmalen[1], Vincent Lauinger[1], Jonas Ney[2], Norbert Wehn[2], Patrick Matalla[1], Sebastian Randel[1], Alexander von Bank[1], Eike-Manuel Edelmann[1]; [1]*Karlsruher Institut für Technologie, Germany;* [2]*Univ. of Kaiserslautern-Landau (RPTU), Germany.* In this paper, we highlight recent advances in the use of machine learning for implementing equalizers for optical communications. We highlight both algorithmic advances as well as implementation aspects using conventional and neuromorphic hardware.

W4H.2 • 17:00
Blind Equalization in Dynamic PMD Channels Using Variational Autoencoders with LSTM, José I. Núñez Kasaneva[1], Boris P. Karanov[1], Alex Alvarado[1], Gabriele Liga[1]; [1]*Eindhoven Univ. of Technology, Netherlands.* We propose a new variational autoencoder-based blind equalizer for polarization demultiplexing, and assess it in a dynamic polarization channel. We demonstrate a 0.4 dB SNR gain and doubled tolerance to state-of-polarization drift compared to CMA-RDE.

W4H.3 • 17:15
Experimental Demonstration of End-to-End Optimization for Directly Modulated Laser-Based IM/DD Systems, Sergio Hernandez[1], Christophe Peucheret[2], Francesco Da Ros[1], Darko Zibar[1]; [1]*Technical Univ. of Denmark, Denmark;* [2]*Univ. Rennes, CNRS, FOTON - UMR6082, France.* We experimentally demonstrate the joint optimization of transmitter and receiver parameters in directly modulated laser systems, showing superior performance compared to nonlinear receiver-only equalization while using fewer memory taps, less bandwidth, and lower radiofrequency power.

W4H.4 • 17:30
Digital Pre-Distortion for Drivers and SOAs Nonlinearities Enabling Power Budget Extension, Xiaohui Zhao[1,2], Trung Hien Nguyen[2], Loig Godard[2], Nayla El Dahdah[2], Romain Brenot[2], Sheherazade Lamkadmi Azouigui[2], Hartmut Hafermann[2], Massimo Tornatore[1], Yann Frignac[2], Sami Mumtaz[2], Abel Lorences-Riesgo[2], Gabriel Charlet[2]; [1]*Politecnico di Milano,*

Italy; [2]Optical Communication Technology Lab, Huawei Technologies France, France. We experimentally show that DPD nonlinear compensation can improve the power budget from 13.5dB to 16.9dB with an 800Gbps 90Gbaud signal thanks to enabling larger transmitted power while reducing nonlinear SNR degradation.

W4H.5 • 17:45

Non-Linear Equalization in 112 Gb/s PONs Using Kolmogorov-Arnold Networks, Rodrigo Fischer[1], Patrick Matalla[2], Sebastian Randel[2], Laurent Schmalen[1]; *[1]Communications Engineering Lab (CEL), Karlsruhe Inst. of Technology, Germany; [2]Inst. of Photonics and Quantum Electronics (IPQ), Karlsruhe Inst. of Technology, Germany.* We investigate Kolmogorov-Arnold networks (KANs) for non-linear equalization of 112 Gb/s PAM4 passive optical networks (PONs). Using pruning and extensive hyperparameter search, we outperform linear equalizers and convolutional neural networks at low computational complexity.

W4H.6 • 18:00

Novel ML-Assisted Optical Equalization Photonic Integrated Circuit for High-Speed IM/DD Systems, George Brestas[1], Giannis Kanakis[1], Maria Spyropoulou[1], Christophe Caillaud[2], Giancarlo Cerulo[2], Vladyslav Vakarin[2], Mokhtar Korti[2], Christoph Füllner[3], Robert Borkowski[4], Alessandro Aimone[3], Rene Bonk[3], Hercules Avramopoulos[1]; *[1]Photonics Communications Research Laboratory, National Technical Univ. of Athens, Greece; [2]III-V lab, a joint lab between Nokia Bell Labs, Thalys Research & Technology and CEA LETI, France; [3]Nokia Bell Labs, Germany; [4]Nokia Bell Labs, USA.* We demonstrate a novel InP equalization circuit capable of compensating bandwidth limitations and dispersion in high-speed IM/DD systems. Controlled by a blind ML-based optimizer, it outperforms digital FFE at 50 Gb/s over 10km.

16:30 -- 18:30
Room 301
W4I • CV-QKD and Frequency Combs
Presider: Andrew Lord; BT Applied Research, UK

W4I.1 • 16:30

Demonstration of Non-Orthogonal Pilot Multiplexing for Continuous-Variable Quantum Key Distribution, Yang Hong[1], Amirhossein Ghazisaeidi[1], Haik Mardoyan[1], Jeremie Renaudier[1]; *[1]Nokia Bell Labs France, France.* We propose and experimentally demonstrate non-orthogonal pilot multiplexing for CV-QKD, which requires no additional time/frequency/polarization resource whilst effectively reducing receiver's DSP complexity. ~53.35-Mb/s average secret key rate over a channel loss of 5dB is achieved.

W4I.2 • 16:45

Field Trials of CVQKD Using 10-MHz Linewidth LO Based on Optical Injection Locking, Jinpeng Liao[1], Yue Wang[1], Jinghang Huang[1], Dawei Wang[1]; *[1]Sun yat-sen Univ., China.* We demonstrated over field-deployed fibers that CVQKD using 10 MHz linewidth LO injected by a 10 kHz seed laser with simplified DSP and no active phase locking performs better than LLO using two 10 kHz lasers.

W4I.3 • 17:00 (Invited)

Experimental Evidence of Multimode Quantum Correlations in Bright SiN Microcombs, Adrien Bensemhoun[1], Silvia Cassina[2], Carlos Gonzalez-Arciniegas[3], Mohamed Faouzi Melalkia[1], Giuseppe Patera[4], Ségolène Olivier[5], Yohan Désières[5], Quentin Wilmart[5], Sylvain Guerber[5], Alessandro Zavatta[6], Anthony Martin[1], Jean Etesse[1], Laurent Labonté[1], Olivier Pfister[3], Virginia D'Auria[1], Sébastien Tanzilli[1]; *[1]Université Côte d'Azur, France; [2]Univ. of Insubria, Italy; [3]Univ. of Virginia, USA; [4]Univ. of Lille, France; [5]Univ. Grenoble Alpes CEA LETI, France; [6]Istituto Nazionale di Ottica, Italy.* We demonstrate multimode quantum correlation in bright frequency combs out of a SiN microresonator. Multimode features naturally arise due to a cascade of non-linear optical process, making one CW pump sufficient to initiate their generation.

W4I.4 • 17:30

273.067 Mbps Gaussian-Modulated Dual-Polarization Continuous-Variable Quantum key Distribution Over 10 km Fiber, Tao Zhang[1], Yan Pan[1], Wei Huang[1], Wang Heng[1], Ting Ye[1], Fan Fan[1], Jinlu Liu[1], Lifeng Fu[1], Yang Li[1], Bingjie Xu[1]; *[1]Inst. of Southwestern Communication, China.* We demonstrate, for the first time to our knowledge, a high-speed Gaussian-modulated dual-polarization continuous-variable quantum key distribution system, achieving a secret key rate of 273.067 Mbps@10km, with a 52% improvement over the single-polarization system.

W4I.5 • 17:45

Discrete-Modulated CVQKD With Composable Security, Adnan A. Hajomer[1], Florian Kanitschar[2], Nitin Jain[1], Michael Hentschel[2], Runjia Zhang[1], Norbert Lütkenhaus[3], Ulrik L. Andersen[1], Christoph Pacher[2], Tobias Gehring[1]; *[1]Technical Univ. of Denmark, Denmark; [2]Austrian Inst. of Technology, Austria; [3]Univ. of Waterloo, Canada.* We report the first continuous-variable quantum key distribution experiment using four states that utilizes a composable security proof to generate a secret key fraction of 0.033 bits/symbol over a 10 km fiber channel, while providing security against collective attacks.

W4I.6 • 18:00

40-km Mbps Discrete-Modulated Continuous Variable Quantum Key Distribution with Constellation Shaping Pre-Optimization, Yiming Bian[1], Lu Fan[1], Xuesong Xu[1], Liang Zhao[1], Mingze Wu[1], Song Yu[1], Yichen Zhang[1]; *[1]Beijing Univ. of Posts &Telecomm., China.* We report a 256-QAM continuous variable quantum key distribution with a source quality evaluation allowing constellation shaping pre-optimization. This method maximizes system performance, achieving an asymptotic/finite-size key rate of 7.05/2.01 Mbps over 40 km distance.

W4I.7 • 18:15

Impact of Pilot-Aided Signal Schemes on Practical CV-QKD Security, Utku Akin[1,2], Jonas Berl[1,3], Wasim Ahamed[1], Christian Schaeffer[4], Vitaly Rymanov[4], Andreas Stöhr[4], Tobias Fehenberger[1], Norbert Hanik[2]; *[1]Adva Network Security GmbH, Germany; [2]Technical Univ. of Munich, Germany; [3]Karlsruhe Inst. of Technology, Germany; [4]Microwave Photonics GmbH, Germany.* We experimentally explore security vulnerabilities in CV-QKD systems due to receiver nonlinearities. We demonstrate that higher pilot powers can lead to underestimating excess noise, showing the critical need to align the signaling scheme with receiver characteristics.

16:30 -- 18:30
Room 304
W4J • Specialty Fiber Devices II
Presider: Victor Kopp; Chiral Photonics Inc, USA

W4J.1 • 16:30 (Invited)
All-Polarization-Maintaining Ultrafast Fiber Lasers, Qian Li[1]; *[1]Peking Univ., China.* Utilizing a self-stabilized interferometer mode-locker, we demonstrate a bidirectional all-polarization-maintaining Er-doped fiber laser, and the generation of both harmonic mode-locking and noise-like pulses in an all-polarization-maintaining Tm-doped fiber laser.

W4J.2 • 17:00
Efficient SMF-to-MCF Power Splitter Using Multimode Interference in Square Core Fiber, Sijing Liang[1], John D. Downie[2], Sergejs Makovejs[3], Merrion Edwards[3], Periklis Petropoulos[1], Yongmin Jung[1]; *[1]Optoelectronics Research Centre, UK; [2]Corning Research and Development Corp., USA; [3]Corning Incorporated, USA.* We present a low-loss (0.3 dB) SMF-to-MCF power splitter, utilizing multimode interference in a square core fiber. This scheme minimizes power loss and offers scalability to diverse multicore fiber types through graded-index-fiber lens integration.

W4J.3 • 17:15
Bidirectional 4-Core MC-EDFA Featuring Integrated Optical Components and Inter-Core Optical Loopback Function, Hitoshi Takeshita[1], Yusuke Shimomura[1], Wakako Maeda[1]; *[1]NEC Corpration, Japan.* Simple implementation of bidirectional 4-core MC-EDFA was achieved by integrating an isolator, coupler, FBG, and GFF. With a loopback, the 0.9-dB gain flatness and 12.6-dB gain amplification performance are sufficient for submarine system use.

W4J.4 • 17:30
Novel Core-Pumped Multicore Fiber Amplifier Integrated with Energy-Efficient Pump Light Distributor, Sijing Liang[1], John D. Downie[2], Sergejs Makovejs[3], Ian A. Davidson[1], Nilotpal Choudhury[1], Zahra Kakaei[1], Jayanta K. Sahu[1], Periklis Petropoulos[1], Yongmin Jung[1]; *[1]Optoelectronics Research Centre, Univ. of Southampton, UK; [2]Corning Research and Development Corp., USA; [3]Corning Incorporated, USA.* We present a novel core-pumped multicore fiber amplifier featuring an energy-efficient pump light distributor and high-NA doped fibers. This amplifier provides a 14.7-dB average gain with a 4.9-dB average noise figure across the C-band.

W4J.5 • 17:45 (Invited)
Fiber Sensing with Structured Light Beams, Juliet Gopinath[1]; *[1]Univ. of Colorado Boulder, USA.* We demonstrate an optical fiber sensor that uses structured light to act as a temperature and force sensor. Our sensor can be used to resolve the direction and magnitude of forces applied to a fiber.

W4J.6 • 18:15
First Demonstration of Multicore Fiber Long Period Gratings Using Femtosecond Laser Direct Inscription Technique, Mingjing Xu[1], Lin Ma[1], Fengrui Yu[1], Yunhe Zhao[1,2], Zuyuan He[1]; *[1]State Key Laboratory of Advanced Optical Communication Systems and Networks, shanghai jiao tong Univ., China; [2]Inst. of Logistics Science and Engineering, Shanghai Maritime*

Univ., China. We demonstrate long period gratings (LPGs) on multicore fibers using femtosecond laser direct writing technique. In experiment, we succeeded in independent LPG fabrication at arbitrary cores with a coupling efficiency as high as 90%.

16:30 -- 18:30
Rooms 201-202
W4A • Advanced Packaging and Integrated Optics for Scale-Up AI interconnects II
Presider: Daniel Kuchta; Nvidia, USA

W4A.1 • 16:30 (Invited)
Photonic and Electronic Co-Packaging Technologies – From Research to Pilot Manufacturing, Peter A. O'Brien[1]; [1]*Tyndall National Inst., Ireland.* This talk will present developments in co-packaging technologies and the transition from research to pilot-scale manufacturing. Areas to be covered include developments in glass-based electrical interposers, BGA-style photonic-electronic packages, and micro-optics for surface pluggable optical fibre connections. The talk will also review the critical role of packaging equipment in determining package designs to ensure manufacturability and emerging packaging trends in co-packaged optics.

W4A.2 • 16:50 (Invited)
Critical Challenges and Design Choices in Massively Parallel Optical Links, Darrell R. Childers[1]; [1]*US Conec Ltd, USA.* Currently, multifiber ferrules are extremely precise optomechanical devices that achieve submicron lateral alignment and physical contact. Greatly increasing the fiber count in ferrules will pose significant challenges, necessitating compromises in both connector performance and functionality.

W4A.3 • 17:05 (Invited)
Scalable Detachable Fiber Connectivity for Seamless Integration with Advanced Semiconductor Packaging, Hesham Taha[1]; [1]*Teramount Ltd, Israel.* This presentation will highlight Teramount's technological advances in wafer-level optics and integration workflows into standard semiconductor foundry and outsourced semiconductor assembly and tests (OSATs) processes.

W4A.4 • 17:20 (Invited)
Advanced Packaging Solution for Co-Packaged Optics, Yu-Po Wang[1]; [1]*SPIL, Taiwan.* As demand of generative AI growing in unprecedented speed, data processing in low latency, high bandwidth, high performance and large memory capacity is a crucial factor. Recent developments on optical engine with Fan-out advanced package and integrated to Co-Packaged Optics will be discussed. In addition, challenges and solutions will be reviewed in several aspects such as design, thermal, warpage and electrical.

W4A.5 • 17:40 (Invited)
CPO Challenges at the Contract Manufacturer (CM) and Electronics Manufacturing Services (EMS) Level, Noam Ophir[1]; [1]*Jabil Circuit, USA.* CPO presents unique challenges for advanced packaging compared to traditional transceiver architectures. This talk will touch on some of those unique considerations and focus on the challenges the CM / EMS businesses are working to overcome to enable commercialization of this new class of photonics solutions.

16:30 -- 18:30
Rooms 205-206
W4C • SDM Fiber Cables
Presider: Chiara Lasagni; Universita degli Studi di Parma, Italy

W4C.1 • 16:30 (Invited)
Deployment and Installation of Multi-Core Fiber Cable to Terrestrial Field, Takayoshi Mori[1], Yusuke Yamada[1], Masashi Kikuchi[1], Kazutaka Noto[1], Takashi Matsui[1], Kazuhide Nakajima[1]; *[1]NTT Corp., Japan.* A stable connection loss below 1.0 dB in laminated-PLC-type FIFOs and pre-connectorized MCF cables is confirmed, as well as feasible temperature cycling properties. These elements enable large-scale deployment of terrestrial MCF-link containing several hundred fibers.

W4C.2 • 17:00
Experimental Verification of Correlation Length Coefficient by 3-D Measurement of Optical Fibers in High-Density Cable, Masashi Kikuchi[1], Takayoshi Mori[1], Tomoya Shimizu[1]; *[1]NTT Corporation, Japan.* We are first to experimentally verify the correlation length, necessary for evaluating crosstalk in multi-core fiber, through 3-D measurement of optical fiber in high-density cables. The measured values are consistent with coupled-power theory.

W4C.3 • 17:15
Behavior of Inter-Core Crosstalk of Two-Core Fiber in Submarine Cable, Yuki Kawaguchi[1], Hirotaka Sakuma[1], Tetsuya Haruna[1], Tetsuya Hayashi[1], Takemi Hasegawa[1], Keisuke Yasuhara[2], Juan C. Aquino[2], Daishi Masuda[2]; *[1]Sumitomo Electric Industries, Ltd, Japan; [2]OCC Corporation, Japan.* We study inter-core crosstalk of two-core fiber in a submarine cable and show the crosstalk in cable is improved by 12 dB compared with that on fiber spool thanks to the heterogeneous core configuration.

W4C.4 • 17:30
Characterization of the First Field-Deployed Weakly-Coupled Few-Mode Fiber Cable, Lei Shen[1], Gang Qiao[2], Baolong Zhu[2], Lipeng Feng[3], Lulu Liu[4], Lei Zhang[1], Honglin Ji[4], Jiarui Zhang[2], Yiran Wang[2], Yuyang Gao[2], Mingqing Zuo[2], Chengbin Long[2], Anxu Zhang[3], Zhaopeng Xu[4], Shangcheng Wang[4], Qi Wu[4], Jie Luo[1], Zhixue He[4], Yongqi He[2], Weisheng Hu[4], Zhangyuan Chen[2], Juhao Li[2]; *[1]State Key Laboratory of Optical Fiber and Cable Manufacture Technology, YOFC, China; [2]State Key Laboratory of Advanced Optical Communication Systems and Networks, Peking Univ., China; [3]China Telecom Research Inst., State Key Laboratory of Optical Fiber and Cable Manufacture Technology, China; [4]Peng Cheng Laboratory, China.* We develop and characterize the first field-deployed weakly-coupled FMF cable link with 4-mode fibers in two tubes inside a 10.4-km cable. The impact of splices on the link loss and modal crosstalk is also investigated.

W4C.5 • 17:45 (Invited)
Impact of Recent Fiber Technologies on Undersea Systems, Dmitriy Kovsh[1]; *[1]SubCom Customer Solutions, USA.* The paper reviews common configurations of undersea optical cables and considerations system designers face selecting fiber parameters. Properties of various fibers (SMF, MCF) will be discussed as they affect optical performance of undersea links.

16:30 -- 18:30
Rooms 209-210
W4E • Advanced Optical and Electronic Techniques in Transmission
Presider: Masanori Nakamura; NTT Network Innovation Laboratories, Japan

W4E.1 • 16:30
Experimental Demonstration of Nonlinearity Mitigation by Phase Conjugation and Digital Chromatic Dispersion Management Using Wavelength Converter DSP, Shoma Tateno[1], Hidemi Noguchi[1], Kohei Hosokawa[1], Emmanuel Le Taillandier de Gabory[1]; *[1]NEC, Japan.* We present nonlinearity mitigation by phase conjugation and digital CD management using wavelength-converter DSP. We experimentally demonstrated Q-factor improvement of a 30.6-Gbaud PM-16 QAM signal over 960-km two-lap transmission in wavelength conversion within the C-band.

W4E.2 • 16:45 (Invited)
Plasmonic PIC for High Baud Rate Transmission, Benedikt Baeuerle[1], Wolfgang Heni[1], Juerg Leuthold[2], Claudia Hoessbacher[1]; *[1]Polariton Technologies Ltd, Switzerland; [2]ETH Zurich, Switzerland.* Plasmonic photonic integrated circuits (plasmonic PICs) enhance high-speed silicon photonics, meeting demands for next-generation electro-optical interfaces. We present recent results showing how plasmonic modulators support 400G per lane, enabling 1.6T and 3.2T optical transceivers and beyond.

W4E.3 • 17:15
Transmission Distance Extension by Using Wideband Incoherent Forward Pump in Bidirectional Distributed Raman Amplification Compared to Coherent Pump, Daichi Ogata[1], Shigehiro Takasaka[1], Junji Yoshida[1], Norihiro Ohishi[1]; *[1]Furukawa Electric co., Ltd., Japan.* We demonstrate full C-band 100 Gbaud DP-16QAM WDM signal transmission and confirm that semiconductor wideband incoherent forward pumps extend transmission distance twice and 1.2 times compared to EDFA only amplification and coherent forward pumps, respectively.

W4E.4 • 17:30
Experimental Demonstration of MPI-Penalty-Free S-Band Transmission Over G.654.E Fibres, Romulo Aparecido de Paula Junior[1], Jiaqian Yang[1], John D. Downie[2], Lidia Galdino[2], Eric Sillekens[1], Henrique Buglia[1], Ronit Sohanpal[1], Robert I. Killey[1], Polina Bayvel[1]; *[1]Univ. College London, UK; [2]Corning Research and Development Corporation, USA.* We demonstrate multipath interference-penalty-free S-band transmission over two G.654.E-compliant fibres with cable cutoff up to 1530 nm. No SNR degradation was observed across various transmission distances and baud rates.

W4E.5 • 17:45 (Invited)

Digital I/Q Signal Processing Technology Enabling High Symbol Rate Transmission Systems, Takayuki Kobayashi[1], Masanori Nakamura[1], Fukutaro Hamaoka[1], Akira Kawai[1], Hiroshi Yamazaki[1], Munehiko Nagatani[1], Hiroyuki Takahashi[1], Yutaka Miyamoto[1]; *[1]NTT Corp., Japan.* This paper reviews I/Q signal processing with various applications, such as high-precision signal distortion compensation essential for high-speed symbol-rate transmission, and pre-processing for bandwidth doubling to achieve higher symbol rates, and presents our research results.

16:30 -- 18:45
Rooms 211-212
W4F • Integrated Sensing and Communication in RoF/FSO
Presider: Abel Lorences-Riesgo; Huawei Technologies, France

W4F.1 • 16:30

Multi-Channel Photonic Integrated Radio-Over-Fiber Frequency Converter for Multi-Beam Antennas, Filippo Scotti[1], Luca Rinaldi[1], Paolo Ghelfi[1]; *[1]CNIT, Italy.* A multi-channel RoF transmitter and frequency converter InP-PIC is reported. Four directly-modulated 10GHz-bandwidth lasers share a local oscillator up to 35GHz. The system is characterized and tested with QAM modulations, demonstrating error-free operation in Ka-band.

W4F.2 • 16:45

120 Gbps PDM-16QAM Signal Outdoor Transmission Over 850 Meters 2×2 MIMO Wireless Link at 300 GHz, Weiping Li[1], Jianjun Yu[1,2], Xianming Zhao[3], Xin Lu[1], Yi Wei[1], Luhan Jiang[1], Wen Zhou[1], Min Zhu[2], Jiao Zhang[2], Kaihui Wang[1], Feng Zhao[4], Jianguo Yu[5]; *[1]Fudan Univ., China; [2]Purple Mountain Laboratories, China; [3]Harbin Inst. of Technology, China; [4]Xi'an Univ. of Posts and Telecommunications, China; [5]Beijing Univ. of Posts and Telecommunications, China.* We demonstrate field trials of a dual-channel 2×2 MIMO THz-wave system for 120-Gbps PDM-16QAM signal transmission over 850-m wireless distance based on the polarization multiplexing and advanced DSP technology, which also sets a new benchmark for the highest *rate-distance-product* in photonic THz-wave wireless delivery globally.

W4F.3 • 17:00

A Crossbar-Based Coherent Silicon Photonic MIMO Processor for Wireless Communications, Stefanos Kovaios[1], Maria Vargemidou[1], Chris Vagionas[1], Ronis Maximidis[1], Apostolis Tsakyridis[1], Miltiadis M. Pegios[1], Amalia Miliou[1], Nikos Pleros[1]; *[1]Aristotle Univ. of Thessaloniki, Greece.* We demonstrate a silicon photonic coherent MIMO processor using a photonic Crossbar (Xbar) layout. Successful experimental validation of its performance as a 4×4 MIMO processor and a 3×3 MIMO with on-chip phase retrieval is presented.

W4F.4 • 17:15

Blind MIMO Vector-Quantized Variational Autoencoder Equalizer for Free-Space Coherent Optical Transmission, Guojin Qin[1], Yuan Wei[1], Ziqi Tang[1], Yingjun Zhou[1], Junwen Zhang[1], Nan Chi[1], Jianyang Shi[1]; *[1]Fudan Univ., China.* We propose a novel blind MIMO vector-quantized variational autoencoder equalizer for free-space coherent optical transmission in turbulence channel. The method is shown to simultaneously achieve better time-varying error correction performance and mitigate the IQ skew in the receiver side.

W4F.5 • 17:30
Demonstration of D-Band Wireless Transmission Over 30.2 km Distance Based on Photonic-Assisted Scheme, Mingxu Wang[1], Jianjun Yu[1], Xiongwei Yang[1], Yi Wei[1], Chengzhen Bian[1], Xianming Zhao[2], Peng Tian[1], Yang Han[1], Qiutong Zhang[1], Jingwen Tan[1], Hansong Ma[1], Bing Zhang[1], Sicong Xu[1], Qinyi Zhang[1], Feng Zhao[3], Wen Zhou[1], Kaihui Wang[1], Weiping Li[1]; *[1]Fudan Univ., China; [2]Harbin Inst. of Technology, China; [3]Xi'an Univ. of Posts and Telecommunications, China.* A record-breaking 30.2-km ultra-long-haul high-speed wireless transmission at D-band is experimentally demonstrated, achieving a data rate of 4 Gbps/λ and a capacity-distance product of 120.8 Gbps×km.

W4F.6 • 17:45 (Invited)
Photonic Terahertz Integrated Sensing and Communication (ISAC) Systems, Lu Zhang[1], Zhidong Lyu[1], Oskars Ozolins[2], Xiaodan Pang[1], Xianbin Yu[1]; *[1]Zhejiang Univ., China; [2]Riga Technical Univ., Latvia.* This paper explores the role of photonic terahertz technologies in integrated sensing and communication systems, focusing on integrated waveform design, optical processing, and algorithms to enhance communication capabilities and sensing performance.

W4F.7 • 18:15
Integrated Communications and Sensing in a 1.8 km FSO Field Trial: Stokes-Based SOP Monitoring and Tracking at 400 Gbps, Sara T. Mantey[1], Marco Fernandes[1], Nuno Silva[1], Gil Fernandes[1], Nourdin Kaai[2], Fernando Guiomar[1], Paulo Monteiro[1], Armando Pinto[1], Nelson Muga[1]; *[1]Instituto De Telecomunicacoes and Univ. of Aveiro, Portugal; [2]Aircision, Netherlands.* We demonstrate simultaneous SOP monitoring and compensation in a 1.8km FSO link at 400Gbps. Long-term measurements (21-hours) reveal that Stokes-based SOP tracking provides improved monitoring accuracy and enhanced communication reliability (>19%), against typical CMA equalization.

W4F.8 • 18:30
A THz/FSO Fusion Transmission System with Shared Transmitter and Communication Link, Qinyi Zhang[1], Jianjun Yu[1], Jianyu Long[1], Chen Wang[1], Jiali Chen[1], Xin Lu[1], Bo Liu[1], Xiongwei Yang[1], Yi Wei[1], Feng Zhao[2], Wen Zhou[1], Yaoqiang Xiao[3], Weiping Li[1], Kaihui Wang[1]; *[1]Fudan Univ., China; [2]Xian Univ. of Posts and Telecommunication, China; [3]Hunan Univ., China.* For the first time, we experimentally demonstrated a THz/FSO fusion transmission system that shares the same transmitter and communication link, which can simultaneously support 30 GBaud QPSK THz and optical signals transmission over a 10 m wireless link.

16:30 -- 18:30
Rooms 213-214
W4G • Digital Twins in Network Control and Management
Presider: Yvan Pointurier; Huawei Technologies, France

W4G.1 • 16:30 (Tutorial)
Digital Twin and AI Agent for Autonomous Optical Networks, Qunbi Zhuge[1], Xiaomin Liu[1], Yihao Zhang[1], Qizhi Qiu[1], Weisheng Hu[1]; *[1]Shanghai Jiao Tong Univ., China.* This tutorial

presents key enabling technologies including digtial twin and AI Agent to realize zero-touch autonomous operations of optical networks. The applications of LLM in this paradigm will also be discussed.

W4G.2 • 17:30 (Top-Scored)
Inputs Refinement with Incremental Learning for Accurate Digital Twin of Optical Networks, Xin Yang[1], Chenyu Sun[2], Reda Ayassi[2], Gabriel Charlet[2], Massimo Tornatore[1], Yvan Pointurier[2]; *[1]Politecnico di Milano, Italy; [2]Huawei Technologies France, France.* We propose a parameter refinement method based on incremental learning, leveraging multiple network snapshots to provide accurate estimated inputs (i.e., lumped losses, gain spectra, and offset noise) to digital twins, improving QoT prediction and optimization.

W4G.3 • 17:45
QoT Digital Twin for Bridging Physical Layer Knowledge Gaps in Multi-Domain Networks, Renato Ambrosone[1], Andrea D Amico[2], Riccardo Schips[1], Andrea Rosso[1], Esther Le Rouzic[3], Stefan Melin[4], Stefano Straullu[5], Giacomo Borraccini[2], Francesco Aquilino[5], Hideki Nishizawa[8], Sai Kishore Bhyri[6], Gert Grammel[7], Vittorio Curri[1]; *[1]Politecnico di Torino, Italy; [2]NEC Laboratories America Inc., USA; [3]Orange, Innovation Networks, France; [4]Telia Company AB, Sweden; [5]Links foundation, Italy; [6]Infinera India Private Limited, India; [7]Juniper Networks, Germany; [8]NTT Network Innovation Labs, Japan.* We propose building a spectrally resolved QoT Digital Twin for optical network domains where models and telemetry are unavailable, by probing transmission on a single spectral slot, using GNPy, and demonstrating accurate experimental results.

W4G.4 • 18:00
Filtering Impairments-Aware Digital Twin for SNR Prediction Over Network Life-Cycle, Reda Ayassi[1], Xin Yang[1], Chenyu Sun[1], Yvan Pointurier[1], Gabriel Charlet[1]; *[1]Huawei Technologies, France.* We propose a new method to improve SNR prediction of existing and new services with the presence of unknown penalties due to filtering effects. We validate the method in a testbed experiment with 5 OMS and up to 200 deployed services and show an average improvement of SNR service prediction of up to 0.9dB.

W4G.5 • 18:15
Machine Learning Based Failure Prediction for Optical Network Digital Twins, Camille Delezoide[1], Petros Ramantanis[1], Fabien Boitier[1], Patricia Layec[1]; *[1]Nokia Bell Labs, France.* We leverage binary classification models to provide digital twins with forecasting ability, to proactively mitigate the impact of failures on availability. Our preferred model achieves 98.5% accuracy on data collected from a live production network.

Thursday, 03 April
08:00 -- 10:00
Room 207
Th1D • Coherent for Datacenters
Presider: Jeffrey Rahn; Meta Platforms Inc, USA

Th1D.1 • 08:00
A Low Complexity Symbol-Rate Joint Equalization and Timing Recovery Scheme for Short-Reach Coherent Systems, Yuyuan Gao[1], Xian Zhou[1], Haiqiang Wei[2], Juntao Cao[2], Alan Pak Tao Liu[2], Kang Ping Zhong[2]; [1]*Univ. of Science and Technology Being, China;* [2]*Hong Kong Polytechnic Univ., China.* The complexity reduction for 32GBaud DP-16QAM with joint equalization and timing recovery scheme using a baud-rate TED algorithm with PLL is demonstrated. ROP penalty less than 0.75 dB are achieved in case of 65.48% complexity reduction with high phase noise tolerance.

Th1D.2 • 08:15
Colorless Detection of a 3.2-Tb/s-Class WDM Superchannel Aiming for Uncooled Coherent Optics, Di Che[1], Mikael Mazur[1], Nicolas K. Fontaine[1]; [1]*Nokia Bell Labs, USA.* We propose a colorless detection for WDM signals with neither laser wavelength control nor demultiplexers using a comb as local oscillator and demonstrate a single-shot reception of 407.2-GHz (3.35-Tb/s) superchannel with >1-THz tolerance on laser frequency drift.

Th1D.3 • 08:30
Demonstration of Bidirectional 200G DCI Based on Ultimate-Simplified Lite-Coherent Detection with Optical Injection Locking, Qijun Bian[1], An yan[1], Yongzhu Hu[1], Penghao Luo[1], Xingyu Li[1], Nan Chi[1], Junwen Zhang[1]; [1]*Fudan Univ., China.* We propose and experimentally demonstrate bidirectional DCI transmission based on ultimate-simplified lite-coherent detection with optical injection locking. By using only one FP-laser at edge, we achieve bidirectional 200G interconnections of central- and edge-DCs.

Th1D.4 • 08:45
Modulated Remote LO Enabled 1.92-Tb/s 5-Dimensional Coherent Transmission Over 10-km SSMF, Xiansong Fang[1], Yixiao Zhu[2], Xiang Cai[1], Xian Zhou[3], Weisheng Hu[2], Fan Zhang[1,4]; [1]*Peking Univ., China;* [2]*Shanghai Jiao Tong Univ., China;* [3]*Univ. of Science and Technology Beijing (USTB), China;* [4]*Pengcheng Laboratory, China.* We demonstrate 1.92-Tb/s line rate 5-dimensional coherent transmission over 10-km SSMF by modulating signal and remote LO simultaneously. The remote LO is modulated with an SSB signal, retaining a residual carrier for phase noise mitigation.

Th1D.5 • 09:00
Beyond 1-Tbs PS-64QAM Coherent-Lite DCI Transmission Using Low-Cost DFB Lasers and Vectorized DDCPE, Chen Wang[1], Jianyu Long[1], Jianjun Yu[1], Bohan Sang[1], Wen Zhou[1], Kaihui Wang[1], Feng Zhao[2], Bo Liu[3], Ze Dong[4], Xiangjun Xin[4], Yong Chen[5], Weizhang Chen[5], Bing Ye[5]; [1]*Fudan Univ., China;* [2]*XUPT, China;* [3]*NUIST, China;* [4]*BIT, China;* [5]*ZTE, China.* We demonstrated beyond 1Tbps coherent-lite 90-GBaud PS-64QAM DCI transmission over 80-km SSMF utilizing low-cost DFB lasers and a novel low-complexity vectorized decision-directed carrier phase estimation algorithm with dynamic factor.

Th1D.6 • 09:15
A Blind and Low-Complexity Tx/Rx IQ Skew and XY Skew Calibration for High-Speed Coherent Optical Transceiver, Hongyu Li[1], Mengfan Cheng[1], Qi Yang[1], Ming Tang[1], Deming Liu[1], Lei Deng[1]; [1]*Huazhong Univ. of Science and Technology, China.* A blind and low-complexity scheme using a partial sideband cross-correlation algorithm is proposed that can simultaneously calibrate Tx/Rx IQ skew and XY-skew of coherent optical transceiver, with the measurement error <0.2ps for 20Gbaud 64QAM signal.

Th1D.7 • 09:30
Spectrally-Efficient 700.4-Gb/s/λ Optical Interconnect Using Asymmetric Self-Coherent Detection and MHz DFB Laser, Yixiao Zhu[1], Xiansong Fang[2], Xiang Cai[2], Yimin Hu[1], Xian Zhou[3], Weisheng Hu[1], Fan Zhang[2]; [1]*Shanghai Jiao Tong Univ., China;* [2]*Peking Univ., China;* [3]*Univ. of Science and Technology Beijing, China.* We experimentally demonstrate 700.4-Gb/s/λ transmission at 7.8-b/s/Hz net electrical spectral efficiency using LO-free asymmetric self-coherent detection and 1.3-MHz DFB laser. The wavelength drifting tolerance and transfer function-enhanced phase noise are characterized for low-cost data-center interconnects.

08:00 -- 10:00
Room 208
Th1E • Advanced Modulator and Detectors
Presider: Guo-Qiang Lo; Advanced Micro Foundry Pte Ltd, Singapore

Th1E.1 • 08:00
Hybrid Silicon Nitride/Lithium Niobate Electro-Optical Modulator With Wide Optical Bandwidth and High RF Bandwidth Based on Ion-cut Wafer-Level Bonding Technology, Zhuoyun Li[1,2], Yang Chen[1], Jianmin Zhang[1,2], Fan Xu[3], Shuxiao Wang[1], Xin Ou[1], Yan Cai[1,3], Mingbin Yu[4,3]; [1]*State Key Laboratory of Materials for Integrated Circuits, Shanghai Inst. of Microsystem and Information Technology, China;* [2]*Univ. of the Chinese Academy of Sciences, China;* [3]*Shanghai Industrial μTechnology Research Inst., China;* [4]*Shanghai Mingkun Semiconductor Co., Ltd, China.* We demonstrate a hybrid SiN/TFLN electro-optic Mach–Zehnder modulator with 3 dB bandwidth beyond 110 GHz and 67 GHz operating at C-band and O-band. Ion-cut wafer-level bonding was employed and the lithium niobate is etchless.

Th1E.2 • 08:15
200 GBd Electro-Optic PLZT Modulator for O-Band Transmission, Shiyoshi Yokoyama[1], Yuexin Yin[1], Sahar Alasvand Yazdani[1], Hiromu Sato[1], Guo-Wei Lu[1]; [1]*Kyushu Univ., Japan.* We demonstrate a 200 GBd modulation using a ferroelectric film-on-insulator (PLZT) modulator. The 2.5 mm-long phase shifter efficiently facilitated modulation, achieving error-free O-band transmission over a 2.0 km distance.

Th1E.3 • 08:30
An 8×256 Gbps Silicon Photonic DWDM Transmitter with Thermally Stable Microring Modulators, Jintao Xue[1,2], Shenlei Bao[1,2], Chao Cheng[1,2], Wenfu Zhang[1,2], Binhao Wang[1,2]; [1]*State Key Laboratory of Transient Optics and Photonics, Xi'an Inst. of Optics and Precision Mechanics, China;* [2]*School of Future Technology, Univ. of Chinese Academy of Sciences, China.* An 8×256 Gbps silicon photonic DWDM transmitter utilizing >67 GHz microring modulators is demonstrated. An optoelectronic closed-loop feedback wavelength

tuning algorithm compensates for process variations and temperature fluctuations.

Th1E.4 • 08:45
A Temporal Tail-Cutting Approach for Optimizing HighSpeed Performance of Ge-Si Photodetectors, Bohan Chu[1], Shihuan Ran[1], Xinhang Li[1], Yu Li[1,2], Jianping Chen[1,2], Linjie Zhou[1,2]; *[1]Shanghai Jiao Tong Univ., China; [2]SJTU-Pinghu Inst. of Intelligent-Optoelectronics, China.* We propose a physically realizable temporal tail-cutting algorithm for Ge-Si photodetectors. We achieve a 160 Gbps data transmission with the transmitter dispersion eye closure quaternary (TDECQ) enhanced from 5.13 dB to 2.64 dB, when the algorithm is engaged.

08:00 -- 10:00
Room 215
Th1I • Distributed Acoustic Sensing
Presider: María R. Fernández-Ruiz; Universidad de Alcala, Spain

Th1I.1 • 08:00 (Invited)
Future SMART Cities Enabled by Fiber Sensing, Biondo Biondi[1]; *[1]Stanford Univ., USA.* We demonstrate the potential impact on modern cities of leveraging pre-existing telecommunication infrastructure to build fiber sensing arrays under whole metropolitan regions with a sensor density of meters.

Th1I.2 • 08:30
Simultaneous Monitoring of 8 Fiber Routes by Means of High-Speed Switching for Time-Sharing FDM-DAS, Hiroshi Takahashi[1], Yoshifumi Wakisaka[1], Takahiro Ishimaru[1], Chihiro Kito[1], Keisuke Murakami[1], Daisuke Iida[1], Yusuke Koshikiya[1], Kunihiro Toge[1]; *[1]NTT Corporation, Japan.* We propose the simultaneous monitoring of 8-fiber routes by means of high-speed switching for time-sharing frequency division multiplexed distributed acoustic sensing (TS-FDM-DAS). We demonstrate traffic monitoring in the field area by our TS-FDM-DAS proposal.

Th1I.3 • 08:45
First Demonstration of Path Diversity of Optical Fiber Cables Using a DAS Interrogator, Michel Leclerc[1], Olivier Plomteux[1], Louis Belanger-Sansoucy[1], Hongxin Chen[1], Michel Leblanc[1]; *[1]Research and Development, Exfo Inc., Canada.* For the first time, we show how to distinguish whether given optical fibers share the same cables using distributed optical sensing. Our method leverages the correlations of distributed environmentally induced vibrations along the deployed cables.

Th1I.4 • 09:00 (Top-Scored)
Optical-Domain Interference Fading Suppression Structure for φ-OTDR Sensors Based on Nonlinear Amplification of Optical Injection Locking, Junda Chen[1,2], Shengming Shi[1], Can Chen[1], Jiajun Zhou[3], Mingming Zhang[1], Zhonghong Lin[1], Can Zhao[1], Ming Tang[1]; *[1]Huazhong Univ. of Science and Technology, China; [2]Chalmers Univ. of Technology, Sweden; [3]JFS Laboratory, China.* An optical-domain fading suppression structure is proposed based on the nonlinear amplification of optical injection locking (OIL) for the φ-OTDR sensor, enhancing the SNR by 27.7 dB of the detected vibration phase.

Th1I.5 • 09:15
Vector-Based Multi-Frequency-Position Phase Averaging of Φ-OTDR DAS for Large-Scale Vibration Monitoring, Yoshifumi Wakisaka[1], Hiroshi Takahashi[1], Takahiro Ishimaru[1], Daisuke Iida[1], Kunihiro Toge[1]; [1]*NTT Corporation, Japan.* We propose vector-based multi-position multi-frequency phase averaging in multi-frequency Φ-OTDR to measure large-scale vibrations over sub-με with high precision while balancing system simplicity and spatial resolution. We detect more correct vibration patterns on real-field network.

Th1I.6 • 09:30
Distributed Acoustic Sensing with Super Spatial-Resolution Based on Deconvolutional Neural Network, Zhang Jingming[1,2], Yaxi Yan[1], Yinghuan Li[1], Alan Pak Tao Lau[1], Liyang Shao[2], Changyuan Yu[1]; [1]*Hong Kong Polytechnic Univ., Hong Kong;* [2]*Southern Univ. of Science and Technology, China.* A deconvolutional neural network based on ResUNet++ is proposed to improve the spatial resolution of DAS from 10m to less than 2m. Multiple simultaneous vibrations within a 10m range are successfully resolved and detected.

Th1I.7 • 09:45 (Top-Scored)
Urban Water Leakage Detection System Based on Distributed Acoustic Sensing Over Dark Fiber Networks, Vahid Sharif[1], Mikel Sagues[1], Alayn Loayssa[1]; [1]*Department of Electrical, Electronic, and Communications Engineering, Inst. of Smart Cities, Universidad Pública de Navarra, Spain.* A novel system for automatically detecting leaks in urban water supply networks is proposed and experimentally demonstrated in a real-world scenario. It leverages the extensive fiber optic access network infrastructure already available.

08:00 -- 10:00
Room 301
Th1J • Advances in Future PON
Presider: Chathurika Ranaweera; Deakin Univ., Australia

Th1J.1 • 08:00 (Invited)
Harmony from Chaos: Orchestrating an Interoperable Ecosystem for the Future of PON, Kevin A. Noll[1]; [1]*CableLabs, USA.* Passive Optical Networks (PON) face complex integrations due to limited interoperability, few management standards, and the challenge of multi-technology access network integration. This paper explores evolving standards and strategies for streamlined, future-ready deployment and management across diverse vendor systems.

Th1J.2 • 08:30
Model-Free Deep Learning of Joint GS and PS for 300G Flexible Coherent PON Based on Direct Information Interaction Between OLT and ONUs, Zhongya Li[1,2], An yan[1], Junhao Zhao[1], Boyu Dong[1], Ouhan Huang[1], Yingjun Zhou[1], Jianyang Shi[1], Ziwei Li[1], Chao Shen[1], Peng Zou[2], Yiheng Zhao[2], Fangchen Hu[2], Junwen Zhang[1], Nan Chi[1]; [1]*Fudan Univ., China;* [2]*Zhangjiang Laboratory, China.* We proposed a model-free deep-learning of joint geometric- and probabilistic-shaping for optimization in a 20-km, 25-Gbaud, 300-Gbps FLCS-CPON using direct information exchanges between OLT and ONUs, achieving a 4 dB dynamic-range enhancement over traditional scheme.

Th1J.3 • 08:45

Multipoint-to-Point All-Optical Channel Aggregation for Coherent Passive Optical Network Using Talbot-Based Processing and Power-Division Multiplexing, Zijian Li[1], Chen Ding[1], Qiarong Xiao[1], Zixian Wei[1], Chaoran Huang[1], Chester Shu[1]; *[1]The Chinese Univ. of Hong Kong, Hong Kong.* We propose a multipoint-to-point all-optical channel aggregation scheme using Talbot-based processing and power-division multiplexing, enhancing scalability of uplink traffic in a coherent passive optical network through superposition of multipath signals at the power-domain physical layer.

Th1J.4 • 09:00

Non-Commensurate Sampling Based Picosecond-Level Measurement Scheme for Enhanced Timing Accuracy in Very High-Speed PON Systems, Yang Zou[1], Zhen Luo[1], Suyi Wang[2], Qiongxia Shen[2], Jian Xu[1], Shenmao Zhang[1,3], Xiaoxiao Dai[1,3], Chen Liu[1,3], Mengfan Cheng[1,3], Lei Deng[1,3], Qi Yang[1,3], Deming Liu[1,3]; *[1]Huazhong Univ of Science and Technology, China; [2]Fiberhome Telecommunication Technologies Co., Ltd., China; [3]Jinyinhu Laboratory, China.* A picosecond-level round trip delay measurement scheme based on non-commensurate sampling has been experimentally validated in 50G and 200G PON systems. This advancement enables reduced guard time, improved bandwidth utilization and enhanced environmental information perception.

Th1J.5 • 09:15 (Invited)

Progress on Very High Speed PON in ITU-T, Derek Nesset[1]; *[1]Huawei Technologies R&D UK Ltd, UK.* This paper provides a status update on the progress of Very High Speed PON in the ITU-T. Emerging requirements coming from network operators and the various technology candidates to meet them are reviewed.

08:00 -- 10:00
Room 304
Th1K • Direct Detection DSP
Presider: Shota Ishimura; KDDI Research Inc., Japan

Th1K.1 • 08:00

Equalizer-Free 60-km Bidirectional Transmission of 100-Gbps PAM4 Signals Using Wavelength-Range Estimation Method, Yasunari Tanaka[1], Kazutaka Hara[1], Junichi Kani[1], Tomoaki Yoshida[1]; *[1]NTT, Japan.* We experimentally demonstrate equalizer-free bidirectional transmission of 100 Gbps PAM4 signals over a 60-km single-mode fiber through a wavelength-range estimation method which extends the zero-dispersion wavelength estimation technique we previously proposed.

Th1K.2 • 08:15

Joint Partial Response Equalization and Multiplication-Free Error Corrector for Beyond 200-Gb/s Intra-DCIs, Xue Zhao[1], Jiahao Zhou[1], Jing Zhang[1], Rui Wang[1], Junyuan Nie[1], Shaohua Hu[1], Zhaopeng Xu[2], Bo Xu[1], Kun Qiu[1]; *[1]Univ of Electronic Science & Tech China, China; [2]Peng Cheng Laboratory, China.* We propose a multiplication-free error corrector (MF-EC) to suppress the error propagation resulted from 1/(1+*D*) decoder in a 256-Gb/s PAM-4 system. The proposed MF-EC achieves the same performance as MLSE at the KP4-FEC threshold.

Th1K.3 • 08:30

Cross-λ Phase Diversity: A Simple Chromatic-Dispersion-Tolerant Direct-Detection Scheme, Hiroshi Yamazaki[2,1], Masanori Nakamura[2], Josuke Ozaki[3], Yoshihiro Ogiso[3], Takayuki Kobayashi[2], Toshikazu Hashimoto[1], Yutaka Miyamoto[2]; *[1]NTT Device Technology Laboratories, NTT Corporation, Japan; [2]NTT Network Innovation Laboratories, NTT Corporation, Japan; [3]NTT Device Innovation Center, NTT Corporation, Japan.* Two adjacent wavelength channels carry the same 2D signal with phase-diverse carriers to enable LO-less 2D field detection with non-redundant DAC/ADCs and simple baseband PAM driving, achieving a net >300-Gbps/λ C-band 80-km transmission.

Th1K.4 • 08:45

Pairwise Transmission Enabling Dispersion-Unconstrained Multilane IM-DD Systems Beyond 100G-per-Lane, Paikun Zhu[1], Yuki Yoshida[1], Kouichi Akahane[1], Ken-ichi Kitayama[1,2], Bahram Jalali[1]; *[1]National Inst. of Information and Communications Technology, Japan; [2]Hamamatsu Photonics, Japan.* We demonstrate a pairwise transmission concept which breaks the fiber dispersion barrier in multilane IM-DD systems by joint optoelectronic coding across multiple lanes. Low-complexity C-band 224Gb/s (112Gb/s/lane) up-to-80km transmissions with different link configurations are investigated.

Th1K.5 • 09:00

Dynamic Nonlinear MIMO Equalization in 3-D Polarization Multiplexed Direct Detection Systems, Weiqi Lu[1], Yuhao Fang[1], Yang Zou[2], Puzhen Yuan[1], Dongxu Lu[3], Xiaoxiao Dai[2], Qi Yang[2], William Shieh[1,3]; *[1]Westlake Univ., China; [2]Huazhong Univ. of Science and Technology, China; [3]Westlake Inst. for Optoelectronics, China.* We demonstrate a first dynamic nonlinear MIMO equalizer for 3-D polarization multiplexed systems. By using this technique, we successfully transmit 150-Gb/s 3-D signals over 10-km SSMF.

Th1K.6 • 09:15

Low-Bit Volterra Equalization with Automatic Grouping-Enabled Non-Uniform Quantization for High-Speed DML-Based IM/DD Systems, Can C. Chen[1], Yue Liu[2], Qi Wu[4], Zhaopeng Xu[1], Jianwei Tang[1], Honglin Ji[1], Tonghui Ji[1], Hui Chen[1], Lulu Liu[1], Shangcheng Wang[1], Zhongliang Sun[1], Junpeng Liang[1], Jinlong Wei[1], Yuan Jiang[3], Weisheng Hu[1]; *[1]Pengcheng Laboratory, China; [2]National Univ. of Singapore, Singapore; [3]Sun Yat-sen Univ., China; [4]Shanghai Jiao Tong Univ., China.* We propose an automatic grouping-enabled non-uniform quantization approach for efficient Volterra equalization in > 50-Gbaud DML-based IM/DD systems. The proposed scheme achieves up to 75.6% storage savings while maintaining BER accuracy, significantly outperforming uniform quantization.

Th1K.7 • 09:30

Channel-Response-Aware Delta-Sigma Modulator Design Based on Genetic Algorithm, Linsheng Zhong[1], Zipeng Liang[1], Yuming Zhao[1], Sunningchang Zhang[1], Xu Jian[1], Xiaoxiao Dai[1], Mengfan Cheng[1], Lei Deng[1], Deming Liu[1], Qi Yang[1]; *[1]Huazhong Univ of Science and Technology, China.* We propose a channel-response-aware DSM design optimized with genetic algorithm to enhance SNR distribution. 32-Gb/s 16-QAM DMT signal, generated with a 2-bit DAC, achieves a 1.6 dB SNR improvement over a bandwidth-limited 15-km fiber link.

Th1K.8 • 09:45

On Geometric Shaping for 400 Gbps IM-DD Links with Laser Intensity Noise, Felipe Villenas[1], Kaiquan Wu[1], Yunus Can Gültekin[1], Jamal Riani[2,1], Alex Alvarado[1]; *[1]Eindhoven Univ. of Technology, Netherlands; [2]Marvell Technology, USA.* We propose geometric shaping for IM-DD links dominated by relative intensity noise (RIN). For 400 Gbps links, our geometrically-shaped constellations result in error probability improvements that relaxes the RIN laser design by 3 dB.

08:00 -- 10:00
Rooms 201-202
Th1A • Machine Learning for Network Operations
Presider: Qiong Zhang; Amazon Web Services, USA

Th1A.1 • 08:00 (Tutorial)

Generative AI for Network Operations, Jin Wang[1]; *[1]AT&T Corp, USA.* Concrete Generative AI use cases in the different phases (Day 0 planning, Day 1 build, Day 2 operation and Day 3 decommissioning) of network operations in AT&T are introduced.

Th1A.2 • 09:00 (Top-Scored)

First Field Trial of LLM-Powered AI Agent for Lifecycle Management of Autonomous Driving Optical Networks, Xiaomin Liu[1], Qizhi Qiu[1], Yihao Zhang[1], Yuming Cheng[1], Lilin Yi[1], Weisheng Hu[1], Qunbi Zhuge[1]; *[1]Shanghai Jiao Tong Univ., China.* We design and demonstrate the first field trial of LLM-powered AI Agent for ADON. Three operation modes of the Agent are proposed for network lifecycle management to process wavelength add/drop, soft/hard failures, and power optimizations.

Th1A.3 • 09:15

Field Trial of Multi-Datacenter Distributed Training for LLM Based on Bandwidth Convergence and Two Parallel Strategies Over 120km High-Reliability 800Gbit/s C+L OTN, Yuyang Liu[1], Anxu Zhang[1], Xishuo Wang[1], Lipeng Feng[1], Kai Lv[1], Hao liu[1], Xia Sheng[1], Xiaoli Huo[1], Junjie Li[1]; *[1]China Telecom Research Inst., China.* We have conducted 175 billion parameters, 1024 GPUs large language model training with up to 99.41% (Pipeline parallel, PP) and 98.95% (Data parallel, DP) training efficiency in two distributed datacenters with an interconnection distance of 120km carried by 800Gbit/s C plus L WDM in the field-deployed high-reliability optical transport network.

Th1A.4 • 09:30 (Invited)

Large Language Model for Optical Network Automation: Prospects and Challenges, Danshi Wang[1], Yao Zhang[1], Yuchen Song[1], Xiaotian Jiang[1], Yidi Wang[1], Yue

Pang[1], Min Zhang[1]; [1]*Beijing Univ. of Posts & Telecom, China.* We reviewed capabilities and limitations of applying large language models (LLMs) to optical network, evaluating their potential contributions towards the advancement of intelligent solutions in optical network automation.

08:00 -- 10:00
Rooms 205-206
Th1C • Optical Computing
Presider: Adonis Bogris; Univ. of West Attica, Greece

Th1C.1 • 08:00 (Tutorial)
Optical Computing: Principles, Examples, and Prospects, Peter L. McMahon[1]; [1]*Cornell Univ., USA.* In this talk I will discuss how optics could in principle be used to perform some computations faster or more energy efficiently than is possible with electronics, as well as the caveats and challenges.

Th1C.2 • 09:00 (Top-Scored)
TOPS-Speed Optical Tensor Convolutional Accelerator for Feature Extraction and Inference Based on Micro-Comb, Yixuan Zheng[1], Shifan Chen[1], Yifu Xu[1], Shuai Wang[1], Zhihui Liu[1], Yunping Bai[1], Sai Tak Chu[2], Xiaotian Zhu[2], Brent E. Little[3], Roberto Morandotti[4], David J. Moss[5], Xingyuan Xu[1], Kun Xu[1]; [1]*State Key Laboratory of Information Photonics and Optical Communications, Beijing Univ. of Posts and Telecommunications, China;* [2]*Department of Physics, City Univ. of Hong Kong, China;* [3]*Xi'an Inst. of Optics and Precision Mechanics, Chinese Academy of Sciences, China;* [4]*INRS-Energie, Matériaux et Télécommunications, Canada;* [5]*Optical Sciences Centre, Swinburne Univ. of Technology, Australia.* We experimentally demonstrated an optical tensor convolution accelerator multiplexing the physical dimensions of wavelength, time, and, importantly, space to represent the image channels, achieving an operational speed exceeding 3 TOPS with low data redundancy.

Th1C.3 • 09:15
Photonic Transposed Convolution Accelerator Based on Micro-Combs, Chengzhuo Xia[1], Yifu Xu[1], Shifan Chen[1], Sirui Huang[1], Zhihui Liu[1], Yunping Bai[1], Sai Tak Chu[2], Xiaotian Zhu[2], Brent E. Little[3], Roberto Morandotti[4], David J. Moss[5], Xingyuan Xu[1], Kun Xu[1], Yixuan Zheng[1]; [1]*State Key Laboratory of Information Photonics and Optical Communications, Beijing Univ. of Posts and Telecommunications, China;* [2]*Department of Physics, City Univ. of Hong Kong, Hong Kong;* [3]*Xi'an Inst. of Optics and Precision Mechanics, Chinese Academy of Sciences, China;* [4]*Energie,Matériaux et Télécommunications, INRS, Canada;* [5]*Optical Sciences Centre, Swinburne Univ. of Technology, Australia.* We demonstrate the first photonic transposed convolution accelerator using micro-combs, achieving a mean squared error of 0.006 in image reconstruction at trillions of operations per second through customizing dimension amplification in a time-wavelength interleaved system.

Th1C.4 • 09:30
GAN-Generated AI Leveraging High-Speed Thin-Film Lithium Niobate Time-Wavelength Interleaved Block, Lin Wang[1], Yang Gao[1], Wenting Jiao[1], Lei Zhang[1], Kun Yin[1], Hui Yu[1]; [1]*Zhejiang Lab, China.* Based on high-speed thin-film lithium niobate modulators, we present a monolithically integrated optical computing block for GAN-generated AI. We have

demonstrated that the system achieves high-quality image generation at various rates.

Th1C.5 • 09:45
Arrays of Non-Volatile III-v/Si Micro-Ring Lasers for Memory Search Applications, Stanley Cheung[2,1], Yanir London[2], Yuan Yuan[2], Bassem Tossoun[2], Yiwei Peng[2], Yingtao Hu[2], Thomas V. Vaerenbergh[2], Chong Zhang[3], Geza Kurczveil[2], Di Liang[4], Raymond G. Beausoleil[2]; *[1]North Carolina State Univ., USA; [2]Hewlett Packard Enterprise, USA; [3]Nexus Photonics, USA; [4]Department of Electrical and Computer Engineering, Univ. of Michigan, USA.* We explore the use of non-volatile III-V/Si ring lasers as storage elements in wavelength-division multiplexed (WDM) optical ternary content-addressable memory (O-TCAM) search. This provides new opportunity for photonic memory applications in non-volatile photonic systems.

08:00 -- 10:00
Rooms 209-210
Th1F • Photonic Advancements for Scalable and Secured Networks
Presider: Odile Liboiron-Ladouceur; McGill Univ., Canada

Th1F.1 • 08:00 (Invited)
Advancing PIC Development Using Machine Learning: From Design to Fabrication to Optical Characterization, Dan-Xia Xu[1]; *[1]National Research Council Canada, Canada.* This work leverages machine learning to accelerate PIC development in design, fabrication, and optical characterization, enabling efficient design exploration, precise fabrication corrections for structural fidelity, and high-resolution optical metrology to enhance process monitoring.

Th1F.2 • 08:30
Chip-to-Chip Photonic Connectivity in Multi-Accelerator Servers for ML, Abhishek Vijaya Kumar[1], Arjun Devraj[1], Darius Bunandar[2], Rachee Singh[1]; *[1]Cornell Univ., USA; [2]Lightmatter, USA.* We present a rack-scale compute architecture for ML using multi-accelerator servers connected via chip-to-chip silicon photonic components. Our architecture achieves (1) multi-tenanted resource slicing without fragmentation, (2) 74% faster rack-scale collective communication and, (3) 1.7X speedup in end-to-end ML training throughput.

Th1F.3 • 08:45
A 50 Gb/s WDM Silicon Photonic Ternary Content Addressable Memory Cell, Theodoros Moschos[1], Christos Pappas[1], Stefanos Kovaios[1], Ioannis Roumpos[2], Antonios Prapas[1], Apostolis Tsakyridis[1], Miltiadis M. Pegios[1], Chris Vagionas[1], Yanir London[3], Thomas V. Vaerenbergh[3], Bassem Tossoun[3], Nikos Pleros[1]; *[1]Aristotle Univ. of Thessalonikis, Greece; [2]Celestial AI, USA Minor Outlying Islands; [3]Hewlett Packard Labs, USA Minor Outlying Islands.* We experimentally demonstrate a silicon integrated WDM ternary content addressable memory cell, capable of performing matchline operations at record-high speeds of 50 Gb/s, with an energy efficiency of just 38 fJ/bit.

Th1F.4 • 09:00
Neuromorphic Physical Unclonable Function and Self-Coherent Receiver Based on a Reconfigurable Photonic Circuit, George Sarantoglou[1], Francesco Da Ros[2], Kostas Sozos[3], Metodi P. Yankov[2], Dimitris Dermanis[1], Adonis Bogris[3], Charis Mesaritakis[1]; *[1]Biomedical Engineering, Univ. of West Attica, Greece; [2]Dept of Electrical and Photonics Engineering,*

Technical Univ. of Denmark, Denmark; [3]Informatics and Computer Engineering, Univ. of West Attica, Greece. We experimentally investigate a neuromorphic receiver which addresses impairments of a 32 Gbaud self-coherent QPSK transmission and simultaneously generates unclonable responses with an equal error below 10^-9 suitable for security in the physical layer.

Th1F.5 • 09:15 (Invited)
Chiplet Solutions to Enable AI Scaling, Tony Chan Carusone[1,2]; *[1]Alphawave Semi, Canada; [2]Electrical and Computer Engineering, Univ. of Toronto, Canada.* Chiplet technology is driving sustainable AI scaling by offering lower cost and accelerating the development of new, bespoke hardware. This talk explores the evolving chiplet ecosystem for high-speed connectivity, underwritten by dense die-to-die interfaces.

08:00 -- 10:00
Rooms 211-212
Th1G • Low Loss Passives
Presider: Mario Dagenais; Univ. of Maryland at College Park, USA

Th1G.1 • 08:00
Integrated Glass Waveguide Circuit for Co-Packaged Optics in Radio-Access Networks, Lars Brusberg[1], Alessandra Bigongiari[2], Lucas W. Yeary[1], Jason R. Grenier[1], Binas Nisic[3], Stefano Stracca[2], Chad C. Terwilliger[1], Jeffrey S. Clark[1]; *[1]Corning Inc., USA; [2]Ericsson Research, Italy; [3]Ericsson AB, Sweden.* We report an integrated optical glass waveguide shuffle with standard fiber connectors to connect six optical transceivers and one shared external laser source module with transmission link loss of ≤3 dB.

Th1G.2 • 08:15
Low-Loss High-Uniformity Silicon Nitride Optical Building Blocks Integrated on Silicon Photonics Platform, Hau-Yan Lu[1]; *[1]tsmc, Taiwan.* We introduce low optical loss and highly uniform passive silicon nitride optical building blocks including straight waveguides, bends, tapers, 1-by-2 MMI, silicon nitride-to-silicon transitions and edge couplers on TSMC's silicon photonics platform with CMOS-compatible process.

Th1G.3 • 08:30 (Invited)
High Performance Passives for Quantum Photonics, Eric Dudley[1], Josep Fargas[1], Bryan Park[1], Donggyu Sohn[1], Jin Lee[1], Mehdi Jadidi[1], Maryam Khodami[1], Vimal Kamineni[1], Mihai Vidrighin[1], Mark Thompson[1]; *[1]PsiQuantum, USA.* Fault tolerance thresholds for photonic quantum computers require extremely low world-line photon loss. Herein, we show waveguide losses below 1dB/m, as well as waveguide bends, beam splitter, and waveguide crossing losses below 0.001 dB.

Th1G.4 • 09:00 (Top-Scored)
Photonic Integrated 4-Meter-Coil Resonator Critically Coupled From 900 nm to 1600 nm, Andrew S. Hunter[1], Kaikai Liu[1], Meiting Song[1], Mark W. Harrington[1], Andrei Isichenko[1], Karl Nelson[2], Daniel J. Blumenthal[1]; *[1]Univ. of California at Santa Barbara, USA; [2]Honeywell Aerospace Technologies, USA.* We demonstrate a silicon nitride photonic-integrated two-point-coupled 4-meter-coil-resonator capable of tunable critical coupling over a 700 nm range, 910 -

1610 nm, with 48 - 77 million intrinsic Q.

Th1G.5 • 09:15

Accessing Octave-Spanning Kerr Soliton Based on Thermally Controlled Microresonators, Huilan Tu[1], Haizhong Weng[2], Qiaoyin Lu[1], Lirong Huang[1], John F. Donegan[2], Weihua Guo[1]; *[1]Huazhong Univ. of Science and Techn, China; [2]School of Physics, CRANN and AMBER, Trinity College Dublin, Ireland.* The Si_3N_4 microresonator integrated thermal electrodes. Tuning the thermal power can adjust the mode spacing from 280 pm to 95 pm and access the octave-spanning Kerr soliton ranges from 125 THz to 250 THz.

Th1G.6 • 09:30 (Invited)

Integrated Photonic Gyroscopes, Mario J. Paniccia[1]; *[1]Anello Photonics, USA.* We discuss ANELLO Photonics advances in navigation solutions based on its silicon chip technology called SiPhOG ™ (Silicon Photonics Optical Gyro) and performance in real use cases as well as present low loss SiN platform.

08:00 -- 10:00
Rooms 213-214
Th1H • Multiband Optical Networks

Presider: Nicola Sambo; Scuola Superiore Sant'Anna, Italy

Th1H.1 • 08:00 (Top-Scored)

Hybrid Quantum-Classical Computing Mechanism for Dynamic QoT-Aware Resource Allocation in Multi-Band Flexible Optical Network, Miao Zhu[1], Rentao Gu[1], Jiangshan Dong[1], Lin Bai[1], Hui Li[1], Yuefeng Ji[1]; *[1]Beijing Univ. of Posts and Telecommunications, China.* We propose a hybrid quantum-classical computing mechanism with Coherent Ising Machine for dynamic QoT-aware RMSA in MB-FONs. The solution time is reduced from nearly 2 sec to 323 μs compared with the auxiliary graph method.

Th1H.2 • 08:15

Applying Auxiliary Graph for Multi-Band Network Planning Based on Hierarchical Optical Cross-Connects, Saki Sakurai[1], Katsuaki Higashimori[1], Takuya Ohara[1]; *[1]NTT Corporation, Japan.* A multi-band network planning method based on hierarchical optical cross-connects is developed. The proposed algorithm demonstrates cost efficiency by reducing more than 70% of the wavelength selective switches and incorporating a band-dependent cost model.

Th1H.3 • 08:30

GSNR-Aware Transmission Optimization in Dynamic Programmable Raman Amplifier-Enabled Multi-Band Optical Systems, Xinyi Liu[1], Rentao Gu[1], Xiaoxuan Gao[1], Junshi Gao[2], Yingchun Wang[2], Zheng He[2], Yuefeng Ji[1]; *[1]State Key Lab of Information Photonics and Optical Communications, Beijing Univ. of Posts and Telecommunications (BUPT), China; [2]China Mobile Group Design Inst. Co., Ltd., China.* We propose a GSNR-aware model with an optimization method based on it for multi-band transmission system, improving mean value and flatness of GSNR by 1.08 dB and 40.02 % across dynamic transmission scenarios.

Th1H.4 • 08:45
Autonomous Service Provisioning and Self-Healing in Multi-Band Multi-Domain IPoWDM Networks, Hussein Zaid[1], Abdelrahmane Moawad[1], Behnam Shariati[1], Robert Emmerich[1], Alessio Giorgetti[2,13], Ramon Casellas[3], Carsten Schmidt-Langhorst[1], Enrique Fernandez[4], Pablo Pavon-Marino[4,5], Filippo Cugini[2], Vignesh Karunakaran[6], Emilio Riccardi[7], Roberto Morro[7], Rui Bian[8], Chris Matrakidis[9], Caio Santos[1,10], Pol Gonzalez[11], Luis Velasco[11], Achim Autenrieth[6], Colja Schubert[1], Johannes K. Fischer[1], Ronald Freund[1,12]; *[1]Fraunhofer Inst. for Telecommunicati, Germany; [2]CNIT, Italy; [3]CTTC-CERCA, Spain; [4]E-lighthouse Network Solutions, Spain; [5]Universidad Politecnica Cartagena, Spain; [6]Adtran Networks SE, Germany; [7]TIM, Italy; [8]pureLiFi Ltd, UK; [9]OpenLightComm, Czechia; [10]Infinera, Germany; [11]UPC, Spain; [12]Technical Univ. of Berlin, Germany; [13]Univ. of Pisa, Italy.* We report on a large-scale demonstration across access, metro, and core networks, using commercial and prototype of multi-band components, achieving significantly reduced provisioning time for live video traffic through seamless IP and optical layer orchestration.

Th1H.5 • 09:00 (Invited)
Channel Power Pre-Equalization for Photonic Exchange Node in Heterogeneous Multi-Band Transmission Networks, Takeshi Seki[1], Haruka Minami[1], Rie Hayashi[1], Takeshi Kuwahara[1]; *[1]NTT Corp., Japan.* We describe a method to pre-equalize transmission line input power on the basis of only basic optical fiber parameters for reducing the effects of inter-channel stimulated Raman scattering in multi-band transmission.

Th1H.6 • 09:30
Performance Analysis of Single Band and Multi-Band Transponders for CD-ROADM Based S-, C-, L-Band WDM Networks, Varsha Lohani[1], Ramon Casellas[1], Raul Muñoz[1]; *[1]Centre Tecnològic de Telecomunicacions d, India.* This paper compares single-band and multi-band transponders for CD-ROADM nodes in UWB-WDM Networks, covering the S, C, and L bands. We also consider various add/drop configurations with WSS of different sizes.

Th1H.7 • 09:45
Performance and Transient-Resiliency of S- and E-Band Upgrades of a C+L-Band System, Andre Souza[1], Nelson Costa[1], Joao Pedro[1]; *[1]Infinera UNIPESSOAL LDA, NIF 510553079, Portugal.* This work analyses two possible band upgrades to a C+L-band system: S- or E-band. The systems (with and without Raman amplification) are compared regarding performance and the magnitude of power transients generated by link faults.

10:30 -- 12:30
Room 303
Th2A • Posters Session II

Th2A.1
A Reconfigurable 4-λ × 25-Gb/s/λ Silicon Ring-Resonator-Based WDM Receiver with Fast Wavelength Calibration, Jae-Ho Lee[1], Yongjin Ji[1], Hyun-Kyu Kim[2], Woo-Young Choi[1]; *[1]Yonsei Univ., Korea (the Republic of); [2]Samsung Electronics, Korea (the Republic of).* We present a reconfigurable 4-λ × 25-Gb/s/λ Si ring-resonator-based WDM receiver and, using it, demonstrate a new wavelength calibration technique that provides ring resonators with desired

resonance wavelengths and maintains them against external temperature variation.

Th2A.2
T-Band 155.7Gbit/s net Data-Rate DMT Signal Transmission Over 3km NANF-HCF With Simple VFFE, Xinkuo Yu[1], Peng Li[2], Lu Dai[2], Li Jianping[1], Maomao Wu[1], Yingcao Zhuo[1], Jianbo Zhang[1], Ou Xu[1], Songnian Fu[1], Yuwen Qin[1]; *[1]Guangdong Univ. of Technology, China; [2]Yangtze Optical Fiber and Cable Joint Stock Limited Company, China.* We experimentally demonstrate the net-data-rate of 155.7Gbit/s DMT signal transmission over 3km NANF-HCF at the thousand-band with 1064nm wavelength using simple VFFE, which shows the potential for future amplifier-less multiband large-capacity low-latency short-reach optical interconnection.

Th2A.3
The Performance of Hybrid Pruning as Nonlinear Impairment Mitigation in Dispersionless Optical Links, Beni Widhianto[1], Jyehong Chen[1]; *[1]National Yang Ming Chiao Tung Univ., Taiwan.* This study proposes a Hybrid Pruned VNLE (HP-VNLE), combining structured and unstructured kernel reduction, significantly lowering complexity while improving BER performance. Better results than full VNLE were achieved by combining the above HP-VNLE with DFE.

Th2A.4
FPGA Implementation of Low-Power Multiplierless Pre-Processing Free Chromatic Dispersion Equalizer, Geraldo Gomes[1], Pedro J. Freire[1], Jaroslaw E. Prilepsky[1], Sergei K. Turitsyn[1]; *[1]Aston Univ., UK.* We present a novel time-domain chromatic dispersion equalizer, implemented on FPGA, eliminating pre-processing and multipliers, achieving up to 54.3% energy savings over 80–1280 km with a simple, low-power design.

Th2A.5
Weight-Clustered Neural Networks for Low-Complexity Nonlinear Equalization in Digital Subcarrier Multiplexing Systems, Sasipim Srivallapanondh[1], Pedro Freire[1], Giuseppe Parisi[2], Mariano Devigili[3], Nelson Costa[4], Bernhard Spinnler[2], Antonio Napoli[2], Jaroslaw E. Prilepsky[1], Sergei K. Turitsyn[1]; *[1]Aston Univ., UK; [2]Infinera, Germany; [3]Universitat Politècnica de Catalunya, Spain; [4]Infinera, Portugal.* We propose a low-complexity weight-clustered NN-based equalizer for digital subcarrier multiplexing systems. Our approach achieved a 91% complexity reduction compared to the perturbation-based model in previous literature and 93% relative to a non-clustered NN.

Th2A.6
DM-Structure-Aided Low-Complexity Soft-Decision Decoder for Improving Performance-Complexity Tradeoffs in Short-Block Length Codes, Takeshi Kakizaki[1], Shuto Yamamoto[1], Masanori Nakamura[1], Etsushi Yamazaki[1]; *[1]NTT Corporation, Japan.* We propose a low-complexity soft-decision decoder using bit-sequence constrain of distribution matcher to efficiently search for codewords, improving an SNR by >0.1-dB or reducing a >50%-complexity, at the same complexity or SNR, respectively.

Th2A.7
End-to-End Optimization of the Pulse Shaper for Enhanced Residual Phase Noise Resilience, Manuel Neves[1], Paulo Monteiro[1], Fernando P. Guiomar[1]; *[1]Instituto De Telecomunicacoes, Portugal.* We leverage an autoencoder to optimize the pulse shaper and

matched filter under residual phase noise (RPN) influence. The learned filters effectively cancel the distortions caused by RPN, enhancing the robustness of the transmitted constellation.

Th2A.8
Nyquist Filtering Based on Fermat Number Transform, JingPeng Liu[1], Sheng Cui[1], Ming Tang[1], Menghong Xu[1], Kangyue Shen[1], Jianfeng Han[1], Jing Dai[2]; *[1]Huazhong Univ of Science and Technology, China; [2]FiberHome Telecommunication Technologies, China.* The Fermat number transform is innovatively applied to Nyquist filtering, reducing hardware complexity by ~80% when the ROF=0.01, while maintaining equivalent performance compared with conventional frequency- and time- domain Nyquist filters.

Th2A.9
An Optical Noise Model for low Power Microcomb Communications, Jorge G. Acosta[1], Yonghang Sun[1], Bill P. Corcoran[1]; *[1]Monash Univ., Australia.* We suggest and experimentally validate a novel channel model for low power optical sources such as microcombs. We show that noise added before modulation appears as a multiplicative term, and not as additive noise.

Th2A.10
Designing Hierarchical Distribution Matcher Through Semi-Analytical Rate Loss Minimization for Probabilistic Constellation Shaped Systems., Pantea Nadimi Goki[1,2], Luca Poti[2,3]; *[1]Scuola Superiore Sant'Anna, Italy; [2]CNIT, Italy; [3]Universitas Mercatorum, Italy.* We propose a new design procedure for hierarchical distribution matchers in a probabilistic constellation-shaped system based on a semi-analytical rate loss minimization. The technique allows optimizing block length, memory, and the number of layers.

Th2A.11
Analysis of Differential Group Delay on 800G LR4 With Partial Response Equalization and MLSE Decoder, Jiahao Zhou[1], Jing Zhang[1], Shaohua Hu[1], Zhaopeng Xu[2], Bo Xu[1], Kun Qiu[1]; *[1]Univ of Electronic Science & Tech. China, China; [2]Peng Cheng Laboratory, China.* We analyze the influence of DGD on beyond 200-Gb/s PAM-4 transmissions. We find the precoding and a joint PRE with MLSE have a better DGD tolerance among various equalizers, achieving 1.9-dB gain compared with MLSE.

Th2A.12
Net 1.15-Tb/s/λ Transmission of PS-256 QAM Signal Using a 7.6-MHz Linewidth DFB Laser and Linear Equalization, Xueyang Li[1], Qibing Wang[1], Hui Chen[1]; *[1]Peng Cheng Laboratory, China.* We propose a carrier-leakage coherent transmitter that effectively enhances laser phase noise tolerance and demonstrate the transmission of single-wavelength net 1.15 Tb/s PS-256QAM signals over 80 km using a DFB laser with 7.6 MHz linewidth.

Th2A.13
Precise Localization of Rapid Instantaneous State of Polarization Fluctuations Over FPGA, Yusuke Sasaki[1], Masaki Sato[1], Hidemi Noguchi[1], Kohei Hosokawa[1], Wakako Maeda[1]; *[1]NEC corporation, Japan.* We demonstrate an improved method employing an optical supervisory channel over FPGA, achieving precise localization of state of polarization variations across a wide frequency range with an accuracy of less than 300 meters.

Th2A.14

Performance Analysis of Lower Raman Gain Coefficient G.654.E Fiber with Distributed Raman Amplifiers, Viacheslav V. Ivanov[1], Lidia Galdino[2], John D. Downie[3]; *[1]Corning Scientific Center, Finland; [2]Corning Optical Communications, UK; [3]Corning Research and Development Corporation, USA.* The performance benefits of G.654.E fiber relative to G.652 fiber in hybrid Raman/EDFA transmission systems are investigated. Despite lower Raman gain coefficient, the G.654.E fiber has 2.6 dB higher GSNR under practical pump power constraints.

Th2A.15

High-Performance Noise Whitening Filter for 112-Gbps PAM-4 IMDD Transmission with Severe Bandwidth Limitation, Fei Xie[1], Xiaoqian Huang[1], Chenglin Bai[2], Hengying Xu[2], Yaojun Qiao[1]; *[1]Beijing Univ. of Posts and Telecomm, China; [2]Liaocheng Univ., China.* We propose a high-performance scale-enhanced noise whitening filter (SE-NWF) to suppress colored noise, which achieves a 99.2% reduction in complexity while improving receiver sensitivity by 1.4 dB compared to the conventional NWF in experiments.

Th2A.16

Spatially Disaggregated Approach to Cross-Channel Interference in Dispersion-Managed Optical Links, Emanuele E. Virgillito[1], Rosario Ietro[1], Santosh C. Ramesh[4], Sai Kishore Bhyri[3], Antonio Napoli[2], Gabriele M. Galimberti[3], Siddharth Varughese[5], Walid Wakim[3], Vittorio Curri[1]; *[1]Politecnico di Torino, Italy; [2]Infinera GmbH, Germany; [3]Infinera Corporation, USA; [4]Sri Sathya Sai Inst. of Higher Learning (SSSIHL), India; [5]Infinera Corporation, USA.* We propose a spatially disaggregated approach to observe and model the XCI coherent accumulation when routing coherent channels through dispersion-managed optical multiplex section enabling real-time digital twin and large capacity gains on legacy deployed infrastructure.

Th2A.17

Capacity Analysis of Submarine Cable System with Hollow Core Fiber, Jiang Lin[1], Yanpu Wang[1], Quanying Wen[1], Bangtian Xu[1], Jianping Li[1]; *[1]HMN TECH, China.* This paper analyzes the maximum capacity of hollow core fiber in submarine system with limited power supply. In comparison to the high performance submarine fiber G.654.D, the capacity is increased by maximum about 54.4% within 10000km.

Th2A.18

Enabling Gain-Clamped SOA in Point-to-Multipoint Digital Subcarrier Coherent Transmission System, Lulu Chen[1], Weihao Li[1], Mingming Zhang[1], Jianfeng Han[1], Zihe Hu[1], Shengming Shi[1], Ming Tang[1]; *[1]Huazhong Univ. of Science and Techn, China.* We implement SOA into DSCM-based coherent P2MP systems for low-cost amplification. Clamped by the round-trip LO, 15-dB gain is achieved without signal distortions. The power budget of 31.12 dB is demonstrated experimentally.

Th2A.19

Meta-Learning Nonlinear Equalizer for Hyperparameters Tuning for 206.9Tbps PCS-WDM Optical Transmission, Zicai Cao[1], Yaqin Wang[2], Ziheng Zhang[1], Shuchang Yao[2], Qingyu He[3], Wenhai Yu[2], Jing Dai[2], Ming Luo[3], Hongguang Zhang[4], Xi Xiao[3,4], Qi Yang[1], Mengfan Cheng[1], Deming Liu[1], Lei Deng[1]; *[1]Huazhong Univ. of Science and Techn, China; [2]Fiberhome Telecommunication Technologies Co., LTD, China; [3]China Information and Communication Technologies Group Corporation (CICT), China; [4]National Information Optoelectronics*

Innovation Center, China. A meta-learning-based nonlinear equalizer architecture is proposed for hyperparameters tuning and experimentally demonstrated in a S+C+L-band PCS128QAM coherent optical transmission over 150km-G654.E, achieving an AIR of 206.9Tbps while significantly reducing additional training cost by 80.2%.

Th2A.20
Adaptive Step-Size Digital Back-Propagation for Ultra-High Baud Unrepeatered Systems with Raman Amplification, Zhiyuan Yang[1], Mengfan Fu[1], Xi Chen[1], Lilin Yi[1], Weisheng Hu[1], Qunbi Zhuge[1]; *[1]Shanghai Jiao Tong Univ., China.* We propose an adaptive step-size subcarrier-multiplexing digital back-propagation (AS-SCM-DBP) which achieves 2.06 dB and 0.99 dB SNR gains compared to linear compensation and SCM-DBP in single-channel 300 GBd 8-subcarrier unrepeatered SCM systems with Raman amplification.

Th2A.21
Experimental Verification of an Analytical Model of Filtering Impact on Coherent Digital Subcarriers Systems, Pablo Torres-Ferrera[1], Giuseppe Parisi[1], Jacqueline Sime[1], Carlos Castro[1], Roberto Gaudino[2], Giuseppe Rizzelli Martella[2], Federico Pevere[3], Sezer Erkilinc[3], Thomas Duthel[1], Chris R. Fludger[1], Antonio Napoli[1]; *[1]Infinera GmbH, Germany; [2]Politecnico di Torino, Italy; [3]Infinera, Sweden.* We present the experimental verification of a developed analytical model to estimate the filtering penalty in digital subcarrier coherent systems, reporting a high model accuracy with a maximum error in sensitivity penalty of 0.4 dB.

Th2A.22
Experimental Demonstration of Ultra-Low-Attenuation Antiresonant Hollow Core Fiber Transmission in S Band Based on Homemade BDFAs, Lei Shen[2], Bing Han[1], Guofeng Yan[1], Shuo Xu[2], Li Zhang[2], Lei Zhang[2], Jun Chu[2], Jie Luo[2], Jian Wang[1]; *[1]Hust, China; [2]YOFC, China.* We demonstrated the 600-km ultra-low-loss NANF transmission of 25 Gbaud QPSK signals in S band based on a solely NANF recirculating loop system and high-performance BDFAs.

Th2A.23
Photonic THz Sensing-Assisted Multipath Channel Estimation for ISAC, Zhidong Lyu[1,2], Lu Zhang[1], Mingzheng Lei[3], Qiuzhuo Deng[1], Zuomin Yang[1], Xing Fang[1], Oskars Ozolins[5,4], Guangyi Liu[6], Min Zhu[3], Xiaodan Pang[1,5], Xianbin Yu[1]; *[1]Zhejiang Univ., China; [2]KTH Royal Inst. of Technology, Sweden; [3]Purple Mountain Laboratories, China; [4]RISE Research Inst.s of Sweden, Sweden; [5]Riga Technical Univ., Latvia; [6]China Mobile Communication Research Inst., China.* We present a sensing-assisted multipath channel estimation method for photonic terahertz integrated sensing and communication systems, achieving ~8 dB compensation gain in a 20 Gbps over 20 m multipath 124 GHz wireless communication link.

Th2A.24
Underwater Acoustic OFDM Transmission Over Optical Fiber with Distributed Acoustic Sensing, Wataru Kohno[1], Jian Fang[1], Shuji Murakami[1], Giovanni Milione[1], Ting Wang[1]; *[1]NEC Laboratories America, Inc, USA.* We demonstrate fiber-optic acoustic data transmission using distributed acoustic sensing technology in an underwater environment. An acoustic orthogonal frequency-division multiplexing (OFDM) signal transmitted through a fiber-optic cable deployed in a standard 40-meter-scale underwater testbed.

Th2A.25

Ultra-Short Period, Wideband, and Uninterrupted Microwave Photonic Frequency-Hopping Communication, Xiaoyang Liu[1], Qichao Lu[2], Tong Cheng[2], Renjie Li[2], Mengfan Cheng[1], Deming Liu[1], Lei Deng[1]; *[1]Huazhong Univ. of Science and Technology, China; [2]China Ship Development and Design Centre, China.* We proposed an ultra-short period, wideband microwave photonic frequency-hopping (FH) communication based on I/Q modulation, and experimentally demonstrated 5ns-period and 10GHz-range QPSK/16QAM multi-frequency-point FH microwave signal transmission without communication interruption caused by frequency switching.

Th2A.26

Overwater Low-Altitude Source Localization by Underwater Distributed Hydrophone, Shuolong Zhu[1], Ke Ai[1], Junfeng Chen[1], Cunzheng Fan[1], Hao Li[1], Zhijun Yan[1,2], Qizhen Sun[1,2]; *[1]Huazhong Univ. of Science and Technology, China; [2]Jinyinhu Laboratory, China.* We propose a method to locate the overwater low-altitude source by the underwater distributed hydrophone with spectral subtraction preprocessing. The strongest external noise component is reduced by 10.2dB and maximum localization error is (7.8°, 0.3444m).

Th2A.27

Photonics-Aided THz ISAC System Based on a Spectral Overlapping Multi-Carrier 16QAM-LFM Waveform, Mingzheng Lei[1], Qingzhi Zhou[2], Junhao Zhang[2], Hao Li[2], Bingchang Hua[1], Yuancheng Cai[1], Jiao Zhang[1], Xingyu Chen[1], Junjie Ding[1], Hongjia Liu[2], Zewei Zhang[2], Sha Zhu[3], Bo Liu[4], Jianjun Yu[5], Min Zhu[2]; *[1]Purple Mountain Laboratories, China; [2]National Mobile Communications Research Laboratory, Southeast Univ., China; [3]Inst. of Intelligent Photonics, Nankai Univ., China; [4]Nanjing Univ. of Information Science & Technology, China; [5]Key Laboratory for Information Science of Electromagnetic Waves, Fudan Univ., China.* We design a spectral overlapping multi-carrier 16QAM-LFM waveform. A photonics-assisted THz integrated sensing and communication (ISAC) system with simultaneous 52-Gbps data rate and 1.2-cm radial resolution is realized using the proposed spectrally efficient multi-carrier waveform.

Th2A.28

Optical QAM Neural Networks for Efficient AI Accelerators, Marc G. Bacvanski[1], Sri K. Vadlamani[1], Kfir Sulimany[1], Dirk R. Englund[1]; *[1]Massachusetts Inst. of Technology, USA.* Analog optical neural networks are a promising paradigm for low power AI accelerators, but analog modulation even at low bit precision is energy intensive. Inspired by telecom's QAM, QAM ONNs leverage light's complex amplitude to boost accuracy and efficiency, creating new opportunities for hardware constrained AI applications.

Th2A.29

Native and Reconfigurable Distributed Acoustic Sensing Integrated with Single-Carrier 64QAM Transmission Signal, Zihe Hu[1], Can Zhao[1], Mingming Zhang[1], Junda Chen[1], Ming Tang[1]; *[1]Huazhong Univ. of Science and Technology, China.* We propose a native and reconfigurable ISAC scheme to extract DAS directly from 64QAM transmission signal, realizing flexible spatial resolutions ranging from 1.6m to 8m, with corresponding phase noise floors from -64.5dB to -48.9dB rad^2/Hz.

Th2A.30

High-Fidelity Discrete Fractional Fourier Transform in Integrated Optics, Guangsong Yuan[1], Hongxiang Guo[1], Shunxin Song[1], Suping Jiao[1], Jian Wu[1]; *[1]Beijing Univerisity of Posts and Communi, China.* We present an inverse-designed integrated optics device achieving a π/4-order discrete fractional Fourier transform (DFrFT) with fidelities of 0.995 (simulation) and 0.899 (experiment). This scalable design enables the implementation of higher-order DFrFTs through additivity.

Th2A.31

Real-Time FBG Wavelength Shift Sensing System Using a Gain Switched Dual Comb, Minghao Wei[2,1], Conor McArdle[2], Aleksandra Kaszubowska-Anandarajah[1,2], Alejandro Rosado[2,1], Davide Janner[3], Malhar Nagar[3], Prince M. Anandarajah[2,1]; *[1]CONNECT Research Centre, Dunlop Oriel House, Trinity College Dublin, Ireland; [2]Photonics Systems and Sensing Lab, School of Electronic Engineering, Dublin City Univ., Ireland; [3]Inst. of Materials Physics and Engineering, DISAT - Politecnico di Torino, Italy.* Real-time FBG wavelength shift tracking system using an injected gain-switched dual comb and a custom signal processing solution is demonstrated. High accuracy and sensing resolution of 0.855 pm at 43 Hz capture rate is achieved.

Th2A.32

Reconfigurable Photonic-Assisted Interrupted-Sampling Repetitive Repeater Jamming System, Senyu Zhang[1,2], Yiqiang Ou[1,2], Hao Lin[3], Yunlong Li[1,2], Shuang Zheng[1,2], Minming Zhang[1,2]; *[1]School of Optical and Electronic Information, Huazhong Univ. of Science and Technology, China; [2]National Engineering Research Center for Next Generation Internet Access System, China; [3]Qingdao Univ., China.* We report the first reconfigurable photonic-assisted interrupted-sampling repetitive repeater jamming system utilizing multi-path optical delay, achieving 22 false targets against an 18 GHz linear frequency-modulated signal and 4 against phase-coded signal using four delay paths.

Th2A.33

Strain Accumulation Rate in Fiber Spools in the Presence of Ambient Acoustic Noise in Laser Phase Interferometry, Yue-Kai Huang[1], Ezra Ip[1], Junqiang Hu[1], Shuji Murakami[1], Yoshiaki Aono[2], Koji Asahi[2]; *[1]NEC Laboratories America Inc., USA; [2]NEC Corporation, Japan.* We investigate the growth rate of phase power spectral density in fiber spools in the presence of ambient acoustic noise, observing a complex interplay between spool geometry, shielding effects, and phase cancellation at high acoustic frequencies.

Th2A.34

A Three-Terminal Nanophotonic Integrator for Deep Neural Networks, Saumil Bandyopadhyay[2,1], Kfir Sulimany[2], Alexander Sludds[2], Ryan Hamerly[2,1], Keren Bergman[3], Dirk R. Englund[2]; *[1]Physics and Informatics Laboratories, NTT Research, Inc., USA; [2]Research Laboratory of Electronics, Massachusetts Inst. of Technology, USA; [3]Department of Electrical Engineering, Columbia Univ., USA.* We demonstrate a nanophotonic integrator, fabricated in a silicon photonic process, that directly accumulates optical signals at 6.25 GSa/s in the optical domain without digitization and applies an inline nonlinearity for deep neural networks.

Th2A.35

An Optoelectronic Neuromorphic Accelerator with Over 1 TOPS for Real-Valued and Over 3 TOPS for Complex-Valued Vectors, Ying Zhu[1], Kailai Liu[1,2], Yuhan Gong[2], Qingyu He[2], Ziyue Dang[1], Chao Yang[2], Ming Luo[2], Hongguang Zhang[1], Daigao Chen[1], Xi Xiao[1,3]; *[1]NationalOptoelectronicsInnovationCenter, China; [2]State Key Laboratory of Optical Communication Technologies and Networks, China; [3]Peng Cheng Laboratory, China.* A scalable and integrable optoelectronic neuromorphic accelerator is demonstrated, achieving computing speeds of $1.024\si{TOPS}$ and $3.072\si{TOPS}$ for real-valued and complex-valued convolutions, respectively. It yields competitive accuracies in processing both real-valued and complex-valued convolution neural networks.

Th2A.36

Sub-Terahertz Signal Demultiplexing and Downconversion Using Photonic Technology, Pham Tien Dat[1], Yuya Yamaguchi[1], Yuki Yoshida[1], Atsushi Kanno[2], Naokatsu Yamamoto[1], Tetsuya Kawanishi[3], Kouichi Akahane[1]; *[1]NICT Network System Research Inst., Japan; [2]Nagoya Inst. of Technology, Japan; [3]Waseda Univ., Japan.* We propose a new method for sub-THz signal demultiplexing and downconverting using photonic technology. We demonstrated demultiplexing and downconversion of three multiplexed signals with a total capacity of 150 Gb/s in the W band to prove the proposed method.

Th2A.37

Experimental Demonstration of Integrated Remote Sensing and SDM Fiber-Optic Communications Through a 50-km 4-Core Fiber, Guofeng Yan[1], Ziyi Tang[1], Bing Han[1], Lei Shen[2], Shuo Xu[2], Li Zhang[2], Lei Zhang[2], Jun Chu[2], Jie Luo[2], Jian Wang[1]; *[1]HUST, China; [2]YOFC, China.* We first propose and demonstrate the integrated sensing and SDM communication system for simultaneous 100 Gbaud 16QAM signals transmission and remote rotational speed measurement.

Th2A.38

A Novel Photonic Instantaneous Frequency Measurement Technique Using Binary Deduction, Sreeraj S J[1], Mandeep Singh[1], Joydip Dutta[1], Pavitra Varsha[1], Deepa Venkitesh[1]; *[1]IIT Madras, India.* This paper presents a novel photonic instantaneous frequency measurement (IFM) system based on sub-Nyquist sampling, utilizing a binary deduction algorithm. The proof of concept is demonstrated with two experiments.

Th2A.39

Localising State-of-Polarisation Perturbation on a Repeatered Link Using Wavelength Dispersion Delay Walk-Off, Kristina Shizuka Yamase Skarvang[1], Daniel J. Elson[2], Shohei Beppu[2], Daiki Soma[2], Steinar Bjørnstad[3], Dag Roar Hjelme[1], Yuta Wakayama[2]; *[1]NTNU, Norway; [2]KDDI Research, Japan; [3]Tampnet, Norway.* Localisation of state-of-polarisation transient events using group delay difference between two wavelengths is investigated for field-type conditions, assuming varying initial states in an amplified 80-km system. A spatial resolution of 5.4 km is achieved.

Th2A.40

All-Optical Multi-Frequency Conversion 5G NR Analog-Radio-Over-Fiber Fronthaul With Enhanced Performance Over Digitised Implementations, Vicente Fito[1], Maria Morant[1], Roberto Llorente[1]; *[1]Nanophotonics Technology Center, Universitat Politècnica de València,* *Spain.* This work demonstrates all-optical frequency conversion for 5G NR by heterodyning two lines of an optical comb transmitted in multicore fiber, which outperforms conventional digital fronthaul systems considering SNR, and achieves long-range 58.8 km reach.

Th2A.41

2D Wide Field-of-View (FOV) Metalens Focal Plane Array (FPA) Based Silicon Photonic Beam Steering for Optical Wireless Communication (OWC), Pin-Cheng Kuo[1], Chung-Yu Hsu[1], Ping-Yen Hsieh[1], Yuan-Zeng Lin[1], You-Chia Chang[1], Chi-Wai Chow[1]; *[1]National Yang Ming Chiao Tung Univ., Taiwan.* We demonstrate a 2D silicon-photonic beam steerer based on a metalens focal plane array with a field-of-view of 51.4°×6.12°. Data rates of 75.83-Gbit/s and 70.34-Gbit/s at center and side channels, respectively, are achieved.

Th2A.42

60 Gb/s SSB-FBMC Signals Wireless Transmission at 0.1THz Based on Simplified Parallel KK Receiver, Long Zhang[1], Jianjun Yu[1,2], Xiongwei Yang[1], Yikai Wang[2,3], Chengzhen Bian[1], Wen Zhou[1], Jiao Zhang[2,3], Min Zhu[2,3], Yi Wei[1], Qiutong Zhang[1], Kaihui Wang[1]; *[1]Fudan Univ., China; [2]Purple Mountain Laboratories, China; [3]Southeast Univ., China.* We proposed and experimentally demonstrated a simplified parallel Kramers–Kronig (KK) receiver for single-sideband (SSB) filter bank multi-carrier (FBMC) signals wireless transmission at 0.1THz utilizing envelope detection. After 10-km wire and 3-m wireless transmission, a net rate of 63.1 Gbit/s 16QAM-SSB-FBMC signals transmission is achieved.

Th2A.43

Side-Emitting Fiber-Based Optical Camera Communication Under Fog Conditions, Klara Eollos Jarosikova[1], Carlos Guerra-Yanez[1], Stanislav Zvanovec[1], Matej Komanec[1]; *[1]Czech Technical Univ. in Prague, Czechia.* We demonstrate the resilience of a side-emitting fiber-based optical camera communication (OCC) channel under severe fog conditions. For visibility of only 6.2 m, the link provides reliable communication vital for outdoor emergency services.

Th2A.44

Highly-Accurate Real-Time Instantaneous Frequency Estimation of a Fast-Chirped Laser and Its Application for FMCW LiDAR Nonlinearity Correction, Xuebing Zhang[2], Javier P. Santacruz[2], Jac Romme[2], Amir A. Kashi[2], Gijs Elzakker[2], Marcus Dahlem[1], Dongjae Shin[2], Ruud Oldenbeuving[2]; *[1]IMEC, Netherlands; [2]IMEC-NL, Netherlands.* A novel real-time optical instantaneous frequency estimator for fast-chirped lasers is introduced, offering higher accuracy, reduced algorithm complexity, and shorter time delay than the traditional Hilbert transform-based approach. An application for FMCW LiDAR nonlinearity correction is demonstrated using a 0.25-m fiber.

Th2A.45

Beam Divergence and Atmospheric Turbulence Resiliency Enhancement in Free Space Optical Communication with Multiple Receivers and Maximal-Ratio Combining Algorithm, Shin-Yu Lee[1], Yin-He Jian[1], Tzu-Chieh Wei[1], Chi-Wai Chow[1]; *[1]National Yang Ming Chiao Tung Univ., Taiwan.* We demonstrate a free-space-optical-communication (FSOC) using multiple receivers (Rxs) processed with maximal-ratio-combining. Results show that multiple Rxs perform not only as well as a large aperture Rx, but also improve the atmospheric turbulence performance.

Th2A.46

Demonstration of Distance-Dependent Data Channel Recovery in a 40-Gbit/s QPSK 2-Channel Mode-Multiplexed FSO Link by Varying the Longitudinal Wavenumbers of Structured Light, Ruoyu Zeng[1], Yingning Wang[1], Abdulrahman Alhaddad[1], Huibin Zhou[1], Hongkun Lian[1], Yuxiang Duan[1], Muralekrishnan Ramakrishnan[1], Zile Jiang[1], Yue Zuo[1], Wing Ko[1], Xinzhou Su[1], Mo Mojahedi[2], Moshe Tur[3], Alan Willner[1]; *[1]Univ. of Southern California, USA; [2]Univ. of Toronto, Canada; [3]Tel Aviv Univ., Israel.* We experimentally demonstrate tunable distance-dependent data channel recovery in a 40-Gbit/s QPSK MDM FSO link by varying the longitudinal wavenumbers of structured beams. Data channel privacy is enhanced by a >25dB power difference between the received signals at the intended and undesired locations.

Th2A.47

Bidirectional High-Speed Beam-Steered Optical Wireless Communication Assisted by LCoS Based 7-Core Fiber, Jin Tao[1], Mian Wu[1], Yuhan Gong[1], Chao Yang[1], Lin Wu[1], Ming Luo[1], Zhen Li[1], Xi Xiao[2], Zhixue He[3], Shaohua Yu[3]; *[1]China Information Communication Technologies Group Corporation (CICT), China; [2]National Information Optoelectronics Innovation Center, China; [3]Pengcheng Laboratory, China.* Supported by LCoS based 7-core fiber and multichannel transmitter, we experimentally demonstrate a 120Gb/s/λ intelligent bidirectional high-speed beam-steering optical wireless communication system with field-of-view of 7.0°×7.2° over 3.2 m within SD-FEC limit of 2.4×10^{-2}.

Th2A.48

End-to-End Learning-Based Autoencoder Framework for Faster-Than-Nyquist Optical Wireless Transmission, Yuan Wei[1], Chaoxu Chen[1], Wentao Sun[1], Chao Shen[1], Ziwei Li[1], Yingjun Zhou[1], Junwen Zhang[1], Nan Chi[1], Jianyang Shi[1]; *[1]Key Laboratory for Information Science of Electromagnetic Waves (MoE), Fudan Univ., China.* We propose a novel autoencoder framework for FTN transmission to jointly optimize the ISI caused by FTN signaling and the impairments of the physical channel. The feasibility of the framework is experimentally demonstrated in a practical optical wireless communication system, achieving the lowest spectrum compression ratio of 0.68.

Th2A.49

Dual-Domain Feature Learning for Anomaly Detection and Localization in Free-Space Optical Systems, Song Song[2,1], Jiaqing Jia[2,1], Xiangyu Liu[3], Yejun Liu[2,1], Lun Zhao[2,1], Tingwei Wu[2,1], Lei Guo[4]; *[1]Inst. of Intelligent Communications and Network Security, Chongqing Univ. of Posts and Telecommunications, China; [2]School of Communications and Information Engineering, Chongqing Univ. of Posts and Telecommunications, China; [3]School of Information Science and Engineering, Shenyang Ligong Univ., China; [4]Inst. of Information and Communications, Chongqing Univ. of Posts and Telecommunications, China.* To enhance reliability of FSO system, we offer a novel approach and propose Dual-Domain Feature Multitask Network (DFMT-Net) for anomaly detection and localization, achieving 99.42% detection accuracy and 98.03% localization accuracy.

Th2A.50

20.1-km D-Band Wireless Transmission Enabled by CVMSO NN Equalizer in Photonics-Aided Coherent MMW Systems, Sicong Xu[1], Wen Zhou[1], Qihang Wang[1], Yi Wei[1], Xiongwei Yang[1], Mingxu Wang[1], Xin Lu[1], Jie Zhang[1], Jingtao Ge[1], Jingwen Lin[1], Yuan Ma[1], Si q. Wang[1],

Zhihang Ou[1], Jianjun Yu[1,2]; [1]*Fudan Univ., China;* [2]*Purple Mountain Laboratories, China.* We demonstrate D-band 2-GBaud QPSK signal transmission over a 20.1-km wireless link at 125-GHz in a photonics-assisted millimeter wave coherent communication system using complexed-valued multi-symbol output (CVMSO) neural network (NN) nonlinear equalizer with 1.8-dB gain.

Th2A.51

Optical Phased Array Beam Steering Utilizing Phase Modulation Characteristics Derived From on-Chip Phase Monitor, Makoto Nakai[1], Hiroyuki Matsubara[1], Atsutaka Miyamichi[1], Tatsuya Yamashita[1], Masashige Sato[2], Shotaro Miyawaki[2], Koichi Oyama[2]; [1]*Toyota Central R&D Labs Inc, Japan;* [2]*MIRISE Technologies Corporation, Japan.* The phase modulation characteristics of the modulator in a 32-channel silicon photonics optical phased array was derived with an on-chip phase monitor. With the derived characteristics, beam forming is demonstrated within 40 degrees Field-of-View.

Th2A.52

Fiber Coupling: A Path to Eye-Safe and Reliable FSO Communications, Vitor D. Correia[1], Manuel José M. de Freitas[1], Paulo Monteiro[1], Fernando Guiomar[1], Gil Fernandes[1]; [1]*Instituto de Telecomunicações, Portugal.* We use MCF coupling to implement a multi-aperture FSO communication system relaxing eye-safety and enhancing reliability. Experimental validation at 200 Gbps in a turbulence chamber shows 20% reliability gains compared to a single-aperture system.

Th2A.53

Bit-Rate Adaptive Optical Attocell Networks With λ-Tunable Beam Steering Under Physical Impairments, Takahiro Kodama[1,2], Kiichiro Kuwahara[1], Mikolaj Wolny[2], Eduward Tangdiongga[2]; [1]*Kagawa Univ., Japan;* [2]*Electro-Optical Communication Systems Group, Eindhoven Univ. of Technology, Netherlands.* We demonstrated maximizing transmission capacity and defining discrete and continuous coverage boundaries in an optical attocell network, utilizing bit-rate adaptation. This approach accounts for beam profile and aberration-induced coupling losses in wavelength-tunable beam steering.

Th2A.54

BER-Analysis Based Resource Allocation Algorithm in SDN-Controlled Multi-User NOMA-OFDM VLC System, Chengju Hu[1], Jianhang Li[1], Yongxin Wang[1], Yang Hong[2], Jian Zhao[1]; [1]*South China Univ. of Technology, China;* [2]*Nokia Bell Labs, France.* We propose a novel BER-analysis based resource allocation algorithm for multi-user NOMA-OFDM and demonstrate in an SDN-controlled VLC system with real-time transmitter that it outperforms conventional algorithms under varying user demand, distances and receiving angles.

Th2A.55

Field Demonstration of Cell-Free Massive MIMO System Utilizing Analog IFoF-Based Fronthaul Link, Shinji Nimura[1], Yu Tsukamoto[1], Takahide Murakami[1], Kazuki Tanaka[1], Kamya Y. Yazdandoost[1], Hiroyuki Shinbo[1], Yoshiaki Amano[1], Ryo Inohara[1]; [1]*KDDI Research, Japan.* Cell-Free massive MIMO, which requires phase accuracy of 15°, was successfully demonstrated with analog-IFoF fronthaul link at outdoor environment. Precise phase stability of < 1.41° and successful MIMO operation were confirmed for 48 hours experiment.

Th2A.56
Achieving High-Efficiency Error-Correcting Transmission of Qutrits with on-Chip Quantum Autoencoder, Denghui Wang[1], Haoran Ma[1], Donghui Chen[1], Liao Ye[1], Fanjie Ruan[1], Yuehai Wang[1], Jianyi Yang[1]; *[1]Zhejiang Univ., China.* We designed a programmable quantum autoencoder on a silicon photonic chip with nearly no compression loss, which enabled us to propose and implement a new highly efficient error-correcting transmission protocol for qutrits.

Th2A.57
Silicon Photonic Generation and Measurement of Multi-Channel Energy-Time Entangled Photons Distributed Over 40km Single Mode Fiber, Yue Qin[1], Hongnan Xu[1], Hon Ki Tsang[1]; *[1]Chinese Univ. of Hong Kong, Hong Kong.* Here we report on a monolithic integrated silicon system that enables the multi-channel energy-time entanglement up to 40 km single mode fiber distribution with visibility over 96%.

Th2A.58
Integrated Frequency-Agile 780 nm PZT Silicon Nitride Ring Modulator and Application to Sub-Doppler Atom Cooling, Andrei Isichenko[1], Nick Montifiore[1], Jiawei Wang[1], Nitesh Chauhan[1], Mark W. Harrington[1], Iain Kierzewski[2], Ryan Q. Rudy[2], Daniel J. Blumenthal[1]; *[1]ECE, UC Santa Barbara, USA; [2]U.S. Army Research Laboratory, USA.* We demonstrate a 780 nm PZT-on-Si_3N_4 stress-optic ring modulator with 2.8 million Q, 11 MHz modulation bandwidth, and 1 GHz/V static tuning. The modulator enables precise laser frequency control for sub-Doppler cooling of rubidium atoms.

Th2A.59
High-Q and Low Mode Volume Photonic Crystal Nanobeam Cavities on a Commercial 300 mm Silicon Photonic Platform, Skylar Deckoff-Jones[1], Angela Donis[1], Ana Elias[1], Jayson Briscoe[2], Gerald Leake[2], Daniel Coleman[2], Michael Fanto[3], Robert Pettit[1], Ananthesh Sundaresh[1], Shobhit Gupta[1], Manish Kumar Singh[1], Sean Sullivan[1]; *[1]memQ Inc, USA; [2]AIM Photonics, USA; [3]Air Force Research Laboratory, USA.* We fabricate photonic crystal nanobeam cavities quality factors in excess of 150,000 on AIM Photonics's 300mm silicon photonic platform. We use the cavities to demonstrate enhancement of Er3+ ion emission with Purcell factors >100.

Th2A.60
Adaptively Optimized Detection of Bright Pico-Second Twin Beams Generated in Fiber, Hongyi Yan[1], Wen Zhao[1], Xueshi Guo[1], Xiaoying Li[1]; *[1]College of Precision Instrument and Opto-Electronics Engineering, Key Laboratory of Opto-Electronics Information Technology, Ministry of Education, Tianjin Univ., China.* We demonstrate an adaptive electrical gain optimized detection scheme for pulsed twin beams in optical fiber. Intensity difference squeezing level of -7.5 dB has been measured without the need of accurately calibrating channel losses.

Th2A.61
Characterizing a Metropolitan Fiber Link with Heralded Single Photons from an Electronic-Photonic Chip, Anirudh Ramesh[1], Ely M. Eastman[1], Danielius Kramnik[2], Imbert Wang[3], Dorde Gluhovic[3], Milos Popovic[2], Vladimir Stojanovic[2], Prem Kumar[1]; *[1]Northwestern Univ., USA; [2]UC Berkeley, USA; [3]Boston Univ., USA.* We characterize single photon transmission through a ∼ 48 km underground fiber link. Using an integrated source, we

measure delay variations in the timing correlations between the photon-pairs of 40 ps over 90 minutes, compared to 200 ps in a 50 km spool kept in the laboratory, showing the suitability of buried fiber for quantum networks.

Th2A.62
Integrated High-Performance LDPC Decoder for Continuous-Variable Quantum Key Distribution System, Chuang Zhou[1], Yang Li[1], Li Ma[1], Yujie Luo[1], Wei Huang[1], Jie Yang[1], Bingjie Xu[1]; *[1]Inst. of Southwestern Communication, China.* The throughput of the error correction decoding is one of the major bottlenecks of high-speed continuous-variable quantum key distribution (CV-QKD) systems and an integrated decoder with Gbps decoding throughput is implemented in this work.

Th2A.63
Demonstration of 400G Optical Interoperability in IP Over WDM Network Scenarios Over Single Span WDM System with and Without Optical Amplifiers, Yu Rong Zhou[1], Adrian Smith[1], Michael Phelan[1], Russell Davey[1], John Keens[2], Martyn Allen[2], Anuj Malik[2], Nikolay Manolov[3], Julian Lucek[3], Leonard Luna[3]; *[1]BT Group plc, UK; [2]Cisco Systems Inc, USA; [3]Juniper Networks Inc, USA.* We show successful demonstration of 400G optical interoperability in IP over WDM investigating 400G ZR and high power ZR+ performance over single span amplified and passive WDM system with streaming telemetry for multi-vendor routers

14:00 -- 16:00
Room 207
Th3D • Point to Multipoint and Satellite Networks
Presider: Daniel Kilper; Univ. of Dublin Trinity College, Ireland

Th3D.1 • 14:00
On the Synergy Between Flexible Ethernet and Point-to-Multipoint Optical Networks, Meihan Wu[1], Xiaoliang Chen[1], Francesco Musumeci[2], Ruoxing Li[1], Yuxiao Zhang[1], Qian Lv[1], Zuqing Zhu[1]; *[1]Univ. of Science and Technology of China, China; [2]Politecnico di Milano, Italy.* We present the first comparative study on the synergistic benefits between flexible Ethernet and point-to-multipoint optical networks. Simulations confirm that by combining the two techniques adaptively, service provisioning can be achieved with significantly higher cost-effectiveness.

Th3D.2 • 14:15
QoS-Aware Resource Allocation in Point to Multipoint (P2MP) Metro Aggregation Networks, Polizois Soumplis[1,2], Konstantinos Christodoulopoulos[2,3], Konstantinos Yiannopoulos[2,4], Emmanuel Varvarigos[1,2]; *[1]School of Electrical and Computer Engineering, National Technical Univ. of Athens, Greece; [2]Inst. of Communication and Computer Systems,, Greece; [3]Department of Informatics and Telecommunications, National and Kapodistrian Univ. of Athens, Greece; [4]Department of Informatics and Telecommunications, Univ. of the Peloponnese, Greece.* We examine dynamic resource allocation using Coherent Point-to-Multipoint (P2MP) transceivers for metro aggregation. Dynamic scheduling improves resource utilization, ensuring high-priority traffic capacity and adaptability, while reducing transceiver needs and costs compared to static methods.

Th3D.3 • 14:30 (Invited)
Point-to-Multipoint Coherent Optics in ROADM-Based Networks: Opportunities and Challenges, Nina Skorin-Kapov[1], Pablo Pavon-Marino[2,3], Antonio Ginés Buendía López[2,3], Joao Pedro[4]; *[1]Centro Universitario de la Defensa, San Javier Air Force Base, Spain; [2]Universidad Politécnica de Cartagena, Spain; [3]E-lighthouse Network Solutions, Spain; [4]Infinera Unipessoal Lda, Portugal.* This paper discusses potential benefits and challenges in introducing point-to-multipoint (P2MP) digital subcarrier-based transceivers in ROADM-based networks. An analysis of different ROADM architectures to support P2MP connections is presented, including costs, insertion losses and functionality.

Th3D.4 • 15:00
Resource Allocation with Service Level Constraints in Point-to-Multipoint Metro-Core Networks, Konstantinos (Kostas) Christodoulopoulos[1,2], Polizois Soumplis[2], Panagiotis Kokkinos[2], Antonio Napoli[3], Mohammad Hosseini[3], Konstantinos Yiannopoulos[2], Emmanuel Varvarigos[2]; *[1]Univ. of Athens, Greece; [2]Inst. of Communication and Computer Systems, Greece; [3]Infinera, Germany.* We analyze the cost-effectiveness of a point-to-multipoint metro-core (P2MP) architecture in scenarios where service-level requirements allow for dynamic allocation and sharing of spectrum. Significant cost savings are demonstrated compared to utilizing point-to-point (P2P) transceivers.

Th3D.5 • 15:15
Multi-Layer Orbit-Weave Optical Satellite Networks with Cross-Layer Routing for Stable Service Delivery, Hua Wang[2], Yongli Zhao[1], Massimo Tornatore[3], Wei Wang[1], Jie Zhang[1]; *[1]Beijing Univ. of Posts & Telecom, China; [2]Nanjing Tech Univ., China; [3]Politecnico di Milano, Italy.* We propose a multi-layer constellation for optical satellite networks and a cross-layer path-aggregation routing strategy to establish persistent links. Our proposal reduces blocking probability (12.6%) and link utilization (10.2%) with respect to a state-of-the-art single-orbit solution.

Th3D.6 • 15:30
Sub-Nanosecond Time Synchronization Method by Quasi-Dual-Frequency Distributed Time Synchronization in Time-Varying Optical Satellite Network, Kangqi Zhu[2,1], Nan Hua[2,1], Xiaoping Zheng[2,1]; *[1]Department of Electronic Engineering, Tsinghua Univ., China; [2]Beijing National Research Center for Information Science and Technology (BNRist), China.* We propose a cost-effective quasi-dual-frequency time synchronization method for time-varying optical satellite networks. The experimental results demonstrate that the prototype system can achieve 0.536-ns synchronization accuracy, which is 2 orders higher than the clock resolution.

14:00 -- 16:00
Room 208
Th3E • Photo-Detector and Integration
Presider: Patrick Runge; Fraunhofer HHI, Germany

Th3E.1 • 14:00
High-Power Germanium-Silicon Photodetector Integrated with On-Chip Antenna for Millimeter-Wave Wireless Communication, Xiangyu Guo[1], De Zhou[1], Zhizhou Zhou[1], Xinliang

Zhang[1], Yu Yu[1]; [1]*Huazhong Univ. of Science and Techn, China.* We demonstrate a fiber-to-millimeter-wave wireless transmitter chip by integrating a high-power germanium-silicon photodiode and a bowtie antenna, achieving 600 Mbps wireless communication at a carrier of 26 GHz.

Th3E.2 • 14:15

16 a/W, DC–200 GHz Ultra-Broadband Photoreceiver Module for High Baud Rate Small Signal Detection, Toshimasa Umezawa[1], Shinya Nakajima[1], Atsushi Matsumoto[1], Kouichi Akahane[1], Atsushi Kanno[2,1], Naokatsu Yamamoto[1]; [1]*National Inst of Information & Comm Tech, Japan;* [2]*Nagoya Inst. of Technology, Japan.* We designed and fabricated a 16 A/W high-responsivity, ultra-broadband uni-travelling carrier photodetector module covering DC-200 GHz (3 dB bandwidth), which was integrated with a semiconductor optical amplifier to enhance responsivity.

Th3E.3 • 14:30 (Invited)

InP-Based Photonic Crystal Surface Emitting Lasers for Optical Communication and LiDAR Applications, Yuhki Itoh[1,2], Takeshi Aoki[1,2], Makoto Ogasawara[1,2], Kosuke Fujii[1], Yusuke Sawada[1,2], Rei Tanaka[1], Shun Kimura[1], Hiroyuki Yoshinaga[1,2], Naoki Fujiwara[1,2], Hideki Yagi[1], Masaki Yanagisawa[1], Masahiro Yoshida[2], Takuya Inoue[2], Menaka De Zoysa[2], Kenji Ishizaki[2], Susumu Noda[2]; [1]*Sumitomo Electric Industries Ltd, Japan;* [2]*Department of Electronic Science and Engineering, Kyoto Univ., Japan.* We report InP-based photonic-crystal surface-emitting lasers for C-band and O-band. Single-mode CW operation with high output exceeding 300 mW, narrow linewidth, and high beam quality is demonstrated utilizing large-area coherent resonance with 2D photonic crystal.

Th3E.4 • 15:00

Towards 200 GBaud Line Rates with Waveguide-Integrated Plasmonic Graphene Photodetectors, Daniel D. Rieben[1], Tobias Blatter[1], Stefan M. Koepfli[1], Laurenz Kulmer[1], Yannik Horst[1], David Moor[1], Shadi Nashashibi[1], Marina Homs[1], Dominik Bisang[1], Michael Baumann[1], Yuriy Fedoryshyn[1], Juerg Leuthold[1]; [1]*ETH Zurich, Switzerland.* We introduce a new waveguide-integrated graphene photodetector using plasmonic resonant enhancement. With the proposed architecture a record-high symbol rate for graphene photodetectors of 192 GBaud was achieved in an all-plasmonic transmission system.

Th3E.5 • 15:15

Planar Tandem APD Arrays with a Large Window Size, High-Responsivity and High-Speed Performance, Pei-Syuan Lin[1], Chao-Chuan Kuo[1], You-Chia Chang[2], Jin-Wei Shi[1]; [1]*Electrical Engineering, National Central Univ., Taiwan;* [2]*Department of Photonics, National Yang Ming Chiao Tung Univ., Taiwan.* Novel APD arrays are demonstrated to relax trade-offs between size and gain-bandwidth-product (GBP). With 0.12mm window sizes, high-responsivity (1.2A/W), wide-bandwidth (6GHz), and large GBP (150GHz) can be simultaneously achieved with these flip-chip packaged 3×3 arrays.

Th3E.6 • 15:30

Monolithically Integrated High-Performance Ge-on-Si PIN Photodetectors With Nearly 60 GHz EO Bandwidth, 0.95 a/W Responsivity, <30 nA Dark Current and -36 dB Optical Return Loss Enabled by Ge Shape Optimization, Yusheng Bian[1]; [1]*GLOBALFOUNDRIES, USA.* We present optimized Ge shaping techniques that significantly reduce the back reflection of O-band Ge-on-Si photodetectors, achieving an optical return loss of -36dB in conjunction with ~60GHz 3-dB-EO-bandwidth, 0.95A/W responsivity and average dark current <30nA.

Th3E.7 • 15:45

High-Gain Ge/Si Avalanche Photodetector Enhanced by Distributed Structure, Zhujun Wei[1], Qiang Zhang[2], Qikai Huang[1], Shengyu Fang[1], Xingyi Jiang[1], Shuyue Zhang[1], Yuchen Shi[1], Yuehai Wang[1], Gangqiang Zhou[2], Jianyi Yang[1], Hui Yu[2]; *[1]Zhejiang Univ., China; [2]Zhejiang Lab, China.* We demonstrate a Ge/Si distributed avalanche photodetector. By implementing 4-stage/8-stage APD scheme, the avalanche gain is enhanced from 11 to 30/55. Furthermore, the corresponding gain-bandwidth product is improved from 102 GHz to 233/577 GHz.

14:00 -- 16:00
Room 215
Th3I • Free-Space Optical QKD, QRNG, and Classical Techniques
Presider: Rui Wang; Univ. of Bristol, UK

Th3I.1 • 14:00

Evaluation of Time-Bin Encoded Reference Frame Independent Quantum Key Distribution from Low-Earth Orbit Satellites, Costantino Agnesi[1], Francesco Piccariello[1], Giuseppe Vallone[1], Paolo Villoresi[1]; *[1]Universita degli Studi di Padova, Italy.* Kinematic phase shift compensation is a major technical challenge for Time-Bin encoded Quantum Key Distribution, which could be solved by exploiting a Reference Frame Independent protocol. Here we present simulation results evaluating different operational scenarios.

Th3I.2 • 14:15

Bidirectional Fiber-Wireless-Fiber QKD Transmission Over 2x8.8Km Field-Deployed Single Feeder Link and 100m FSO Link, Konstantinos Tsimvrakidis[1], Persefoni Konteli[1], Argiris Ntanos[2], Aristeidis Stathis[2], Nikolaos Makris[1], Panagiotis Kourelias[2], Alkinoos Papageorgopoulos[1], Giannis Giannoulis[2], Ilias Papastamatiou[3], Petros Papapetropoulos[3], Hercules Avramopoulos[2], George T. Kanellos[1], Dimitris Syvridis[1]; *[1]NKUA , Dept. of Inf. and Tel., Greece; [2]National Technical Univ. of Athens (NTUA), Greece; [3]GRNET S.A. – National Infrastructures for Research and Technology, Greece.* We report on a bidirectional Fiber-Wireless-Fiber QKD system operating on a single feeder field-deployed fiber link with a 100m outdoor free-space optic segment. The QKD system performance is analyzed with and without the free-space link.

Th3I.3 • 14:30

FPA Beamforming for Alignment-Tolerant FSO QKD Links, Florian Honz[1], Winfried Boxleitner[1], Michael Hentschel[1], Philip Walther[2], Hannes Hübel[1], Bernhard Schrenk[1]; *[1]AIT, Austria; [2]Univ. of Vienna, Austria.* We demonstrate focal plane array beamforming for semi-blind deployments of free-space optical QKD links. We accomplish a secure-key rate of 1.2 kb/s at a QBER of 9.1% over a 63-m outdoor link during full sunshine.

Th3I.4 • 14:45 (Top-Scored)

Photonic Integrated Chip-Based Reference Frame Independent Quantum Key Distribution Transmitter, Kyongchun Lim[1], Byung-Seok Choi[1], Ju Hee Baek[1], Minchul Kim[1], Joong-Seon Choe[1], Kap-Joong Kim[1], Dong Churl Kim[1], Junsang Oh[1], Chun Ju Youn[1]; *[1]ETRI, Korea (the*

Republic of). For the first time, we present a photonic integrated chip-based RFI QKD transmitter, modularized in CFP2 form factor. The transmitter's capability is demonstrated through free-space QKD experiments, highlighting its potential for secure quantum communication.

Th3I.5 • 15:00
Experimental Demonstration of Quantum Nearest Centroid Classification Algorithm Using Orbital Angular Momentum of Photons, Dawei Lyu[1,2], Qianke Wang[1,2], Jun Liu[1,2], Jian Wang[1,2]; *[1]Wuhan National Laboratory for Optoelectronics and School of Optical and Electronic Information, Huazhong Univ. of Science and Technology, China; [2]Optics Valley Laboratory, China.* We experimentally demonstrate a classical simulation of the quantum nearest centroid classification algorithm using orbital angular momentum (OAM) modes of photons, achieving an impressive classification accuracy of 86.7% on the Iris dataset.

Th3I.6 • 15:15 (Invited)
High-Speed on-Chip Real-Time QRNG, Cédric Bruynsteen[1]; *[1]IMEC, Belgium.* Quantum random number generators harness the inherent unpredictability of quantum entropy sources to produce truly random numbers. This talk explores how integration enables high-speed, real-time generation of these numbers for use in secure communication.

14:00 -- 16:00
Room 301
Th3J • Device Applications for Wireless Communications
Presider: Maria Morant; Universitat Politècnica de València, Spain

Th3J.1 • 14:00 (Top-Scored)
Demonstration of Mid-Wavelength Infrared IM/DD Communications Using Air-Suspended Thin-Film Lithium Niobate Intensity Modulator, Xinzhou Su[1], Chun-ho Lee[1], Xinyi Ren[1], Zile Jiang[1], Huibin Zhou[1], Yue Zuo[1], Shaoyuan Ou[1], Reshma Kopparapu[1], Yue Yu[1], Adam Heiniger[2], Moshe Tur[3], Zaijun Chen[1], Mengjie Yu[1], Alan Willner[1]; *[1]Univ. of Southern California, USA; [2]TOPTICA Photonics Inc., USA; [3]Tel Aviv Univ., Israel.* We demonstrate an air-suspended thin-film-lithium-niobate Mach-Zehnder intensity modulator for mid-infrared communications. Data channels of various modulation formats are achieved, including 1.5-Gbaud OOK, 1.5-Gbaud PAM-4, 0.5-Gbaud PAM-6, and 0.5-Gbaud PAM-8.

Th3J.2 • 14:15
Generation of High-Extinction-Ratio PPM Signals Using a Single IQ Modulator, Jihoon Lee[1], Hoon Kim[1]; *[1]KAIST, Korea (the Republic of).* We propose a novel method to generate a pulse-position modulation (PPM) signal having a high extinction ratio (ER) using an IQ modulator. We achieve a 40-dB ER for 64-PPM signals in our experimental demonstration.

Th3J.3 • 14:30 (Invited)
Optomechanical Cavities for All-Optical Microwave Signal Processing, Laura Mercade[1,2], Roberto Llorente[2], Alejandro Martínez[2]; *[1]Department of Applied Physics, Escuela Politecnica Superior de Alcoy, Spain; [2]Nanophotonics Technology Center, Universitat Politècnica de València, Spain.* All-optical microwave signal processing using optomechanical cavities on silicon chips in the optical domain is demonstrated. Demonstrations include low phase noise

generation, frequency conversion, and enhanced stability, showing promise for next-generation wireless and satellite communications.

Th3J.4 • 15:00 (Top-Scored)
Silicon-Based Optical Phased Array Enabled Non-Line-of-Sight Optical Wireless Communication, Yingzhi Li[1], Baisong Chen[1], Xuetong Li[1], Huan Qu[1], Heming Hu[1], Jie Li[1], Weipeng Wang[1], Quanxin Na[2], Qijie Xie[2], Lei Wang[2], Junfeng Song[1,2]; *[1]Jilin Univ., China; [2]Peng Cheng Laboratory, China.* We propose and demonstrate an optical wireless communication (OWC) system with the silicon-based optical phased arrays (OPAs) transceiver. The system achieved full-duplex data transmission covering 120° steering range and 220-Gbps non-line-of-sight signal transmission.

Th3J.5 • 15:15
All-Plasmonic sub-Terahertz Wireless Link, Laurenz Kulmer[1], Tobias Blatter[1], Amane Zuerrer[1], Stefan M. Koepfli[1], Samuel Hess[1], Yannik Horst[1], Marcel Destraz[2], Jasmin Smajic[1], Yuriy Fedoryshyn[1], Juerg Leuthold[1]; *[1]ETH Zurich, Switzerland; [2]Polariton Technologies AG, Switzerland.* We offer a highest bandwidth, low-footprint, scalable and low-cost solution for sub-THz wireless communication links. We employ a plasmonic-graphene approach. The solution is tested for transmission of 120 Gbit/s at a carrier-frequency of 285 GHz.

Th3J.6 • 15:30
A 15-25GHz RF Photonic Front-End With 22nm CMOS Dual-Differential Driver and Silicon Traveling-Wave Mach-Zehnder Modulator, Yu-Lun Luo[1], Dharma Paladugu[1], Christi Madsen[1], Kamran Entesari[1], Samuel Palermo[1]; *[1]Electrical and Computer Engineering, Texas A&M Univ., USA.* A RF photonic front-end using dual-differential driving scheme is reported with a 22nm CMOS FD-SOI driver co-integrated with a silicon traveling-wave Mach-Zehnder modulator. The proposed front-end achieves 15-25GHz bandwidth with 2dBm IIP3 and consumes 448mW.

Th3J.7 • 15:45
High-Extinction-Ratio PCSEL-Based on-off-Keyed Signal Generation for Fiber-Amplifier-Free Space Optical Communications, Shota Ishimura[1], Takuya Inoue[2], Shin Fukuhara[1], Ryohei Morita[3], Hidenori Takahashi[1], Takehiro Tsuritani[1], Menaka De Zoysa[2], Kenji Ishizaki[2], Masatoshi Suzuki[4], Susumu Noda[2,3]; *[1]KDDI Research Inc., Japan; [2]Photonics and Electronics Science and Engineering Center, Kyoto Univ., Japan; [3]Department of Electronic Science and Engineering, Kyoto Univ., Japan; [4]Chitose Inst. of Science and Technology, Japan.* We demonstrate PCSEL-based on-off-keyed signal generation with high extinction ratios using a 1-bit delay interferometer. We show that this approach enhances receiver sensitivity by >10 dB.

14:00 -- 16:00
Room 304
Th3K • Coherent DSP
Presider: Chen Zhu; Baidu Inc., China

Th3K.1 • 14:00 (Invited)
Low-Power DSP for Next-Generation Interoperable 1.6T Coherent Pluggables Employing Digital Subcarriers, Mohamed Osman[1], Han Sun[1], Chris R. Fludger[1], Harald Bock[1], Robert Maher[1]; *[1]Infinera Corp., Canada.* We emphasize the need for digital subcarrier multiplexed

(DSCM) signals for next-generation 1.6T coherent pluggables to alleviate the impact of EEPN. We review the DSP stack for the DSCM system and highlight operational implications relative to today's interoperable single carrier signals.

Th3K.2 • 14:30

Transmitter Impairment Mitigation by 8X4 Phase-Dependent Frequency-Domain Equalizer, Pengpeng Wei[1], Xuemeng Hu[2], Zepeng Gong[2], Xu Zhang[2], Qingyu He[3], Ming Luo[3], Tianye Huang[2], Xiang Li[2], Xiaobin Hong[1], Yan Li[1], Jian Wu[1]; *[1]State Key Laboratory of Informaics and Optical Communications, Beijing Univ. of Posts and Telecom(Beijing), China; [2]School of Mechanical Engineering and Electronic Information, China Univ. of Geosciences (Wuhan), China; [3]National Laboratory of Optical Communication Technologies and Networks, China Information and Communication Technologies Group Corporation (CICT), China.* In this paper, we propose to mitigate the transmitter IQ impairments by introducing phase-dependent decision-directed least mean squares algorithm in a 8X4 channel equalizer in frequency domain with low computational complexity characteristics.

Th3K.3 • 14:45

A Novel Blind Adaptive Filter Based on Subband Decomposition and Synthesis for Optical Coherent Systems, Wanzhen Guo[1], Zhaoquan Fan[1], Jiating Luo[2], Bofang Zheng[2], Yi Cai[3], Jian Zhao[1]; *[1]South China Univ. of Technology, China; [2]Huawei Technologies Co. Ltd., China; [3]Soochow Univ., China.* We propose a novel subband-based blind adaptive filter and show that the proposed method exhibits faster convergence speed, higher tolerance to optical filtering, loop delay and RSOP speed, and lower complexity than conventional fullband filter.

Th3K.4 • 15:00

Optimized Sparsification Algorithm for Low-Complexity Adaptive Equalizers in Short-Reach Coherent Transmission, Xiangyong Dong[2,1], Yu Zhenming[2,1], Hongyu Huang[2,1], Kaixuan Sun[2,1], Kun Xu[2,1]; *[1]Shenzhen Research Inst., Beijing Univ. of Posts and Telecommunications, China; [2]State Key Laboratory of Information Photonics and Optical Communications, Beijing Univ. of Posts and Telecommunications, China.* We propose and experimentally demonstrate an optimized sparsification algorithm for low-complexity adaptive equalizers in short-reach coherent transmission, reducing complexity by over 50%, with a maximum of 71.5%, while preserving performance and robustness to IQ imbalance.

Th3K.5 • 15:15

Baud-Rate Finite Field Adaptive Equalization for 400G/800G-ZR Transmission, JingPeng Liu[1], Kangyue Shen[1], Sheng Cui[1], Ming Tang[1], Menghong Xu[1], Tianhang Yao[1], Jing Dai[2]; *[1]Huazhong Univ of Science and Technology, China; [2]FiberHome Telecommunication Technologies, China.* A novel baud-rate sampling finite field AEQ is proposed for 400G/800G-ZR transmission, which reduces hardware complexity by >67% compared with the existing FD-AEQs, without compromising the performance.

Th3K.6 • 15:30
Baud-Rate Clock Recovery for Coherent Receivers and its FPGA Implementation, Menghong Xu[1], Chengbo Li[1], Sheng Cui[1], Ming Tang[1], JingPeng Liu[1], Jianfeng Han[1], Jing Dai[1]; [1]*Huazhong Univ of Science and Technology, China.* Baud-rate clock recovery for coherent receivers is realized on a FPGA based real-time DSP platform using a modified Mueller and Müller timing error detector which is multiplication-free and resilient to distortions.

Th3K.7 • 15:45
A Robust Baud-Rate Timing Recovery for Short-Reach Coherent Optical Interconnections, Siyu Gong[1], Yanfu Yang[1], Qian Xiang[1], Yongchao Jin[1], Linsheng Fan[1], Chen Cheng[1], Jianwei Tang[1]; [1]*Harbin Inst. of Technology, shenzhen, China.* A novel baud-rate timing recovery scheme is experimentally demonstrated in a 118 GBaud PDM 16QAM system. The proposed method exhibits robustness against polarization crosstalk and lower jitter, leading to superior BER performance compared to traditional schemes.

14:00 -- 16:00
Rooms 201-202
Th3A • Frontiers of Optical Network Architecture Summit – Network Architecture Evolution in the Age of AI

Presider: Vincent Chan; Massachusetts Inst. of Technology, USA

Th3A.1 • 14:00 (Invited)
Evolution of Optical Network for Ubiquitous AI, Xiang Liu[1]; [1]*Huawei Technologies, Hong Kong.* We review the emerging optical network evolution trends to support ubiquitous AI by providing sufficient capacity, latency, flexibility, scalability and reliability, while maximally reusing modern network architectures such as C-RAN and OXC-based 3D mesh connection.

Th3A.2 • 14:30 (Invited)
Scaling ML Workloads with Google's Evolving Datacenter Network Architecture, Anny Zheng[1], Remy Chang[1], Leon Poutievski[1]; [1]*Google LLC, USA.* We discuss the challenges posed by growing machine learning workloads on datacenter networks and present how Google's Jupiter datacenter network fabrics effectively support diverse traffic.

Th3A.3 • 15:00 (Invited)
Title to be Announced, Young Jung[1]; [1]*Amazon Web Services, USA.* Abstract not available.

Th3A.4 • 15:30 (Invited)
Title to be Announced, Arman Rezaee[1]; [1]*CISCO, USA.* Abstract not available.

14:00 -- 16:00
Rooms 205-206
Th3C • Ultra-Wideband Transmission
Presider: Ruben Luis; NICT, Japan

Th3C.1 • 14:00
First Field Demonstration of Real-Time Sub-100-Tb/s Transmission with Net 1.2-Tb/s Channels Over 12-THz-Wide Super C+L Band Along 305-km G.652.D Fiber, Mingqing Zuo[1], Dechao Zhang[1], Dong Wang[1], Hongqiang Zou[2], Da Liu[2], Baoluo Yan[3], Hu Shi[3], Han Li[1]; *[1]China Mobile Research Inst., China; [2]China Mobile Communications Corporation Group Co., China; [3]ZTE Corporation, China.* We demonstrate a record of real-time 96-Tb/s (80×1.2-Tb/s) DP-64QAM-PCS field transmission covering 12-THz-wide super C+L band over 305-km terrestrial G.652.D fiber, which is repeated by pure Erbium-doped-fiber-based amplification.

Th3C.2 • 14:15 (Top-Scored)
Net 107.7-Tb/s Triple-Band WDM Transmission Over 1200-km Single-Mode Fiber with Forward- and Backward-Pumped Distributed Raman Amplifiers, Fukutaro Hamaoka[1], Kosuke Kimura[1], Masanori Nakamura[1], Takeo Sasai[1], Takayuki Kobayashi[1], Yutaka Miyamoto[1], Etsushi Yamazaki[1]; *[1]NTT Network Innovation Laboratories, Japan.* We demonstrate a net 107.7-Tb/s S+C+L-band long-haul transmission over 1200 km with the WDM-launch and the forward and backward Raman-pump powers optimized by a closed-form GN model and by experimental evaluation of the RIN transfer.

Th3C.3 • 14:30
214-Tb/s Transmission Over 2×75-km in the S+C+L Band With >1-Tb/s/λ Signals Using Only Doped Fiber Amplifiers, Yuqian Zhang[1], Mingqing Zuo[1], Qiang Qiu[2], Dawei Ge[1], Dong Wang[1], Huan Chen[2], Baoluo Yan[2], Hu Shi[2], Jun Wu[3], Hongyan Zhou[3], Dechao Zhang[1], Han Li[1]; *[1]Department of Fundamental Network Technology, China Mobile Research Inst., Beijing 100053, China, China; [2]WDM System Department of ZTE Corporation, Shenzhen 518055, China, China; [3]Yangtze Optical Fibre and Cable Joint Stock Limited Company, Wuhan, Hubei, China,430073, China.* We demonstrate a 214-Tb/s S+C+L band optical signal over 2×75-km G.654 transmission in an 18.7-THz bandwidth using only DFAs. The net bit rate per wavelength exceeds 1 Tb/s for each of the 204 channels.

Th3C.4 • 14:45 (Tutorial)
Transmission System Technologies for Large-Scale Multiplexing in Wavelength and Space, Benjamin J. Puttnam[2,1]; *[1]NICT, NICT, Japan; [2]Microsoft Azure Fiber, UK.* This tutorial discusses research progress on high-capacity optical transmission systems utilizing large-scale multiplexing either through space-division multiplexing (SDM) or through multi-band wavelength-division multiplexing (WDM). We report the achievable data-rates, use cases and design constraints for both approaches.

14:00 -- 16:00
Rooms 209-210
Th3F • Fiber Sensing and Characterization
Presider: Mikael Mazur; Nokia Bell Labs, USA

Th3F.1 • 14:00
Microwave Frequency Fiber Interferometry in Submarine Deployed Telecommunication Cables, Adonis Bogris[1], Christos Simos[2], Iraklis Simos[1], Yuhan Wang[3], Andreas Fichtner[3], Stavros Deligiannidis[1], Nikos S. Melis[4], Charis Mesaritakis[1]; *[1]Univ. of West Attica, Greece; [2]Univ. of Thessaly, Greece; [3]ETH Zurich, Switzerland; [4]National Observatory of Athens, Greece.* We operated a microwave frequency fiber interferometer in a telecommunication cable in the Ionian Sea, Greece, for two months. The capability of detecting undersea micro earthquakes (magnitude~1.5), tides and ocean waves is reported

Th3F.2 • 14:15
300-km Unrepeatered Φ-OTDR With High Spatial Resolution Based on Fractional Fourier Transform and Hybrid Amplification, Zichen Qian[1], Mingming Zhang[1], Zihe Hu[1], Youmin Zhang[1], Can Zhao[1], Ming Tang[1]; *[1]Huazhong Univ of Science and Technology, China.* We demonstrate a 300-km unrepeatered Φ-OTDR with 1-meter-high spatial resolution, achieving a record of 300000 effective sensing points through fractional Fourier transform for pulse compression and hybrid amplification using EDF and Raman pumping.

Th3F.3 • 14:30 (Invited)
SMART Subsea Cables: Joint Task Force and the Future of Ocean Monitoring, Charlotte Rowe[1], Bruce Howe[3], Ceci Rodriguez-Cruz[2]; *[1]Los Alamos National Laboratory, USA; [3]Univ. of Hawaii, USA.* Science Monitoring and Reliable Telecommunications (SMART) Cables will equip transoceanic telecommunications cables to monitor ocean heat, circulation and sea level rise, provide earthquake and tsunami early warning, and offer sensing for enhanced cable security.

Th3F.4 • 15:00 (Top-Scored)
527.8km Ultra-Long Single Span Distributed Optical Sensing With Co-Propagating 400Gb/s Optical Transmission, Xu Jian[2,1], Ming Li[1], William Shieh[3], Qi Yang[2], Dajun Long[4], Qianggao Hu[1], Jiekui Yu[1], Chen Liu[2], Zhenyu Zhu[1], Xiaoyu Wang[1], Mingxiong Duan[1], Guangli Pan[4], Mingchao Nie[1], Jianjun Wu[1], Tian Qiu[1], Jiale Liu[2], Zhen Tong[2], Hao Chen[5]; *[1]ACCELINK, China; [2]School of Optical and Electronic Information, Huazhong Univ. of Science and Technology, China; [3]College of Information Science and Electronic Engineering, Westlake Univ., China; [4]China Yangtze Power Co., Ltd, China; [5]Corning Corporation Inc, USA.* The longest span of 527.8km distributed sensing of temperature and vibration measurement with 400Gb/s data transmission is reported, based on bidirectional sensing configuration and ROPA technology. Removing the communication signal, the distance can be further extended to 551.1km

Th3F.5 • 15:15 (Top-Scored)
Multi-Event Forward-Transmission Vibration Sensing with Dual-Sensor Adaptive Beamforming, Jian Fang[1], Yaowen Li[1], Wataru Kohno[1], Ting Wang[1]; *[1]NEC Laboratories America, USA.* We present adaptive beamforming techniques to forward-transmission multi-event vibration sensing in environments with interference and jamming. Experimental validation over 100km fiber demonstrates significant improvements on signal reconstruction, noise

reduction, and interference rejection from other locations.

Th3F.6 • 15:30
Observation of Polarization Pulses in Aerial Fiber with Slew Rates Exceeding 10 Megaradians per Second, Robert M. Jopson[1], Mikael Mazur[1], Roland Ryf[1], Ellsworth Burrows[1]; [1]*Nokia Bell Labs, USA.* Polarization was monitored of probe signals transmitted over the optical ground wires of a high-voltage power transmission line. Multiple lightning-induced polarization pulses with slew rates that would challenge current receivers were observed over five months.

Th3F.7 • 15:45
First Demonstration of Distributed Characterization Over 100 km Anti-Resonant Hollow-Core Fiber in Real-Time Widened C+L-Band WDM Transmission, Xia Gao[1], Qian Zhang[2], Lipeng Feng[1], Anxu Zhang[1], Peng Li[1], Lei Zhang[3], Jie Luo[1], Zhengyu Liu[1], Xin Qin[1], Xiaoli Huo[1], Xiaobin Hong[2], Jian Wu[2], Junjie Li[1], Chengliang Zhang[1], Zhisheng Yang[2]; [1]*China Telecom Research Inst., State Key Laboratory of Optical Fiber and Cable Manufacture Technology, China;* [2]*Beijing Univ. of Posts and Telecommunications, China;* [3]*State Key Laboratory of Optical Fiber & Cable Manufacture technology, China.* We demonstrate real-time monitoring of 80×800-Gb/s PCS-16QAM widened C+L-band WDM transmission over 100 km HCF using a specifically-designed on-line FDM-OTDR, achieving a 40-dB dynamic range, 30-s measurement time, and 870-m spatial resolution without BER penalty.

14:00 -- 16:00
Rooms 211-212
Th3G • Enabling Techniques for PON
Presider: Yanni Ou; Beijing Univ. of Posts & Telecom, China

Th3G.1 • 14:00 (Invited)
High Power Emitters for Beyond 50G-PON, Ricardo Rosales[1], Xin Chen[2], Samir Rihani[2], Daniel Drysdale[2], Richard Cronin[2], Thomas Tilbury[2], Haibo Wang[2], Pantelis Aivaliotis[2], Giuseppe Talli[1], Maxim Kuschnerov[1]; [1]*Huawei Technologies Duesseldorf GmbH, Germany;* [2]*Huawei Technologies Research and Development Ltd., Ipswich Research Centre, UK.* Transmitter technologies and requirements for very high speed PON using IM/DD will be analyzed, with a focus on high power electro-absorption-modulator-laser-based emitters for potentially compact and cost-effective implementations.

Th3G.2 • 14:30 (Invited)
Advances in High-Speed Opto-Electronic Circuits and Transmitter/Receiver Subsystems for Optical Access Networks, Peter Ossieur[1], Gertjan Coudyzer[1], Cheng Wang[1], Jakob Declercq[1], Xin Wang[1], Shengpu Niu[1], Bruno Govaerts[1], Warre Geeroms[1], Johan Bauwelinck[1], Guy Torfs[1], Xin Yin[1]; [1]*IDLab, Ghent Univ., IMEC, Belgium.* An overview of opto-electronic integrated circuits intended for upcoming optical access network systems is provided. Photonic integrated circuits for access applications and associated front-end electronics are addressed. DSP for enabling higher baudrates is discussed.

Th3G.3 • 15:00
First Demonstration of 200G Bi-Direction Self-Coherent PON Based on Pre-Amplified Stokes Vector Direct Detection, Yuhao Fang[1], Haojie Zhu[1], Weiqi Lu[1], Puzhen Yuan[1], Honglin Ji[2], William Shieh[1]; *[1]Westlake Univ., China; [2]peng cheng lab, China.* We propose bidirectional self-coherent PON (SC-PON) architecture based on pre-amplified SVDD using semiconductor optical amplifiers (SOA) in the transceiver of ONUs and experimentally demonstrate the first 200G bidirectional SC-PON. We achieve 30.5 and 31.5-dB power budget for the downstream and upstream transmission over a 20-km SMF respectively.

Th3G.4 • 15:15
First Demonstration of Joint NOMA-PCS Coherent Passive Optical Networks Supporting Fixed-Rate and Flexible Fine-Grained Access, Chen Ding[1], Qiarong Xiao[1], Zijian Li[1], Zixian Wei[2], Chaoran Huang[1], Chester Shu[1]; *[1]CUHK, Hong Kong; [2]Tsinghua Univ., China.* We demonstrate joint non-orthogonal multiple access probabilistic constellation shaping coherent passive optical network with 160-Gbps peak rate, supporting fixed-rate and flexible fine-grained access, while reducing 62.5% complexity in carrier phase recovery by a 2-stage method.

Th3G.5 • 15:30
Experimental Demonstration of Alamouti Coded 200-Gbps/λ Coherent PON Transmission Enabled by Polar Coded Truncated Probabilistic Shaped 64-QAM, Xiaoshuo Jia[1], Junwei Li[1], Ning Wang[1], Dongxu Zhang[2], Kaibin Zhang[2], Xiaofeng Hu[2], Xiaoan Huang[2], Mingyang Lv[3], Dechao Zhang[1]; *[1]China Mobile Research Inst., Department of Fundamental Network Technology, China; [2]Nokia Bell Labs, China; [3]Nokia Shanghai Bell, China.* An Alamouti coded 200-Gbps/λ coherent PON downstream is achieved with 32-dB and 29-dB power budget under optical-back-to-back and 20-km cases respectively enabled by polar coded truncated probabilistic shaped 64-QAM scheme with 40-GHz signal bandwidth.

Th3G.6 • 15:45
Real-Time Demonstration of Softwarized 4-Port 10G-EPON PCS for Fully Virtualized Access Systems, Takahiro Suzuki[1], Kim Sang-Yuep[1], Junichi Kani[1], Tomoaki Yoshida[1]; *[1]NTT Corporation, Japan.* This paper demonstrates real-time 4-port 10G-EPON physical coding sublayer (PCS) softwarization by proposing and implementing multi-port polling. The previous throughput of 8.7 Gb/s is increased to 4 x 8.7 Gb/s while maintaining code performance.

14:00 -- 16:00
Rooms 213-214
Th3H • Packaging and Coupling Techniques
Presider: Antonio Tartaglia; Ericsson, Italy

Th3H.1 • 14:00
High-Density Evanescent Chip Coupling with Detachable Fiber Connector for Co-Packaged Optics, Lars Brusberg[1], Jorge A. Holguin-Lerma[1], Janderson R. Rodrigues[1], Betsy J. Johnson[1], Jason R. Grenier[1], Marissa Granados-Baez[1], Robin M. Force[1], Aramais Zakharian[1], Chad C. Terwilliger[1], Katerina Rousseva[1]; *[1]Corning Inc., USA.* A glass interconnect for fiber-to-chip coupling with integrated pitch conversion and detachable fiber array connector for CPO is reported. The minimum evanescent coupling loss is 0.38 dB at 1337 nm for flip-chip assembled SiN chip.

Th3H.2 • 14:15
Connectorized Optical I/O Chiplet with v-Groove for AI and High Performance Computing, Chong Zhang[1], Chip Greely[1], Jianhua Li[1], Li-Fan Yang[1], Annie Hsieh[1], Haiwei Lu[1], Neil Sapra[1], John Fini[1], Vishal Chandrasekar[1], Lakshmikant Bhupathi[1], Vladimir Stojanovic[1], Chen Sun[1], Pooya Tadayon[1], Mark Wade[1]; *[1]Ayar Labs, USA.* This paper presents connectorized in-package optical I/O chiplets with V-groove for passive fiber attach, enabling robust and scalable connectivity solutions for AI and high-performance compute. We demonstrate a process for ensuring known good chiplets using Ayar Labs' TeraPHY™ optical I/O chiplet.

Th3H.3 • 14:30 (Invited)
DARPA HAPPI: New Dimensions in Photonics, Anna Tauke-Pedretti[1], Radoslav Bogoslovov[2], Amil Patel[3], Chelsea Haughn[3]; *[1]Defense Advanced Res Projects Agency, USA; [2]Bogoslovov Consulting, USA; [3]Booz Allen Hamilton, USA.* The device and link density of today's photonic integrated circuits limit the functionality of optical microsystems. The DARPA Heterogenous Adaptively Produced Photonic Interfaces (HAPPI) program aims to break these limits and scale photonic circuits by moving from planar to 3D photonic architectures.

Th3H.4 • 15:00
Photonic Modules with High Density Polymer Waveguide Interface, Jean Benoit Heroux[2], Adrian Paz Ramos[2], Francois Arguin[2], Yan Thibodeau[2], Badr Terjani[2], HIdetoshi Numata[1], Chinami Marushima[1], Sayuri Kohara[1], Akihiro Horibe[1], Hiroyuki Mori[1], Yoichi Taira[1], Hsianghan Hsu[3], Neng Liu[3], Daniel Kuchta[4], Mark Schultz[4], John Knickerbocker[4]; *[1]IBM Japan, Japan; [2]IBM Canada, Canada; [3]IBM Research- Albany, USA; [4]IBM Research - Yorktown Heights, USA.* We report on the design and fabrication of optical modules in which a polymer waveguide interface is integrated for low loss, high density optical data transfer with very low space requirements on the photonic die.

Th3H.5 • 15:15 (Invited)
Latest Advanced Packaging Solutions for AI, Chih-Pin Hung[1]; *[1]ASE Group, Taiwan.* Abstract not available

2025 Technical Program and Steering Committees

General Chairs

Nicolas Fontaine, *Nokia Bell Labs, USA*
Fotini Karinou, *Microsoft, USA*
Elaine Wong, *Univ. of Melbourne, Australia*

Program Chairs

Mei Du, *Tata Communications, USA*
Lara Garrett, *SubCom, USA*
Xiaodan Pang, *ZJU, China and RTU, Latvia*

Subcommittees

D-Track: Devices, Components and Fibers

D1: Advanced Prototyping, Packaging and Integration
Samuel Palermo, *Texas A&M Univ., USA, Subcommittee Chair*
Yoojin Ban, *imec, Belgium*
Juthika Basak, *Nokia Corp., USA*
Janet Chen, *NVIDIA, USA*
Daniel Kuchta, *IBM Thomas J. Watson Research Center, USA*
Sylvie Menezo, *SCINTIL Photonics, France*
Hong Nguyen, *Sumitomo Electric, Japan*
Sabarni Palit, *ANELLO Photonics, USA*
Molly Piels, *OpenLight, USA*
Sudip Shekhar, *Univ. of British Columbia, Canada*
Antonio Tartaglia, *Ericsson, Italy*
An Bin Wang, *Alibaba Group, China*
Xi Xiao, *NOIEC, China*
Li Yang, *Suzhou Dawning Semi Technology Co., Ltd., China*

D2: Passive Components
Milos Popovic, *Ayar Labs, Boston Univ., USA, Subcommittee Chair*
Matteo Cherchi, *Xanadu, Canada*
Mario Dagenais, *Univ. of Maryland at College Park, USA*
Thalia Dominguez Bucio, *Optoelectronics Research Centre, Univ. of Southampton, UK*
Sonia Garcia-Blanco, *ALUVIA, Universiteit Twente, Netherlands*
Takako Hirokawa, *Global Foundries, USA*
Sagi Mathai, *Hewlett Packard Labs, USA*
Laurent Vivien, *Universite de Paris XI Paris Sud, France*
Keita Yamaguchi, *NTT, Japan*
Mengjie Yu, *Univ. of Southern California, USA*
Linjie Zhou, *Shanghai Jiao Tong Univ., China*

D3: Active Components
Guo-Qiang (Patrick) Lo, *Advanced Micro Foundry (AMF), USA, Subcommittee Chair*
Connie Chang-Hasnain, *Berxel Photonics Co. Ltd, USA*
Gong-Ru Lin, *National Taiwan Univ., Taiwan*

Hai-Feng Liu, *HGGenuine, USA*
Liu Liu, *Zhejiang Univ., China*
Joyce Poon, *Max Planck Institute of Microstructure Physics, Germany*
Johann Peter Reithmaier, *Universitat Kassel, Germany*
Jessie Rosenberg, *Lightmatter, USA*
Patrick Runge, *Fraunhofer HHI, Germany*
M. Ashkan Seyedi, *NVIDIA, USA*
Changzheng Sun, *Tsinghua Univ., China*
Yuichi Tohmori, *Tsurugi Photonics Foundation, Japan*
Shi Wei, *Université Laval, Canada*
Chao Xiang, *Univ. of Hong Kong, Hong Kong*

D4: Fibers and Propagation Physics
Pierre Sillard, *Prysmian Group, France, Subcommittee Chair*
Jose Antonio-Lopez, *Univ. of Central Florida, CREOL, USA*
Jin-Xing Cai, *SubCom, USA*
Lauren Dallachiesa, *Nokia Bell Labs, USA*
Yuki Kawaguchi, *Sumitomo Electric Industries, Ltd, Japan*
Tristan Kremp, *OFS Fitel, USA*
Chiara Lasagni, *Università degli Studi di Parma, Italy*
Takashi Matsui, *NTT, Japan*
Georg Rademacher, *Universität Stuttgart, Germany*
Jiajing Tu, *Jinan Univ., China*
Natalie Wheeler, *Univ. of Southampton, UK*
Aramais Zakharian, *Corning, USA*

D5: Fiber Devices, Fiber Lasers and Amplifiers and Nonlinear Waveguides
John Ballato, *Clemson Univ., USA, Subcommittee Chair*
Enkeleda Balliu, *Cobolt AB, a part of Hübner Photonics, Sweden*
Lawrence Chen, *McGill Univ., Canada*
Peter Dragic, *Univ. of Illinois at Urbana-Champaign, USA*
Vladimir Gordienko, *Aston Univ., UK*
Victor Kopp, *Chiral Photonics, USA*
Xiaoying Li, *Tianjin Univ., China*
Atsushi Nakamura, *NTT, Japan*
Sergei Nikitin, *OOO T8 Sensor, Russia*
Anna Peacock, *Univ. of Southampton, UK*
Hesham Sakr, *Microsoft Research, UK*
Yi Sun, *OFS, USA*
Masato Tanaka, *Sumitomo Electric Industries, Ltd, Japan*
Seongwoo Yoo, *Nanyang Technological Univ., Singapore*

S-Track: Subsystems and Systems

S1: Datacom Subsystems and Systems
Thomas (Trey) Greer, *NVIDIA, USA, Subcommittee Chair*
Robert Borkowski, *Nokia Bell Labs, USA*
Fabio Bottoni, *Cisco, Italy*
Brandon Buscaino, C*iena, USA*
Jingchi Cheng, *Huazhong Univ. of Science and Technology, China*
Fan Li, *Sun Yat-sen Univ., China*
Jeffrey Rahn, *Meta Platforms Inc., USA*
Clint Schow, U*niv. of California, Santa Barbara, USA*
Xin (Scott) Yin, *imec, Belgium*

Kangping Zhong, *Hong Kong Polytechnic Univ., Hong Kong*

S2: Transmission Subsystems
Di Che, *Nokia Bell Labs, USA, Subcommittee Chair*
Georg Böcherer, *Huawei, Germany*
Yi Cai, *Soochow Univ., USA*
John Downie, *Corning, USA*
Ming-Fang Huang, *NEC Laboratories America, USA*
Shota Ishimura, *KDDI Research, Japan*
Gabriele Liga, *Eindhoven Univ. of Technology, Netherlands*
Zhixin Liu, *Univ. College London, UK*
David Millar, *Infinera, USA*
Dario Pilori, *Politecnico di Torino, Italy*
Ke Wang, *Royal Melbourne Institute of Technology, Australia*
Chen Zhu, *Baidu, China*

S3: Transmission Systems
Ezra Ip, *NEC Laboratories America, USA, Subcommittee Chair*
Gabriel Charlet, *Huawei Technologies, France*
Boris Karanov, *Karlsruhe Institute of Technology, Germany*
Ruben Soares Luís, *National Institute of Information and Communications Technology (NICT), Japan*
Sergejs Makovejs, *Corning, UK*
Haik Mardoyan, *Nokia Bell Labs, France*
Antonio Mecozzi, *Università degli Studi dell'Aquila, Italy*
Masanori Nakamura, *NTT Network Innovation Laboratories, Japan*
Olga Vassilieva, *Fujitsu Network Communications, USA*
Deepa Venkitesh, *Indian Institute of Technology, Madras, India*
Yuta Wakayama, *KDDI Research, Japan*

S4: Optical Processing, Microwave Photonics and Fiber-Sensing
Mikael Mazur, *Nokia Bell Labs, USA, Subcommittee Chair*
Prince Anandarajah, *Dublin City Univ., Ireland*
Adonis Bogris, *Univ. of West Attica, Greece*
María Rosario Fernández-Ruiz, *Universidad de Alcalá, Spain*
Nazanin Hoghooghi, *National Institute of Standards and Technology, USA*
Tomoyuki Kato, *Fujitsu Laboratories Ltd., Japan*
Abel Lorences-Riesgo, *Huawei Technologies, France*
Mark Pelusi, *National Institute of Advanced Industrial Science and Technology, Japan*
Lalitha Ponnampalam, *Univ. College London, UK*
Xiaoke Yi, *Univ. of Sydney, Australia*

S5: Free-Space (FSO), Ranging (LiDAR) and Radio-over-Fiber (RoF)
Maria Morant, *Universitat Politècnica de València, Spain, Subcommittee Chair*
Michael Eiselt, *IEEE, USA*
Chao Lu, *Hong Kong Polytechnic Univ., Hong Kong*
James Lott, *Technische Universität Berlin, Germany*
David Marpaung, *Universiteit Twente, Netherlands*
Katherine Newell, *Johns Hopkins Univ. Applied Physics Laboratory, USA*
Boon Ooi, *King Abdullah Univ. of Science & Technology (KAUST), Saudi Arabia*

Oskars Ozolins, *RISE Research Institutes of Sweden, Sweden*
Simon Rommel, *Eindhoven Univ. of Technology, Netherlands*
Rakesh Sambaraju, *Vitex LLC, USA*
Kevin Shortt, *Airbus, Germany*
Bernhard Schrenk, *AIT Austrian Institute of Technology, Austria*
Jhih-Heng Yan, *Chunghwa Telecom Co., Ltd., Taiwan*

N-Track: Networks and Services

N1: Advances in the Development of Networks, Systems and Services
Stephan Pachnicke, *Christian-Albrechts-Universität zu Kiel, Germany, Subcommittee Chair*
Jean-Christophe Antona, *Alcatel Submarine Networks, France*
Mattia Cantono, *Google, USA*
Md. Saifuddin Faruk, *Bangor Univ., UK*
Binbin Guan, *Microsoft, USA*
Sander Jansen, A*dtran, Germany*
Robert Maher, *Infinera, USA*
Carmen Mas Machuca, *Universität der Bundeswehr München, Germany*
Lynn Nelson, *AT&T, USA*
Jeremie Renaudier, *Nokia Bell Labs, France*
Shikui Shen, *China Unicom, China*
Dirk Van Den Borne, *Juniper Networks, Germany*
Ting Wang, *NEC Laboratories America, USA*
Qiong Zhang, *Amazon Web Services, USA*

N2: Optical Networking for Data Center and Computing Applications
Odile Liboiron-Ladouceur, *McGill Univ., Canada, Subcommittee Chair*
Liam Barry, *Dublin City Univ., Ireland*
Hitesh Ballani, *Microsoft Research, UK*
Keren Bergman, *Columbia Univ., USA*
Nicola Calabretta, *Eindhoven Univ. of Technology, Netherlands*
Qixiang Cheng, *Univ. of Cambridge, UK*
Chaoran Huang, *Chinese Univ. of Hong Kong, Hong Kong*
George Michelogiannakis, *Lawrence Berkeley National Laboratory, USA*
Osamu Moriwaki, *NTT, Japan*
Shu Namiki, *National Institute of Advanced Industrial Science and Technology, Japan*
Mahdi Nikdast, *Colorado State Univ., USA*
Nikos Pleros, *Aristotle Univ. of Thessaloniki, Greece*
Angelina Totovic, *Celestial AI, Greece*

N3: Architectures and Software-Defined Control for Metro and Core Optical Networks
Daniel Kilper, *Trinity College Dublin, Ireland, Subcommittee Chair*
Juliana de Santi, *Universidade Tecnológica Federal do Paraná, Brazil*
Marija Furdek, *Chalmers Tekniska Högskola, Sweden*
Ashwin Gumaste, *Indian Institute of Technology, Bombay*
Hiroshi Hasegawa, *Nagoya Univ., Japan*

Jason Jue, *Univ. of Texas at Dallas, USA*
Mariam Kiran, *Oak Ridge National Laboratory, USA*
Yvan Pointurier, *Huawei Technologies, France*
Cristina Rottondi, *Politecnico di Torino, Italy*
Jesse Simsarian, *Nokia Bell Labs, USA*
Ricard Vilalta, *Centre Tecnològic de Telecomunicacions de Catalunya (CTTC), Spain*
Murat Yuksel, *Univ. of Central Florida, USA*
Jiawei Zhang, *Beijing Univ. of Posts and Telecommunications, China*

N4: Optical Access Networks for Fixed and Mobile Services
Jim Zou, *Adtran, Germany, Subcommittee Chair*
Sarvesh Bidkar, *Nokia Bell Labs, USA*
Nan Chi, *Fudan Univ., China*
Yuanqiu Luo, *Futurewei Technologies, USA*
Yanni Ou, *Beijing Univ. of Posts and Telecommunications (BUPT), China*
Annachiara Pagano, *FiberCop, Italy*
Chathurika Ranaweera, *Deakin Univ., Australia*
Lihua Ruan, *Peng Cheng Laboratory, China*
Gaël Simon, *Orange Labs, France*
Luca Valcarenghi, *Scuola Superiore Sant'Anna, Italy*
Paul Wright, *British Telecom, UK*
Lilin Yi, *Shanghai Jiao Tong Univ., China*
Haipeng Zhang, *CableLabs, USA*

N5: Market Watch, Network Operator Summit & Data Center Summit (Invited Program Only)
Werner Weiershausen, *Deutsche Telekom Technik GmbH, Germany, Subcommittee Chair*
Vipul Bhatt, *Coherent, USA*
Martin Birk, *Curbius, USA*
Tim Doiron, *Infinera, USA*
Paulina Gomez, *Ciena, Canada*
Lisa Huff, *Omdia, USA*
Di Liang, *Univ. of Michigan, USA*
Anuj Malik, *Cisco Systems, USA*
Kentaro Nakamura, *Fujitsu Network Communications, Japan*
Stephan Neidlinger, *ADVA, Germany*
Zuowei Shen, *Google, USA*
Yoshiaki Sone, *NTT Network Innovation Laboratories, Japan*

Subcommittee Q: Quantum Devices, Systems and Networking
Cheryl Sorace-Agaskar, *MIT Lincoln Laboratory, USA, Subcommittee Chair*
Eleni Diamanti, *CNRS, France*
Tobias Gehring, *Technical Univ. of Denmark, Denmark*
Hannes Hübel, *AIT Austrian Institute of Technology, Austria*
Gregory Kanter, *NuCrypt, USA*
Michael Kues, *Hannover Univ., Germany*
Rui Lin, *Chalmers tekniska högskola, Sweden*
Andrew Lord, *BT Applied Research, UK*
Taofiq Paraiso, *Toshiba Europe, UK*
Li Qian, *Univ. of Toronto, Canada*
Fabio Sciarrino, *Sapienza Università di Roma, Italy*

Rui Wang, *Univ. of Bristol, UK*
Feihu Xu, *Univ. of Science and Technology of China, China*
Lai Zhou, *Beijing Academy of Quantum Information Sciences, China*

Subcommittee: Demo Zone

Dora van Veen, *Nokia, USA, Subcommittee Chair*
Luiz Anet Neto, *IMT Atlantique, France*
Achim Autenrieth, *ADVA Optical Networking, Germany*
Pedro Freire, *Aston Univ., UK*
David Millar, *Infinera, USA*
Paolo Monti, *Chalmers tekniska högskola, Sweden*
Hideyuki Nasu, *Furukawa Electric, Japan*
Chigo Okonkwo, *Technische Universiteit Eindhoven, Netherlands*
Paola Parolari, *Politecnico di Milano, Italy*
Benjamin Puttnam, *National Institute of Information and Communications Technology (NICT), Japan*
Michela Svaluto Moreolo, *Centre Tecnològic Telecom de Catalunya, Spain*
Yikai Su, *Shanghai Jiao Tong Univ., China*
Shuyi Yan, *Cisco Systems, USA*
Georgios Zervas, *Univ. College London, UK*
Ligia Zorello, *Meta, USA*

Show Floor Programming Coordinators

Scott Wilkinson, *Cignal AI, USA*

Steering Committee

Optica

Jun Shan Wey, *Verizon, USA, Chair*
Keren Bergman, *Columbia Univ., USA*
Ramon Casellas*, Centre Tecnològic de Telecomunicacions de Catalunya (CTTC), Spain*
Andrew Lord, *BT Applied Research, UK*

IEEE/Communications Society

Biswanath Mukherjee, *Univ. of California Davis, USA*
Loukas Paraschis, *IEEE Communication Society, USA*
Ann von Lehmen*, DARPA, USA*
Doug Zuckerman, *IEEE Communications Society, USA*

IEEE/Photonics Society

Gabriella Bosco, *Politecnico di Torino, Italy*
Jörg-Peter Elbers, *Adtran, Germany*
Fatima Garcia Gunning, *Tyndall National Institute, Ireland*
Ampalavanapilla Thas Nirmalathas, *Univ. of Melbourne, Australia*

Ex-Officio

Jiajia Chen, *ByteDance, USA*
Mei Du, *TATA Communications, USA*
Johannes Fischer, *Fraunhofer Heinrich-Hertz Inst., Germany*
Nicolas Fontaine*, Nokia Bell Labs, USA*
Lidia Galdino, *Corning, UK*
Lara Garrett, *SubCom, USA*
Tetsuya Hayashi, *Sumitomo Electrc Industries Ltd., Japan*

Fotini Karinou, *Microsoft, USA*
Takashi Matsui, *NTT, Japan*
Xiaodan Pang, *ZJU, China and RTU, Latvia*
Elaine Wong, *Univ. of Melbourne, Australia*
Qiong (Jo) Zhang, *Amazon Web Services, USA*

Budget Committee

Loudon Blair, *Ciena, USA*
Elizabeth Nolan, *Optica, USA*
Douglas M. Razzano, *IEEE Photonics Society, USA*
Seb Savory, *Univ. of Cambridge, UK*
Harold Tepper, *IEEE Communications Society, USA*
Jun Shan Wey, *Verizon, USA*

Long Range Planning Committee

Jörg-Peter Elbers, *Adtran, Germany, Chair*
Fred Bartholf, *Comcast, USA*
Stu Elby, *MSG Ventures, USA*
Lynn Nelson, *AT&T, USA*
Elizabeth Nolan, *Optica, USA*
Loukas Paraschis, *Banais Labs, USA*
Douglas M. Razzano, *IEEE Photonics Society, USA*
Harold Tepper, *IEEE Communications Society, USA*
Vijay Vusirikala, *Google, USA*
Glenn Wellbrock, *Verizon, USA*
Jun Shan Wey, *Verizon, USA*
Peter Winzer, *Nubis Communications, USA*