# OFC

The future of optical networking
and communications

# Conference Guide

Technical Conference: 15 – 19 March 2026
Exhibition: 17 – 19 March 2026
Los Angeles Convention Center
Los Angeles, California, USA

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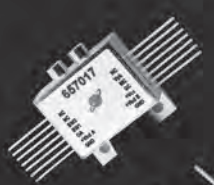
OPTICA

# WIDE BANDWIDTH OPTICAL RECEIVERS FOR MAXIMUM NETWORK FLEXIBILITY

**Booth 4953**
**West Hall**
*Very Close To Expo Theater 1*

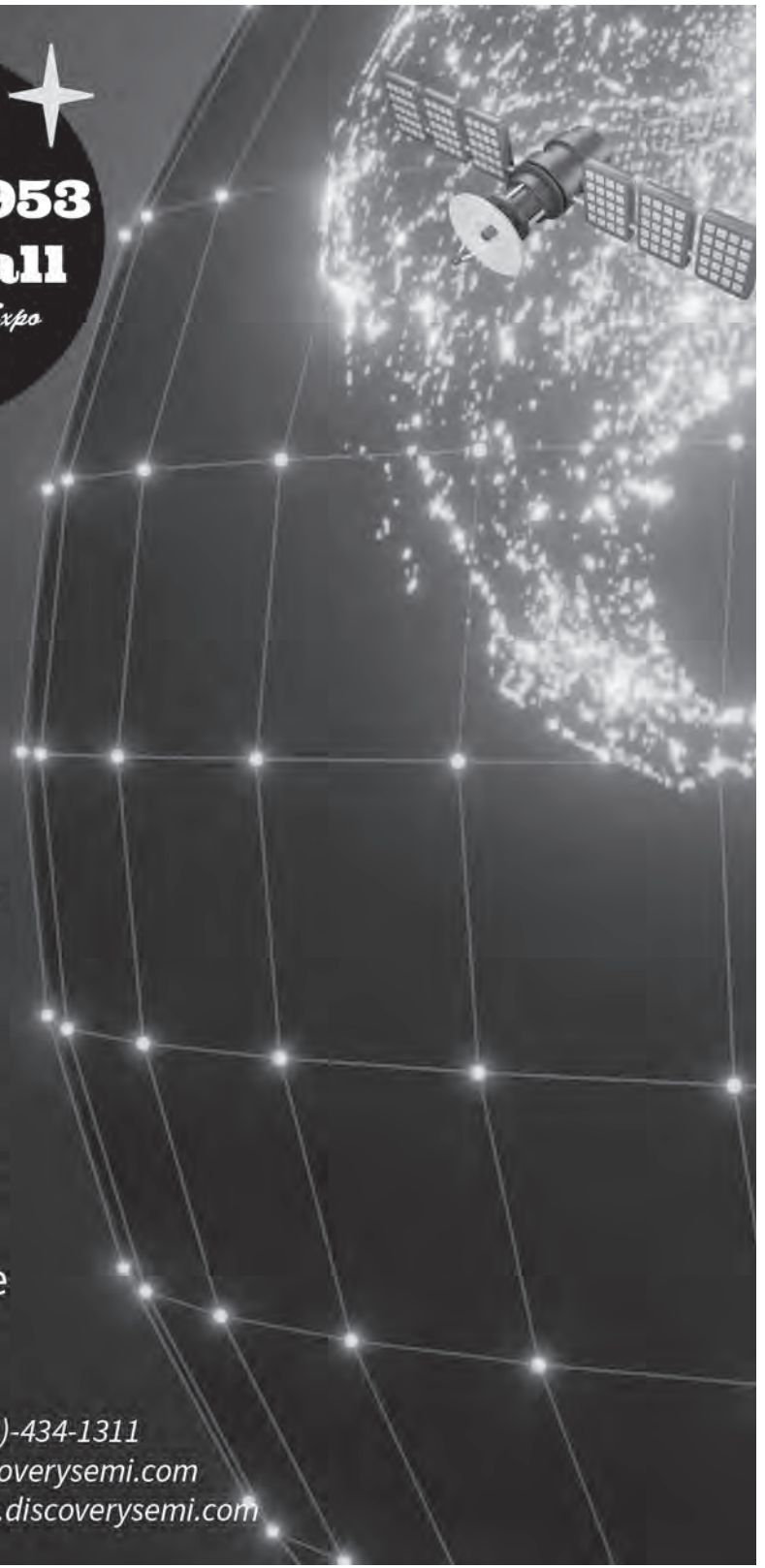


## Applications

- Aero-Space
- Datacom
- Defense
- LIDAR
- Optical Clocks
- QKD
- RF-over-Fiber
- Telecom

## Features

- Extensive Reliability and Space Radiation Qualifications
- Fibered and Free Space coupled options
- Wavelength range from 800nm - 2400nm
- Proven Defense and Space Flight Heritage



Discovery Semiconductors, Inc.®
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# Plenary Session

Tuesday, 17 March, 08:00–10:00, *Diamond Ballroom, JW Marriott*

## Scaling the Optical Future: Optical Technologies Driving AI, Data Centers and Communications Networks

Julie Sheridan Eng, *Coherent, USA*

AI is driving a new wave of innovation in optical interconnects, accelerating new technology development and deployment within the data center and the broader communications network. This talk will examine market dynamics and key technological advances in lasers and modulators, transceivers, co-packaged optics and optical circuit switches, enabling higher bandwidth density and energy efficiency within the data center. It will also highlight advances in coherent optics and transport technologies that are enabling scalable, high-capacity data center interconnect (DCI) and communications networks.

**Dr. Julie Sheridan Eng** is Chief Technology Officer (CTO) of Coherent. Prior to becoming CTO, Dr. Eng served as Senior Vice President and General Manager of the Optoelectronic Devices and Modules Business Unit.

Before Coherent, Dr. Eng held various senior management positions at Finisar Corporation, including Executive Vice President and General Manager of 3D Sensing and Executive Vice President of Datacom Engineering. Over the 15 years she managed datacom transceiver engineering, her teams production-released hundreds of fiber optic transceiver products and achieved numerous industry firsts. Dr. Eng began her career at AT&T Bell Laboratories/Lucent/Agere. She is a Fellow of Optica and a member of the National Academy of Engineering.

Dr. Eng holds a B.A. degree summa cum laude in Physics from Bryn Mawr College and a B.S. degree in Electrical Engineering with honors from the California Institute of Technology (Caltech). She earned M.S. and Ph.D. degrees in Electrical Engineering from Stanford University.

## Revolutionizing Networking for Gigawatt AI Factories

Alexis Bjorlin, *NVIDIA, USA*

Training at the future million-GPU scale requires significant advancements in compute, memory (scale-up) and networking (both scale-up and scale-out). Concurrently, human-like, chain-of-reasoning based iterative inferencing — as opposed to zero-shot answers — requires extremely low latencies and reduced energy consumption per answer.

The massive networking challenges are being addressed by optical innovations, including CPO, with micro-ring modulators, 3D-stacked silicon photonics engines, high-power lasers and detachable fiber connectors. This technology collectively promises substantial improvements in power efficiency, network resiliency and speedier deployment versus existing methods.

**Dr. Alexis Bjorlin** is Senior Vice President and General Manager, DGX Cloud at NVIDIA. She also currently serves on the board of directors at Global Semiconductor Association (GSA).

Prior to NVIDIA, Bjorlin was Vice President of Infrastructure at Meta, where her team was responsible for Infrastructure hardware/software co-designed systems, including AI Systems, compute and storage platforms and custom Silicon. Prior to Meta, she served as Senior Vice President and General Manager of Broadcom Optical Systems Division and previously was Corporate Vice President of the Data Center Group and General Manager of the Connectivity Group at Intel, where she oversaw three business units: Ethernet/Networking, High Performance Computing Fabrics and Silicon Photonics. Prior to Intel, she spent eight years as President of Source Photonics, where she also served on the board of directors.

Bjorlin earned a B.S. in Materials Science and Engineering from Massachusetts Institute of Technology and a Ph.D. in Materials Science from the University of California at Santa Barbara.

## Optical Networks in Space — From Technology to Application

Siegbert Martin, *Tesat-Spacecom, Germany*

It began in 2000 with an inspiration to develop communication systems in space with laser technology. Fast forward to today and optical networks in space are becoming a substantial, resilient solution for worldwide communication — either serving as a backup solution to terrestrial data networks or as an independent extension.

Significantly lower launch costs and other developments are leading to the deployment of satellite constellations of unprecedented scale. Laser-based communications between satellites offer several advantages over conventional RF links, but challenges too. Operators have recently demonstrated successful laser-based inter-satellite communications at scale and the industry is now examining the technology for optical links to the ground, Quantum Key Distribution (QKD) and packet-based routers. This talk will examine how the industry got to this point and the exciting new opportunities it is creating.

**Dr. Siegbert Martin** is Chief Technology Officer at Tesat-Spacecom. Tesat is a subsidiary of Airbus (formerly EADS) and develops, produces and tests communications payloads for satellites, including laser communications.

Dr. Martin's career has been concentrated in terrestrial and satellite communication networks, spanning microwave and optical technologies. He has held positions at Bosch Telecom, Marconi, Ericsson and has been with Tesat-Spacecom since 2007. Dr. Martin has a Ph.D. from Open University in Hagen, Germany.

# Short Course Schedule

## Sunday, 15 March

### 08:30–12:30

**SC105: Modulation Formats and Receiver Concepts for Optical Transmission Systems**
Peter Winzer, *Nubis Communications, USA;* Vivian Chen, *Nokia Bell Labs, Alcatel-Lucent, USA*

**SC203: 400, 800Gb/s and Beyond Optical Communications Systems: Design and Design Trade-offs**
Chongjin Xie, *PhotonicX AI, USA;* Ezra Ip, *NEC Labs, USA*

**SC395: Modeling and Simulation of Optical Transmitter and Receiver Components for Coherent Communications**
Harald Rohde, *Nokia, Germany;* Howard Wang, *Nokia, USA*

**SC432: Hands-on: Silicon Photonics Components**
Lukas Chrostowski, *Univ. of British Columbia, Canada*

**SC452: Data Center Interconnects for Hyper-scale Cloud & AI Networking**
Noriaki Kaneda, *Nokia, USA;* Robert Elschner, *Fraunhofer HHI, Germany*

**SC461: High-Capacity Data Center Interconnects for Cloud-Scale Networking**
Dirk van den Borne, *Hewlett Packard Enterprise, Germany;* Mark Filer, *Oracle, USA*

**SC469: Hands-on: Laboratory Automation and Control using Python**
Jochen Schröder, *Chalmers Univ. of Technology, Sweden;* Roland Ryf, *Nokia Bell Labs, USA;* John Dorighi, *Keysight Technologies Inc., USA;* Binbin Guan, *OpenAI, USA*

**SC513: Data Center Short Links – Link Design, Modeling, Test and Measurements**
Greg D. Le Cheminant, *Keysight Technologies, USA;* Petar Pepeljugoski, *Lightmatter, USA*

**SC546: Applications of Coherent Distributed Fiber Sensing in Optical Communication Networks**
Mikael Mazur, *Nokia Bell Labs, USA*

### 09:00–12:00

**SC114: Technologies and Applications for Passive Optical Networks (PONs)**
Yuanqiu Luo, *Futurewei, USA*

**SC261: ROADM Technologies and Network Applications**
Thomas Strasser, *Molex, USA*

**SC459: Multimode Photonic Devices, Characterization and Applications**
Nicolas Fontaine, *Nokia Bell Labs, USA*

### 13:00–16:00

**SC447: The Life Cycle of an Optical Network: From Planning to Decommissioning**
Lynn Nelson, *AT&T, USA*

**SC512: Modern Subsea Cable Systems**
Mei Du, *Tata Communications, USA*

### 13:00–17:00

**SC443: Optical Amplifiers: From Fundamental Principles to Technology Trends**
Peter Andrekson, *Chalmers Univ. of Technology, Sweden;* Michael Vasilyev, *Univ. of Texas at Arlington, USA*

**SC543: Deep Reinforcement Learning for Optical Networking**
Carlos Natalino, *Chalmers Univ. of Technology, Sweden;* Sebastian Troia, *Polytechnic of Milan, Italy*

### 13:30–17:30

**SC160: Microwave Photonics**
Jose Capmany, *Polytechnic University of Valencia, Spain*

**SC216: An Introduction to Optical Network Design and Planning**
George Rouskas, *North Carolina State Univ., USA*

**SC267: Silicon Microphotonics: Technology Elements and the Roadmap to Implementation**
Lionel Kimerling, *Massachusetts Institute of Technology, USA*

**SC327: Modeling and Design of Long-Haul Fiber-Optic Communication Systems**
Rene-Jean Essiambre, *Nokia Bell Labs, USA*

**SC384: Background Concepts of Optical Communication Systems**
Alan Willner, *Univ. of Southern California, USA*

**SC514: FEC Techniques for Optical Communications**
Georg Böcherer, *Huawei Technologies, Technical Univ. of Munich, Germany*

## Monday, 16 March

### 08:30–12:30

**SC325: Highly Integrated Monolithic Photonic Integrated Circuits**
Chris Doerr, *Doerr Consulting, LLC, USA*

**SC369: Hands-on: Test and Measurement for Coherent Optical Transceivers**
Michael Koenigsmann, *Keysight, Germany;* Fabio Pittala, *Keysight, Germany*

**SC393: Digital Signal Processing for Coherent Optical Transceivers**
Chris Fludger, *Attotude, Germany*

**SC444: Emerging Optical Network Technologies Towards 2030**
Xiang Liu, *Huawei Technologies, China*

**SC453A: Hands-on: Fiber Optic Handling, Measurements and Component Testing**
Alex Chew, *Seiko Giken, USA;* Tobie Blum, *Santec Canada, Canada;* Jérome Allaigre, *Data-Pixel, France;* Julien Maille, *Data-Pixel, France*

**SC454: Hands-on: Silicon Photonics Design – Circuits**
Wim Bogaerts, *Univ. of Ghent, Belgium*

**SC463: AI-Driven Optical Transport Networks: Architectures, Applications and Intelligent Automation**
Achim Autenrieth, *ADVA Optical Networking SE, Germany;* Jörg-Peter Elbers, *ADVA Optical Networking SE, Germany*

**SC473: Photonic Switching Systems**
David Neilson, *Nokia Bell Labs, USA;* Benjamin Lee, *NVIDIA, USA*

**SC483: Machine Learning in Optical Networks**
Massimo Tornatore, *Politecnico di Milano, Italy;* Mëmëdhe Ibrahimi, *Politecnico di Milano, Italy*

**SC487: Hands-on: Laboratory Automation and Control using Python (Advanced)**
Jochen Schröder, *Chalmers Univ. of Technology, Sweden; Roland Ryf, Nokia Bell Labs, USA;* John Dorighi, *Keysight Technologies Inc., USA;* Binbin Guan, *OpenAI, USA*

**SC527: Optical Satellite Communications**
Vincent Chan, *Massachusetts Institute of Technology, USA*

## 09:00–12:00

**SC177: High-Speed Semiconductor Lasers and Modulators**
John Bowers, *Univ. of California at Santa Barbara, USA*

**SC347: Reliability and Qualification of Fiber-Optic Components**
Robert Herrick, *Robert Herrick Consulting, USA*

**SC359: Networking for Datacenters and Machine Learning**
Hong Liu, *Google, USA,* Ryohei Urata, *Google, USA*

**SC465: Optical Fiber & Cable- Enabling Existing & Future Networks**
John Hedgpeth, *Corning Optical Communications, USA;* Nilson Gabela, *Corning Optical Communications, USA*

## 13:30–16:30

**SC408: Space Division Multiplexing for Optical Communication Systems and Networks**
Roland Ryf, *Nokia Bell Labs, USA*

**SC485: Advanced Fiber Access Networks**
Jun Shan Wey, *Verizon, USA;* Rajesh Yadav, *Verizon, USA*

**SC526: Optical Wireless Technologies, Systems and Applications**
Harald Haas, *Univ. of Strathclyde, UK*

## 13:30–17:30

**SC217: Applications of Radio-over-Fiber Technologies Including Future G Networks**
Dalma Novak, *Octane Wireless, USA*

**SC328: Standards for High-Speed Optical Networking**
Tom Huber, *Nokia, USA*

**SC357: Circuits and Equalization Methods for Coherent and Direct Detection Optical Links**
Alexander Rylyakov, *Nokia, USA;* Sudip Shekar, *Univ. of British Columbia, Canada*

**SC431: Photonic Technologies in Datacenters and AI Machines**
Clint Schow, *Univ. of California at Santa Barbara, USA*

**SC433: Introduction to Photodetectors and Optical Receivers**
Andres Beling, *Univ. of Virginia, USA*

**SC451: Distributed Fiber Optic Sensing for Communication Networks and Infrastructure Applications**
Alexis Méndez, *MCH Engineering, LLC, USA;* Andres Chavarria, VIAVI Solutions, *USA*

**SC453B: Hands-on: Fiber Optic Handling, Measurements and Component Testing**
Alex Chew, *Seiko Giken, USA;* Tobie Blum, *Santec Canada, Canada;* Jérome Allaigre, *Data-Pixel, France;* Julien Maille, *Data-Pixel, France*

**SC525: Photonic and Electronic Packaging - Materials, Processes, Equipment and Reliability**
Peter O'Brien, *Tyndall, Ireland*

**SC528: Hands-on: Practical Optical Transmission and Fiber Network testing for Real-World Scenarios**
Gwenn Amice, *EXFO, USA;* Christine Tremblay, *École de Technologie Supérieure, Canada*

**SC542: Generative AI Essentials for Telecommunications: From Fundamentals to Implementation**
Subhash Talluri, *Amazon Web Services, USA;* Qiong (Jo) Zhang, *Amazon Web Services, USA*

**OFC and Co-Sponsors Awards Ceremony and Luncheon**

Tuesday,17 March, 12:30–14:00
*JW Marriott Los Angeles L.A. LIVE*

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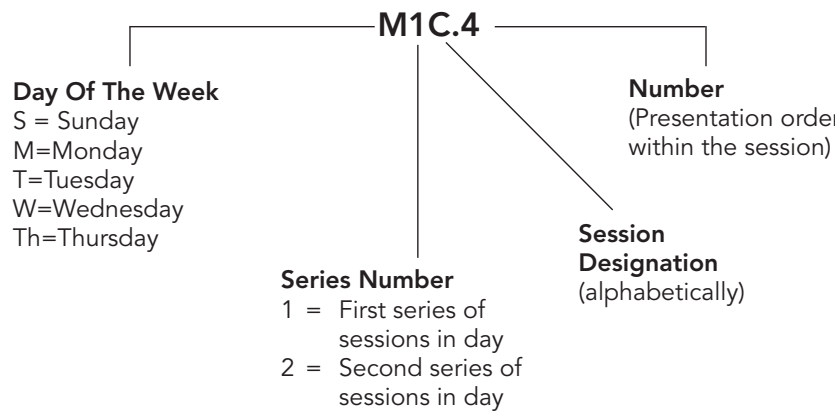
The event is open to anyone who purchases a ticket, but seating is limited. Ticket sales end on the 16 March. Learn more about the honorees being recognized.

## Explanation of Session Codes




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 11 February 2026. 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 www.ofcconference.org and clicking on the "Download Technical Digest Papers" from the button 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, 15 March

| | Room 502A | Room 502B | Room 515A | Room 515B | Room 408A | Room 408B |
|---|---|---|---|---|---|---|
| 07:30–19:00 | **Registration Hours,** *South Hall Lobby* | | | | | |
| 08:30–12:30 | **SC105, SC203, SC395, SC432, SC452, SC461, SC469, SC513, SC546** | | | | | |
| 09:00–12:00 | **SC114, SC261, SC459** | | | | | |
| 12:00–13:00 | **Lunch Break** *(on own)* | | | | | |
| 13:00–15:30 | **S1A • What Will Shape the Future of Optical Computing? Integrated vs. Bulk Optics, Analog vs. Digital** | **S1B • Optical Networking for AI Data Centers: Technology Enablers and Key Applications** | **S1C • Anti-Resonant Hollow Core Fiber: The Hype, The Hope, The Headaches** | **S1D • Chasing the Limit: On the Path to Photonic Scale-Up with Ultra-Low-Energy/Bit** | **S1E • Toward Holistic Network and Environment Visibility: Are Fiber Sensing and Tomography Ready to Deliver in Real Networks?** | **S1F • Will Coherent Pluggables Take Over Everything?** |
| 13:00–16:00 | **SC447, SC512** | | | | | |
| 13:00–17:00 | **SC443, SC543** | | | | | |
| 13:30–17:30 | **SC160, SC216, SC267, SC327, SC384, SC514** | | | | | |
| 15:30–16:00 | **Coffee Break,** *Outside Rooms 408AB, 502AB, 515AB* | | | | | |
| 16:00–18:30 | **S2A • MCFs at the Edge of AI: Can They Transform Intra-DC and Campus Connectivity?** | **S2B • The Intelligent Operator: AI's Role in the Optical Network** | **S2C • How Far is Too Far? Interconnect Latency and Distributed AI Training** | **S2D • Is CPO Integration Ready for AI Pipelines?** | **S2E • Do We Need to Rethink the Role of Networks in the Quantum Era?** | **S2F • How to Make More Money Out of Optics for Fixed and Wireless Access Networks?** |
| 19:00–21:00 | **Hack Your Research! Tools and Tricks for Today's Telecommunications Techies,** *Concourse F Room 152* | | | | | |

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 www.ofcconference.org/program/short-courses for a list of available short courses and the format in which they will be offered.

**Key to Shading**

Short Courses

# Agenda of Sessions — Monday, 16 March

| | Room 403A | Room 403B | Room 408A | Room 408B | Room 411 | Rooms 501ABC |
|---|---|---|---|---|---|---|
| 07:00–19:30 | **Registration Hours,** *South Hall Lobby* | | | | | |
| 08:00–10:00 | **M1A • Data Center Interconnection** (ends at 09:45) | **M1B • Data Center WDM and Comb** | **M1C • SDM and Multiband Transmission Systems** (ends at 09:30) | **M1D • LiDAR Systems and Narrow Linewidth Lasers** (ends at 09:30) | **M1E • Optical Signal Processing, Filtering and Mode Division Multiplexing** (ends at 09:30) | **M1F • Advances in High-Speed Direct-Detection PON** |
| 08:30–12:30 | **SC325, SC369, SC393, SC444, SC453A, SC454, SC463, SC473, SC483, SC487, SC527** | | | | | |
| 09:00–12:00 | **SC177, SC347, SC359, SC465** | | | | | |
| 10:00–10:30 | **Coffee Break,** *Outside Rooms 403AB, 408AB, 502AB, 515AB* | | | | | |
| 10:30–12:30 | **M2A • Silicon Photonics Modulators** | **M2B • IM/DD for Data Center** | **M2C • Next-generation Optical Transmission Systems** | **M2D • Reconfigurable Devices and Optical Switches** | **M2E • Multi-mode Fiber Devices, EDFA Gain Dynamics and Optical Signal Processing** | **M2F • Novel Architectures and Intelligence for Future Access Networks** |
| 12:30–14:00 | **Lunch Break** *(on own)* | | | | | |
| 13:30–16:30 | **SC408, SC485, SC526** | | | | | |
| 13:30–17:30 | **SC217, SC328, SC357, SC431, SC433, SC451, SC453B, SC525, SC528, SC542** | | | | | |
| 14:00–16:00 | **M3A • AI Failure and Anomaly Detection in Optical Networks** | **M3B • Digital and Analog Signal Processing** | **M3C • Ultra-wideband Transmission Systems** | **M3D • Optical Phased Arrays, Free Space Beams and Metasurface Devices** | **M3E • Optical Amplifiers for Space Division Multiplexing** | **M3F • Optical Switching for AI Networking** |
| 14:00–15:30 | **Dataset and Machine Learning Challenge Presentations,** *Concourse F Room 152* | | | | | |
| 14:00–16:00 | **M3Z • Demo Zone,** *Concourse F Room 152* | | | | | |
| 16:00–16:30 | **Coffee Break,** *Outside Rooms 403AB, 408AB, 502AB, 515AB* | | | | | |
| 16:30–18:30 | **M4A • QoT and AI Based Digital Twins** | **M4B • Optical Engines** | **M4C • Optical Parametric and Raman Amplifiers** | **M4D • Heterogeneous Integrated Devices** | **M4E • Few-Mode and Multi-Mode Fiber** | **M4F • Photonic Interconnects for Scalable AI** (ends at 18:15) |
| 19:00–21:00 | **OFC Student Party,** *33 Taps, 1240 S. Figueroa St.* | | | | | |

**Key to Shading**

Short Courses

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| Room 502A | Room 502B | Room 515A | Room 515B | Room 518 |
|---|---|---|---|---|
| **Registration Hours,** *South Hall Lobby* | | | | |
| **M1G • Optical Computing** | **M1H • High Speed Coherent FSO** | **M1I • DAS for Geoscience and Emerging Applications** (ends at 09:45) | **M1J • Hollow-Core Fiber Fabrication and Connectivity** (ends at 09:45) | **M1K • Advances in Continuous-Variable QKD Systems and Processing** |
| **SC325, SC369, SC393, SC444, SC453A, SC454, SC463, SC473, SC483, SC487, SC527** | | | | |
| **SC177, SC347, SC359, SC465** | | | | |
| **Coffee Break,** *Outside Rooms 403AB, 408AB, 502AB, 515AB* | | | | |
| **M2G • Panel: Scaling Networks for the AI Era: From Data Centers to Wide Area Networks** | **M2H • Panel: Satellite Optical Networks: Avoiding Vendor Lock-in Through Interoperability** | **M2I • 6G and Radio Over Fiber** | **M2J • Hollow-Core Fiber Monitoring and Sensing** | **M2K • QKD Real-World Deployments** |
| **Lunch Break** *(on own)* | | | | |
| **SC408, SC485, SC526** | | | | |
| **SC217, SC328, SC357, SC431, SC433, SC451, SC453B, SC525, SC528, SC542** | | | | |
| **M3G • Panel: High-Speed Optical Modulators for Intra-Data Center Links: Unlocking 400 Gb/s per Lane and Beyond** | **M3H. Visible Light and Optical Wireless Communication** | **M3I • Symposium: Beyond the Atmosphere: Architectures and Technologies for Optical Space Communication I** | **M3J • Fiber Sensing I** | **M3K • Machine Learning Assisted Design and Optimization** |
| **Dataset and Machine Learning Challenge Presentations,** *Concourse F Room 152* | | | | |
| **M3Z • Demo Zone,** *Concourse F Room 152* | | | | |
| **Coffee Break,** *Outside Rooms 403AB, 408AB, 502AB, 515AB* | | | | |
| **M4G • Panel: Probabilistic Amplitude Shaping after 10 Years: Where Are we Now and What is to Come?** | **M4H • Practical Demonstrations of THz Communications** | **M4I • Symposium: Beyond the Atmosphere: Architectures and Technologies for Optical Space Communication II** | **M4J • Fiber Sensing II** | **M4K • Fiber Monitoring and Modeling** |
| **OFC Student Party,** *33 Taps, 1240 S. Figueroa St.* | | | | |

# Agenda of Sessions — Tuesday, 17 March

| | Room 403A | Room 403B | Room 408A | Room 408B | Room 411 | Rooms 501ABC | Room 502A |
|---|---|---|---|---|---|---|---|
| 07:00–19:00 | **Registration Hours,** *South Hall Lobby* | | | | | | |
| 07:30–08:00 | **Plenary Session Coffee Break,** *Diamond Ballroom Foyer, JW Marriott* | | | | | | |
| 08:00–10:00 | **Tu1A • Plenary Session,** *Diamond Ballroom, JW Marriott* | | | | | | |
| 10:00–17:00 | **Exhibition Hours,** *South and West Hall (Coffee Service 10:00–11:00, Booths 349, 5041)* | | | | | | |
| 10:00–14:00 | **Dedicated Exhibition-Only Time,** *South and West Hall* | | | | | | |
| 10:30 –12:00 | **The Art of Writing the Perfect OFC Paper,** *Room 409B* | | | | | | |
| 12:30–14:00 | **OFC and Co-Sponsors Awards Ceremony and Luncheon,** *Platinum E, JW Marriott*<br>*Separate Registration Required* | | | | | | |
| 12:30–14:00 | **Lunch Break** *(on own)* | | | | | | |
| 14:00–16:00 | **Tu2A• Advanced Coherent Technologies and Event Localization** (ends at 15:30) | **Tu2B • Single-Core Fiber and Spatial Division Multiplexing** | **Tu2C • Autonomous Optical Networks** | **Tu2D • Scaling Photonic Integrated Circuits** (ends at 15:45) | **Tu2E • Metro-Access Integration and Traffic Optimization** | **Tu2F • Subsea Cable Sensing** | **Tu2G • Panel: Machine Learning is Taking Over Optical Communications - But Which Algorithms Should We Use?** |
| 16:00–16:30 | **Coffee Break,** *Outside Rooms 408AB, 502AB, 515AB* | | | | | | |
| 16:30–18:30 | **Tu3A • Transmission System Modeling and Its Validation** (ends at 18:15) | **Tu3B • THz and Microwave Generation** | **Tu3C • Tunable Microrings, MZIs, Isolators and Athermal PICs** | **Tu3D • Optical Doped Fiber Amplifiers** | **Tu3E • Submarine & Hollow-Core Fiber Systems** | **Tu3F • Satellite Optical Networks** | **Tu3G • Panel: Artificial Intelligence in Optical Network Control and Management** |
| 17:15–18:15 | **Exhibitor Reception,** *Lucky Strike, 800 W Olympic Blvd.* | | | | | | |
| 18:30–20:00 | **Conference Reception,** *Petree Plaza* | | | | | | |
| 19:30–21:00 | **Rump Session: From Short Hops to Long Hauls: What Parts of the Fiber Spectrum Shall We Use in the Future and Why?,** *Room 502A* | | | | | | |

| Room 502B | Room 515A | Room 515B | Room 518 |
|---|---|---|---|
| **Registration Hours,** *South Hall Lobby* | | | |
| **Plenary Session Coffee Break,** *Diamond Ballroom Foyer, JW Marriott* | | | |
| **Tu1A • Plenary Session,** *Diamond Ballroom, JW Marriott* | | | |
| **Exhibition Hours,** *South and West Hall (Coffee Service 10:00–11:00, Booths 349, 5041)* | | | |
| **Dedicated Exhibition-Only Time,** *South and West Hall* | | | |
| **The Art of Writing the Perfect OFC Paper,** *Room 409B* | | | |
| **OFC and Co-Sponsors Awards Ceremony and Luncheon,** *Platinum E, JW Marriott* *Separate Registration Required* | | | |
| **Lunch Break** *(on own)* | | | |
| **Tu2H • Photonic Integrated Circuits for Wireless Communications** | | **Tu2J • Inverse Designed Integrated Photonic Components** | **Tu2K • Entanglement Sources, Distribution and Photonic Architectures** |
| **Coffee Break,** *Outside Rooms 408AB, 502AB, 515AB* | | | |
| **Tu3H • Beamsteering for Optical Wireless** | **Tu3I • Symposium: Next Generation Interconnects for AI Scale up Systems I** | **Tu3J • High-Speed EAMs and EMLs** | **Tu3K • Quantum Networking Protocols, Control, and Multi-Node Architectures** |
| **Exhibitor Reception,** *Lucky Strike, 800 W Olympic Blvd.* | | | |
| **Conference Reception,** *Petree Plaza* | | | |
| **Rump Session: From Short Hops to Long Hauls: What Parts of the Fiber Spectrum Shall We Use in the Future and Why?,** *Room 502A* | | | |

| Expo Theater I | Expo Theater II | Expo Theater III |
|---|---|---|
| CISCO ACACIA COMMUNICATIONS, INC. | Amphenol | HL HYPERLIGHT |
| **Exhibit Hall Opens at 10:00** | | |
| **MW1 • State of the Industry: Now and in 2031**<br>10:30–12:00<br><br>**MW2 • Market Status and Enabling Technologies of 1.6Tbps and Beyond**<br>12:30–14:00<br><br>**MW3 • Recent Advances in AI Cluster Interconnects**<br>14:15–15:45<br><br>**SF1 • Future Photonics for AI: From PICs to Pods to Factories**<br>16:00–17:00 | **SF3 • The Network and System Implications of CPO/NPO/xPO and the New Photonics Ecosystem for AI/ML Interconnects**<br>10:30–11:30<br><br>**DCSK • Keynote, Scaling with Optics: Building AI Ready Fabrics from IMDD Pluggables to Coherent DCI**<br>12:00–12:30<br><br>**DCS1 • Data Center Interconnect Trends, Challenges and Opportunities in the AI Era**<br>12:30–14:00<br><br>**DCS2 • Scaling AI Clusters: Challenges in Scale-Up and Scale-Out for Future Growth**<br>14:15–15:45<br><br>**SF2 • Global Forum's Vision for Future Open AI Networking: What Industry Collaboration Is Needed for Scalable AI Cluster Networks?**<br>16:00–17:00 | **SF4 • OpenROADM MSA Updates**<br>10:30–11:30<br><br>**Technology Showcase: Data Center Reliability in Crisis: Why Past Validation Breaks at 1.6T**<br>KEYSIGHT<br>11:45-12:15<br><br>**Technology Showcase: Smart Infrastructure Monitoring with Advanced Fiber Optics**<br>Lightera<br>12:30-13:00<br><br>**Technology Showcase: Silicon Micro Lens: The Optical Heart of AI-Driven CPO and OCS Architectures**<br>SUNA<br>13:15-13:45<br><br>**Technology Showcase: Semiconductor-Enhanced Passives: The Evolutionary Path Towards High Speed Transceiver**<br>SUNA<br>14:00-14:30<br><br>**SF5 • Advances in International Optical Networks Towards 2030 and Beyond (ION-2030)**<br>14:45–15:45<br><br>**SF6 • OIF Presents CEI-448Gbps – Fast and Furious Signaling Spec Development**<br>16:00–17:00 |
| **Exhibit Hall Closes at 17:00** | | |

# Agenda of Sessions — Wednesday, 18 March

| | Room 403A | Room 403B | Room 408A | Room 408B | Room 411 | Rooms 501ABC | Room 502A |
|---|---|---|---|---|---|---|---|
| 07:30–17:00 | **Registration Hours,** *South Hall Lobby* | | | | | | |
| 06:00–07:00 | **OFC Fun Run/Walk,** *L.A. Live Plaza, Behind JW Marriott* | | | | | | |
| 08:00–10:00 | | **W1A • Thin-Film LN/LT and Silicon Mach-Zehnder Modulators** | **W1B • Laser Prototypes and Packaging** (ends at 09:45) | **W1C • High-Speed Transmission Systems** (ends at 09:15) | **W1D • Transceiver Design, Characterization and Optimization** | **W1E • Next-Generation Fiber Links** (ends at 09:30) | **W1F • Multicore Fiber** |
| 10:00–17:00 | **Exhibition Hours,** *South and West Hall (Coffee Service 10:00–11:00, Booths 349, 5041)* | | | | | | |
| 10:30–12:00 | **W2A • Poster Session I,** *Petree Hall C* | | | | | | |
| 12:00–14:00 | **Lunch Break** *(on own; concessions available in Exhibit Hall)* | | | | | | |
| 12:30–14:00 | **The Journal Review Process: All You Need to Know!,** *Room 409B* | | | | | | |
| 12:30–14:00 | **Dedicated Exhibition-Only Time,** *South and West Hall* | | | | | | |
| 14:00–16:00 | **W3A • Optical Network Optimization and Scaling I** | **W3B • Coding, Modulation and DSP** | **W3C • Photonic AI Computing** | **W3D • Distributed Sensing I** (ends at 15:45) | **W3E • Laser Sources and Optical Engines for Optical Interconnection** | **W3F • Optical Signal Processing** (ends at 15:45) | **W3G • Panel: How Do We Model Novel Fiber Designs Such as SDM Fibres, Hollow-Core Fibers and Other New Fibers?** |
| 16:00–16:30 | **Coffee Beak,** *Outside Rooms 408AB, 502AB, 515AB* | | | | | | |
| 16:30–18:30 | **W4A • Optical Network Optimization and Scaling II** | **W4B • Fiber-to-Chip Coupling** | **W4C • Wireless Integrated Sensing and Communications** | **W4D • Distributed Sensing II** | **W4E • Advanced Semiconductor Laser Sources** | **W4F • High-Speed Coherent PON Systems and Enabling Technologies** | **W4G • Panel: Is the Ecosystem Ready for Multicore Fibers?** |
| 17:00–18:00 | **Network Operator Happy Hour,** *On the DL Lounge* | | | | | | |
| 17:00–19:00 | **Photonic Society of Chinese Heritage (PSC), Photonic Switching for AI Infrastructure - Architecturing the Next-Generation AI Fabric,** *Concourse F (Room 152)* | | | | | | |

| Room 502B | Room 515A | Room 515B | Room 518 |
|---|---|---|---|
| **Registration Hours,** *South Hall Lobby* | | | |
| **OFC Fun Run/Walk,** *L.A. Live Plaza, Behind JW Marriott* | | | |
| **W1G • Co-Existence of Sensing and Communication** (ends at 09:45) | **W1H • Multi-Band/ Core and Hollow Core Fiber Optical Networks** | **W1I • Optical Access Network Evolution** | **W1J • Foundations of Quantum Systems: Hardware, Protocols, and Emerging Architectures** |
| **Exhibition Hours,** *South and West Hall (Coffee Service 10:00–11:00, Booths 349, 5041)* | | | |
| **W2A • Poster Session I,** *Petree Hall C* | | | |
| **Lunch Break** *(on own; concessions available in Exhibit Hall)* | | | |
| **The Journal Review Process: All You Need to Know!,** *Room 409B* | | | |
| **Dedicated Exhibition-Only Time,** *South and West Hall* | | | |
| **W3H • Panel: The Return of TWDM-PON!** | **W3I • Symposium: Generative AI for Optical Networking I** | **W3J • Transmission Systems for Data Center Networks** (ends at 15:30) | **W3K • Quantum–Classical Coexistence and Access Networks** |
| **Coffee Beak,** *Outside Rooms 408AB, 502AB, 515AB* | | | |
| **W4H • Next-Gen Pluggables & High-Reliability DCI** | **W4I • Symposium: Generative AI for Optical Networking II** | **W4J • Ultra-High-Speed Subsystems** | **W4K • Photonic Integrated Quantum Devices: Sources, Detectors & Receivers** |
| **Network Operator Happy Hour,** *On the DL Lounge* | | | |
| **Photonic Society of Chinese Heritage (PSC), Photonic Switching for AI Infrastructure - Architecturing the Next-Generation AI Fabric,** *Concourse F (Room 152)* | | | |

| Expo Theater I | Expo Theater II | Expo Theater III |
|---|---|---|
| CISCO ACACIA | Amphenol | HL HYPERLIGHT |
| **Exhibit Hall Opens at 10:00** | | |
| **NOSK • Keynote: Evolving Transmission Networks: Towards Disaggregation and Automation**<br>10:15–10:45<br><br>**NOS1 • Realizing IP over DWDM: Benefits, Challenges and Customer Deployments**<br>10:45–12:15<br><br>**NOS2 • What's Next in Long-Haul and Carrier Networks?**<br>12:30–14:00<br><br>**MW4 • Advanced Packaging and CoPackaging for Efficient Optical Systems**<br>14:15–15:45<br><br>**SP1 Architecting the AI Network Infrastructure at Scale**<br>CISCO ACACIA<br>16:00–17:00 | **SF7 • Ethernet's Accelerating Evolution - Enabling the Expansion of AI**<br>10:30–11:30<br><br>**SF8 • 800ZR/LR and 1600ZR/ZR+/CL - Changing the Game... Again**<br>10:45–11:45<br><br>**SF9 • AIM Photonics Presents PICs, Heterogeneous Integration & Packaging for Next-Gen Integrated Photonics**<br>13:15–14:15<br><br>**Technology Showcase: Scaling the AI Data Center: Optical Technologies Redefining Data Center Interconnection**<br>LIGHTWAVE + BTR<br>14:30-15:30<br><br>**Technology Showcase: Engineering the Future of Connectivity: How Optical Technologies are Redefining Data Center Performance**<br>Amphenol<br>15:45-16:45 | **Technology Showcase: Leading the Way – Future-ready Test Strategies for PIC and CPO Manufacturing**<br>QUANTIFI PHOTONICS<br>10:45-11:15<br><br>**SP3 TFLN Photonics at the Inflection Point: Product Readiness, Manufacturing Scaling, Packaging, and Deployment**<br>HL HYPERLIGHT<br>11:30-12:30<br><br>**SF20 Bridging Silicon and Light: Innovations at the Intersection of Semiconductors and Photonics**<br>12:45 - 13:45<br><br>**SF10 • Capitalizing on Optics in 5G, 6G and Cloud RAN with Higher Data Rates and Longer Reaches**<br>14:00–15:00<br><br>**Technology Showcase: Open-Tooled Gold Box Kit for ELSFP applications: Unlocking High Power External Laser Solutions for Scalable Co-Packaged Optics**<br>HITACHI<br>15:15-15:45<br><br>**Network Operator Briefing**<br>16:00-17:00 |
| **Exhibit Hall Closes at 17:00** | | |

# Agenda of Sessions — Thursday, 19 March

| | Room 403A | Room 403B | Room 408A | Room 408B | Room 411 | Rooms 501ABC | Room 502A |
|---|---|---|---|---|---|---|---|
| 07:30–16:00 | **Registration Hours,** *South Hall Lobby* | | | | | | |
| 08:00–10:00 | **Th1A • Short Reach Optical and THz Interconnects** | **Th1B • Clock Recovery and EEPN Mitigation** | **Th1C • Data Center Subsystems** (ends at 09:45) | **Th1D • Photonics Platforms, Fabrication Methods and Low Loss Materials** | **Th1E • Terrestrial Free Space Optics** (ends at 09:45) | **Th1F • Optical Sources and Their Applications** | **Th1G • Next-Generation Optical I/O** (ends at 09:30) |
| 10:00–16:00 | **Exhibition Hours,** *South and West Hall (Coffee Service 10:00–11:00, Booths 349, 5041)* | | | | | | |
| 10:30–12:00 | **Th2A • Poster Session II,** *Petree Hall C* | | | | | | |
| 12:00–14:00 | **Lunch Break** *(on own; concessions available in Exhibit Hall)* | | | | | | |
| 12:30–14:00 | **Dedicated Exhibition-Only Time,** *South and West Hall* | | | | | | |
| 14:00–16:00 | **Th3A • Subsystems for Novel Transmission Links** | **Th3B • AI Data Center Networks** (ends at 15:15) | **Th3C • Co-packaged Optics and Advanced Packaging Techniques** (ends at 15:30) | **Th3D • Microwave Photonic Systems** | **Th3E • Access and Converged Network Architectures** | **Th3F • Photodetectors** | **Th3G • Panel: Optical Sensing as a Service on Transceiver and Fiber Systems: Catering to More than just Telecom Industry** |
| 16:00–16:30 | **Coffee Break,** *Outside Rooms 403AB, 408AB, 502AB, 515AB* | | | | | | |
| 16:30–18:30 | **Postdeadline Paper Sessions,** *Rooms 502A, 502B, 515A, 515B* | | | | | | |

| Room 502B | Room 515A | Room 515B | Room 518 |
|---|---|---|---|
| **Registration Hours,** *South Hall Lobby* | | | |
| **Th1H • Emerging Photonic Devices and Materials** | **Th1I • Security & AI-Driven Network Operation** (ends at 09:30) | **Th1J • Hollow-core Fiber Transmission System** (ends at 09:45) | **Th1K • Optimization and Virtualization in Future PONs** (ends at 09:45) |
| **Exhibition Hours,** *South and West Hall (Coffee Service 10:00–11:00, Booths 349, 5041)* | | | |
| **Th2A • Poster Session II,** *Petree Hall C* | | | |
| **Lunch Break** *(on own; concessions available in Exhibit Hall)* | | | |
| **Dedicated Exhibition-Only Time,** *South and West Hall* | | | |
| **Th3H • Programmable Photonics** | **Th3I • Special Session: Rethinking Networking Convergence from Operational Perspective: Towards a Data and AI-centric Operational Future** | **Th3J • Coherent for Data Center** | |
| **Coffee Break,** *Outside Rooms 403AB, 408AB, 502AB, 515AB* | | | |
| **Postdeadline Paper Sessions,** *Rooms 502A, 502B, 515A, 515B* | | | |

| Expo Theater I | Expo Theater II | Expo Theater III |
|---|---|---|
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| **Exhibit Hall Opens at 10:00** | | |
| **MW5 • Deployment and Architectural Challenges in Metro, Access and Mobile X-Haul**<br>10:15–11:45<br><br>**SF11 • AI Scale-up Opportunities with Short-Reach Optical Interconnects**<br>12:15–13:15<br><br>**SF12 • Fiber Broadband Progress and New Horizons**<br>13:45–14:45<br><br>**SF13 • Silicon Photonics and Co-Packaged Optics Standardized Ecosystem**<br>15:00–16:00 | **SF14 • From Access Fiber to Awareness Grid: Deploying DFOS for Security, Reliability and New Services**<br>10:30–11:30<br><br>**SF15 • Operationalizing Open XR Optics – Enabling Improved Economics in the Optical Networks**<br>12:00–11:00<br><br>**SF16 • Driving Optical Interconnect Specs for AI**<br>13:30–14:30<br><br>**SF17 • Standards Update on Multicore Fibre and the Impact of AI on Access and Transport Networks**<br>14:45–15:45 | **Technology Showcase: Designing for Density: Direct-to-Plug Liquid Cooling for Next-Generation Pluggable Optics**<br>ciena STÄUBLI<br>10:15-10:45<br><br>**Technology Showcase: Beyond SiPh, Game-changing InP Photonic Integration for Next Gen Pluggables in AI Data Centers**<br>SMART PHOTONICS<br>11:00-11:30<br><br>**SF18 • How Will Optical Interconnects Meet AI Demand?**<br>11:45–12:45<br><br>**Technology Showcase: Near-Package Optics: The Practical Path Beyond CPO**<br>LIGHTSPEED PHOTONICS<br>13:45–14:45<br><br>**SF19 • From Connectivity to Intelligence: Evolving Toward a Converged Multi-Access Optical PON Network**<br>14:30-15:30 |
| **Exhibit Hall Closes at 16:00** | | |

# Technical Program and Steering Committees

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## Subcommittees

### D-Track: Devices, Components and Fibers

**D1: Advanced Prototyping, Packaging and Integration**

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**D2: Integrated and Micro/Nanoscale Photonic Components, Circuits, and Switching Devices**

Sagi Mathai, *Hewlett Packard Labs, USA, Subcommittee Chair*
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Francesco Morichetti, *Politecnico di Milano, Italy*
Joris Van Campenhout, *IMEC, Belgium*
Laurent Vivien, *University Paris Saclay, CNRS, Centre for Nanoscience and Nanotechnology, France*
Yi-Kuei Ryan Wu, *Broadcom, USA*
Keita Yamaguchi, *NTT, Japan*
Linjie Zhou, *Shanghai Jiao Tong University, China*

**D3: Active Optoelectronic Components**

Hideyuki Nasu, *Furukawa Electric, Japan, Subcommittee Chair*
Shamsul Arafin, *The Ohio State University, USA*
Connie Chang-Hasnain, *Berxel Photonics, China*
Laura Giovane, *Broadcom, USA*
Claudia Hoessbacher, *Polariton, Switzerland*
Daniel Kuchta, *NVIDIA, USA*
Liu Liu, *Zhejiang University, China*
Nobuhiko Nishiyama, *Institute of Science Tokyo, Japan*
Jessie Rosenberg, *Lightmatter, USA*
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Wei Shi, *Université Laval, Canada*
Mizuki Shirao, *Mitsubishi Electric, Japan*
Changzheng Sun, *Tsinghua University, China*
Geert van Steenberge, *Ghent University, Belgium*
Chao Xiang, *University of Hong Kong, Hong Kong*

**D4: Fibers, Connectivity, Characterization and Propagation Physics**

Tristan Kremp, *Lightera Laboratories, USA, Subcommittee Chair*
Sidi-Ely Ahmedou, *Prysmian Group, France*
Jose Enrique Antonio-Lopez, *University of Central Florida, CREOL, USA*
Jin-Xing Cai, *SubCom, USA*
Lauren Dallachiesa, *Nokia Bell Labs, USA*
Yuki Kawaguchi, *Sumitomo Electric, Japan*
Andrey Kobyakov, *Corning, USA*
Chiara Lasagni, *Università di Parma, Italy*
Gustavo Ocampo, *Hokkaido University, Japan*
Takuya Oda, *Fujikura, Japan*
Jiajing Tu, *Jinan University, China*
Hesham Sakr, *Microsoft, UK*
Masaki Wada, *NTT, Japan*

**D5: Fiber Devices, Fiber Lasers and Amplifiers and Nonlinear Waveguides**

Vladimir Gordienko, *Aston University, UK, Subcommittee Chair*
Enkeleda Balliu, *Cobolt AB, Sweden*
Lawrence Chen, *McGill University, Canada*
Peter Dragic, *University of Illinois, USA*
Filipe Marques Ferreira, *University College of London, UK*
Victor Kopp, *Chiral Photonics, USA*
Atsushi Nakamura, *NTT, Japan*
Anna Peacock, *University of Southampton, UK*
Mark Pelusi, *AIST, Japan*
Masato Tanaka, *Sumitomo Electric Industries, Japan*
Robert Tench, *FiberTek, USA*
Kenneth Kin-Yip Wong, *University of Hong Kong, Hong Kong*
Yiwei Xie, *Zhejiang University, China*
Seongwoo Yoo, *Nanyang Technological University, Singapore*

### S-Track: Subsystems and Systems

**S1: Datacom Subsystems and Systems**

Robert Borkowski, *Nokia Bell Labs, USA, Subcommittee Chair*
Paraskevas Bakopoulos, *NVIDIA, Greece*
Fabio Bottoni, *Cisco, Italy*
Brandon Buscaino, *Ciena, USA*
Weisheng Hu, *Shanghai Jiao Tong University, China*
Jeffrey Rahn, *Meta Platforms, USA*
Nebojša Stojanović, *Huawei, Germany*
Matt Traverso, *Marvell, USA*
Shuang Yin, *Google, USA*
Xin (Scott) Yin, *Ghent University, Belgium*
Ying Zhao, *Aloe Semiconductor, USA*
Kangping Zhong, *Hong Kong Polytechnic University, Hong Kong*

**S2: Subsystems for Transmission**

David Millar, *Nokia, USA, Subcommittee Chair*
Georg Böcherer, *Huawei, Germany*
Yi Cai, *Soochow University, China*
Bin Chen, *Hefei University, China*
Stella Civelli, *CNR-IEIIT, Italy*
Christian Häger, *Chalmers University, Sweden*

Ming-Fang Huang, *NEC Labs America, USA*
Shota Ishimura, *KDDI Research, Japan*
Zhixin Liu, *University College London, UK*
Timo Pfau, *Cisco, USA*
Chen Zhu, *Bytedance, China*

**S3: Transmission Systems**

Yuta Wakayama, *KDDI Research, Japan, Subcommittee Chair*
Gabriel Charlet, *Huawei, France*
Andrea d'Amico, *NEC Laboratory America, USA*
Tobias Fehenberger, *Adtran, Germany*
Pedro Freire, *Ofcom, UK*
Boris Karanov, *Karlsruhe Institute of Technology, Germany*
Domanic Lavery, *Infinera, UK*
Ruben Soares Luis, *NICT, Japan*
Haïk Mardoyan, *Nokia Bell Labs, France*
Darli Mello, *Universidade Estadual de Campinas, Brazil*
Masanori Nakamura, *NTT Network Innovation Laboratories, Japan*
Olga Vassilieva, *1Finity Americas Inc., USA*
Deepa Venkitesh, *Indian Institute of Technology, India*
Qunbi Zhuge, *Shanghai University, China*

**S4: Fiber-Sensing and Microwave Photonics**

Tomoyuki Kato, *1Finity Inc., Japan, Subcommittee Chair*
Prince Anandarajah, *Dublin City University, Ireland*
Steinar Bjørnstad, *Tampnet AS, Norway*
Antonella Bogoni, *CNIT, Italy*
Adonis Bogris, *University of West Attica, Greece*
Thomas Clark, *Michigan State University, USA*
María Fernández-Ruiz, *Universidad de Alcalá, Spain*
Sterenn Guerrier, *Nokia Bell Labs, France*
Alan Lau, *The Hong Kong Polytechnic University, Hong Kong*
Abel Lorences-Riesgo, *Huawei, France*
Takeo Sasai, *NTT, Japan*
Siddharth Varughese, *Infinera, USA*

**S5: Next Generation Comms: Wireless Optical Communications (FSO, OWC, VLC) and Radio over Fiber (ROF)**

Katherine Newell, *Johns Hopkins University, USA, Subcommittee Chair*
Kasia Balakier, *European Space Agency (ESA), UK*
Liam Barry, *Dublin City University, Ireland*
Devin Brinkley, *X, USA*
Alberto Carrasco-Casado, *NICT, Japan*
Michael Eiselt, *Adtran, Germany*
Fernando Guiomar, *Instituto de Telecomunicacoes, Portugal*
Roberto Llorente, *University of Valencia, Spain*
Chao Lu, *The Hong Kong Polytechnic University, Hong Kong*
Boon Ooi, *King Abdullah University of Science and Technology (KAUST), Saudi Arabia*
Simon Rommel, *Eindhoven University of Technology, Netherlands*
Kevin Shortt, *Airbus, Germany*
Todd Ulmer, *MIT/LL, USA*
Xianbin Yu, *Zhejiang University, China*

## N-Track: Networks and Services

**N1: Advances in the Development of Networks, Systems and Services**

Sander Jansen, *Adtran, Germany, Subcommittee Chair*
Jean-Christophe Antona, *ASN, France*
Zahra Bakhtiari, *Microsoft, USA*
Annika Dochhan, *University of Kiel, Germany*
Md Saifuddin Faruk, *Bangor University, UK*
Carmen Mas Machuca, *Bundeswehr University Munich, Germany*
Lynn E. Nelson, *ATT, USA*
Jeremie Renaudier, *Nokia, France*
Rene Schmogrow, *Attotude, USA*
Shikui Shen, *China Unicom, China*
Yu Sun, *Google, USA*
Cen Wang, *KDDI, Japan*

**N2: Optics and Photonics for Data Center and Computing Applications**

Nikos Pleros, *Aristotle University of Thessaloniki, Greece, Subcommittee Chair*
Farshid Ashtiani, *Nokia Bell-Labs, USA*
Qixiang Cheng, *University of Cambridge, UK*
Matej Hejda, *HPE Belgium, Belgium*
Chaoran Huang, *Chinese University 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 University, USA*
Daniel Pérez-López, *iPronics, Spain*
Patty Stabile, *Technical University of Eindhoven, Netherlands*
Angelina Totovic, *Celestial AI, Greece*
Nathan Youngblood, *University of Pittsburgh, USA*

**N3: Architectures, Control and Management of Optical Networks**

Jesse Simsarian, *Nokia Bell Labs, USA, Subcommittee Chair*
Juliana de Santi, *UTFPR, Brazil*
Marija Furdek, *Chalmers Tekniska Högskola, Sweden*
Ashwin Gumaste, *Microsoft, USA*
Hiroshi Hasegawa, *Nagoya University, Japan*
Mariam Kiran, *ORNL, USA*
Yvan Pointurier, *Huawei, France*
Nicola Sambo, *Scuola Superiore Sant'Anna Pisa, Italy*
Behnam Shariati, *Fraunhofer HHI, Germany*
Massimo Tornatore, *Politecnico di Milano, Italy*
Ricard Vilalta, *CTTC, Spain*
Jiawei Zhang, *BUPT, China*

**N4: Optical Access Networks for Fixed and Mobile Services**

Paola Parolari, *Politecnico di Milano, Italy, Subcommittee Chair*
Sarvesh Sanjay Bidkar, *Nokia Bell Labs, USA*
Frank Effenberger, *Futurewei, USA*
Ryo Koma, *NTT, Japan*
Yanni Ou, *BUPT, China*
Chathurika Ranaweera, *Deakin University, Australia*
Lihua Ruan, *Peng Cheng Lab, China*
Gaël Simon, *Orange Labs, France*
Anna Tzanakaki, *National and Kapodistrian University of Athens, Greece*
Luca Valcarenghi, *Scuola Superiore Sant'Anna, Italy*
Haipeng Zhang, *CableLabs, USA*
Jim Zou, *Adtran Networks SE, Germany*

**N5: Market Watch, Network Operator Summit and Data Center Summit (Invited Program Only)**

Yoshiaki Sone, *NTT, Japan, Subcommittee Chair*
Balagangadhar Bathula, *AT&T, USA*
Vipul Bhatt, *Coherent, USA*
Tim Doiron, *Infinera, USA*
Christian Ilmi, *Ligent, USA*
Di Liang, *University of Michigan, USA*
Anuj Malik, *Cisco, USA*
Stephan Neidlinger, *Adtran, Germany*

Kumi Omori, *NEC, Japan*
Francesca Parmigiani, *Microsoft, UK*
Fabienne Saliou, *Orange, France*
Atul Srivastava, *NTT, USA*
Naoki Suzuki, *Mitsubishi, Japan*

## SC-Q: Quantum Devices, Systems and Networking

Andrew Lord, *BT, UK, Subcommittee Chair*
Obada Alia, *JP Morgan Chase, Singapore*
Davide Bacco, *Universita degli Studi di Firenze, Italy*
Yuan Cao, *Nanjing University of Post and Communication, China*
Virginia D'Auria, *Université* Côte d'Azur, France
Tobias Gehring, *DTU, Denmark*
Jun Gao, *KTH, Sweden*
Natalia Herrera Valencia, *Heriot Watt University, UK*
Hannes Hübel, *AIT, Austria*
Greg Kanter, *NuCrypt, USA*
Rui Lin, *Chalmers Tekniska Högskola, Sweden*
Mehdi Namazi, *Qunnect, USA*
Reza Nejabati, *Cisco, USA*
Taofiq Paraiso, *Toshiba Europé, UK*
Li Qian, *University of Toronto, Canada*
Lai Zhou, *Beijing Academy of Quantum Information Sciences, China*

## Demo Zone

Michela Svaluto Moreolo, *CTTC, Spain, Subcommittee Chair*
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## Room 403A

**08:00–09:45**
**M1A • Data Center Interconnection**
*Presider: Jesse Simsarian; Nokia Bell Labs, USA*

**M1A.1 • 08:00**
**Logical Topology Adaptation in DCI/DCX-Embedded Multi-Granularity Routing Layered Optical Networks,** Hayato Yuasa[1], Takuma Kuno[1], Yojiro Mori[2,1], Shih-Chun Lin[3], Motoharu Matsuura[4], Suresh Subramaniam[5], Wakako Maeda[6], Shigeyuki Yanagimachi[6], Hiroshi Hasegawa[1]; *[1]Nagoya Univ., Japan; [2]Toyota Technological Inst., Japan; [3]NC State Univ., USA; [4]Univ. of Electro-Communications, Japan; [5]The George Washington Univ., USA; [6]NEC Corp., Japan*. Novel dynamic optical networks with coarse-granularity routing bypass are proposed. The networks can successfully adapt to dynamic traffic variation in embedded DCI/DCX through periodic bypass reconfiguration and exhibit smaller capacity deterioration than conventional alternatives.

**M1A.2 • 08:15**
**Straggler-Avoiding Scheduling: How P2MP Optical Networks Accelerate Geo-Distributed LLM Training,** Bohan Fu[1], Meihan Wu[1], Binjun Tang[1], Ruoxing Li[1], Xiaoliang Chen[1], Zuqing Zhu[1]; *[1]Univ. of Science and Technology of China, China*. We propose a straggler-avoiding job scheduling algorithm for accelerating the geo-distributed LLM training across data-centers interconnected by a P2MP optical network. Simulation results show our proposal prevails the baselines by achieving up to 34.6% and 16.7% reductions in training time and GPU utilization, respectively.

## Room 403B

**08:00–10:00**
**M1B • Datacenter WDM and Comb**
*Presider: Brandon Buscaino, Ciena Corportation, USA*

**M1B.1 • 08:00**
**9dB Link Margin Gain Using a Quantum Dot SOA in an 8-Wavelength DWDM 50Gbps NRZ CPO Link,** Alexander J. Sludds[1], Srinivasan A. Srinivasan[1], Aly Elrefaie[1], Mazin Alalusi[1], Ian Macfarlane[1], Dominic Goodwill[1], Joyce Poon[1], Darius Bunandar[1], Jessie Rosenberg[1]; *[1]Lightmatter, USA*. We report using a quantum dot SOA in an 8-wavelength 50Gb/s NRZ DWDM CPO link to reduce the transmit power by 9dB. With the 8-wavelength spaced at 400GHz, the SOA link penalty was 2.0dB

**M1B.2 • 08:15**
**An 8×256 Gbps DWDM Silicon Photonic Microring Transmitter Using a 200 GHz Spaced Quantum-Dot Comb Laser,** xianglin bu[1,2], Shujie Pan[3,4], Jintao Xue[1,2], Shenlei Bao[1,2], Junjie Yang[4], Chao Cheng[1,2], Wenfu Zhang[1,2], Siming Chen[3,5], Binhao Wang[1,2]; *[1]State Key Laboratory of Ultrafast Optical Science and Technology, Xi'an Inst. of Optics and Precision Mechanics, Chinese Academy of Sciences, China; [2]Univ. of Chinese Academy of Sciences, China; [3]Laboratory of Solid State Optoelectronics Information Technology, Inst. of Semiconductors, Chinese Academy of Sciences, China; [4]HS Photonics Co., Ltd., Xiangjiang Science & Technology Innovation Base, China; [5]College of Materials Science and Opto-Electronic Technology, Univ. of Chinese Academy of Science, China*. We demonstrate a DWDM silicon photonic transmitter enabled by a quantum-dot mode-locked laser with 200 GHz channel spacing, achieving 8×256 Gbps data transmission using microring modulators with 73 GHz bandwidth.

## Room 408A

**08:00–09:30**
**M1C • SDM and Multiband Transmission Systems**
*Presider: Darli Mello; UNICAMP, Brazil*

**M1C.1 • 08:00** Invited
**Multiband Transmission Supported by Wavelength Conversion and Parametric Amplification,** Shimpei Shimizu[1], Kosuke Kimura[1], Akira Kawai[1], Masashi Abe[2], Shunya Konno[2], Takushi Kazama[2], Koji Enbutsu[2], Takahiro Kashiwazaki[2], Megumi Hoshi[1], Masanori Nakamura[1], Fukutaro Hamaoka[1], Takeshi Umeki[2], Takayuki Kobayashi[1], Yutaka Miyamoto[1]; *[1]Network Innovation Laboratories, NTT, Inc., Japan; [2]Device Technology Laboratories, NTT, Inc., Japan*. We present ultra-wideband long-haul transmission systems based on waveband conversion using PPLN-based optical parametric amplifiers and the WDM-bandwidth extension to extremely long wavelengths up to 1702 nm by effectively utilizing inter-channel stimulated Raman scattering.

## Room 408B

**08:00–09:30**
**M1D • LiDAR Systems and Narrow Linewidth Lasers**
*Presider: Sudip Shekhar; Univ. of British Columbia, Canada*

**M1D.1 • 08:00**
**Highly Accurate Range Acquisition for FMCW LiDAR With Optimized Resampling and Maximum Likelihood Estimation,** Ying Lu[1], Jun Zhou[1], Ruiqiong Yang[1], Ning Cheng[1], Xuezhe Zheng[1]; *[1]InnoLight Technology (Suzhou) Ltd., China*. We proposed a hybrid signal processing technique that combines resampling with maximum likelihood estimation (MLE) for FMCW LiDAR. 150m ranging experiment achieved 3.25cm accuracy using a compact 5m auxiliary interferometer.

**M1D.2 • 08:15**
**High-Linearity Directly-Modulated DFB Laser for Pre-Distortion-Free FMCW LiDAR,** Zhangdi Chen[1,2], Phillippe Pagnod-Rossiaux[1], Victor Rodrigues[1], Candice Blin[1], Martine Thebault[1], Angelo Vanga[1], Kamelya Bougueroua[1], Guang-Hua Duan[1], Andreas Kohl[1], Frédéric Grillot[2,3], Nicolas Chimot[1]; *[1]3SP Technologies SAS, France; [2]LTCI, Telecom Paris, France; [3]Center for Optics, Photonics and Lasers, Universite Laval, Canada*. A high-linearity two-section DFB laser which enables pre-distortion-free FMCW LiDAR with a nonlinearity of 0.65% (up-ramp) and 0.28% (down-ramp) is demonstrated. 0.05 m ranging accuracy and 0.7 km/h velocity accuracy are achieved.

## Room 411

**08:00–09:30**
**M1E • Optical Signal Processing, Filtering, and Mode Division Multiplexing**
*Presider: Duanni Huang; Intel Corporation, USA*

**M1E.1 • 08:00**
**Super Linewidth Broadening Based on Heater-Free Mach–Zehnder-Interferometer-Coupled Microring Resonator,** Wenju Li[1,2], Hanghang Li[1,2], Haodong Yang[1,2], Yizheng Chen[1,2], Zhuang Fan[1,2], Xiaolong Fan[1,2], Wenchan Dong[1,2], Jing Xu[1,2], Xinliang Zhang[1,2]; *[1]Huazhong Univ. of Science and Technology, China; [2]Wuhan National Laboratory of Optoelectronics, China*. This work demonstrates super linewidth broadening in a high-Q micro-resonator coupled to a Mach-Zehnder interferometer, achieving a bandwidth of 110 GHz that occupies over two-thirds of the cavity free-spectral range, significantly improving spectral utilization.

**M1E.2 • 08:15**
**Silicon Flat-Top MZI Based O-Band CWDM (De)Multiplexer With Arbitrary Coupling Ratio MMI Couplers,** Zakriya Mohammed[1], Mayank Raj[1], Chuan Xie[1], Ali Dorche[1], Ari Novack[1], Matthew Streshinsky[1], Parag Upadhyaya[1], Yohan Frans[1]; *[1]Advanced Micro Devices Inc, USA*. A fully MMI-based CWDM (de)multiplexer fabricated in CMOS process demonstrates crosstalk below –20 dB and 16 nm 1-dB bandwidth. Flat-top response is achieved using multistage MZI filters engineered to different MMIs phase and coupling characteristics.

## Room 501ABC

**08:00–10:00**
**M1F • Advances in High-Speed Direct-Detection PON**
*Presider: Frank Effenberger; Futurewei Technologies Inc, USA*

**M1F.1 • 08:00**
**Improving 50G-PON Performances Exploiting Self-Phase Modulation and Chromatic Dispersion,** Brendan Torillec[2,1], Gaël Simon[2], Jérémy Potet[2], Fabienne Saliou[2], Monique Thual[1], Laurent Bramerie[1], Pascal Scalart[3], Michel Joindot[1], Philippe Chanclou[2]; *[1]Institut Fonctions Optiques pour les Technologies de l'Information, France; [2]Orange Innovation, France; [3]Institut de Recherche en Informatique et Systemes Aleatoires, France*. 50G-PONs downstream sensitivity is enhanced thanks to the interaction between Self-Phase Modulation and Chromatic Dispersion phenomena. Relative gains of 2.3 dB and 3.7 dB are measured with and without signal processing at receiver side.

**M1F.2 • 08:15**
**Long Short-Term Memory Based Signal Recovery in Flexible VHSP Downstream Using 25 G-Class Optoelectronic Devices,** Liyan Wu[1], Yanni Ou[1], Yanlu Huang[1], Kai Jin[1], Shangya Han[1], Mingyang Guo[1], Kun Xu[1]; *[1]Beijing Univ. of Posts and Telecommunications, China*. We propose enhanced LSTM-based signal recovery for flexible downstream PON with 25G-class devices. Experimental results indicate an optical power budget of 20.2dB and a record net bit rate >202Gb/s in bandwidth-limited 240Gb/s direct-detection transmission @2E-2.

## Room 502A

**08:00–10:00**
**M1G • Optical Computing**
*Presider: Chaoran Huang; Chinese Univ. of Hong Kong, Hong Kong*

**M1G.1 • 08:00** Invited
**In-Memory Computing With Photonics,** Bowei Dong[1]; [1]*A*STAR Research Entities, Singapore.* We will discuss what is photonic in-memory computing, how photonic memory function is enabled and integrated into conventional silicon photonics, how photonic circuits with memory functions are designed and operated to realize in-memory computing. We will also discuss the limitations and provide an outlook on photonic in-memory computing.

## Room 502B

**08:00–10:00**
**M1H • High Speed Coherent FSO**
*Presider: Fernando Guiomar; Universidade de Aveiro, Portugal*

**M1H.1 • 08:00**
**Over-3-Tb/s/λ Free-Space MIMO Transmission Under Diffraction with Geometric Mode-Division Multiplexing,** Akira Kawai[1], Shimpei Shimizu[1], Katsuaki Higashimori[1], Kohki Shibahara[1], Megumi Hoshi[1], Masanori Nakamura[1], Kazumitsu Sakamoto[1], Yosuke Fujino[1], Takayuki Kobayashi[1], Yutaka Miyamoto[1]; [1]*NTT, Inc., Japan.* We propose geometric mode-division multiplexing (GMDM) to overcome diffraction-induced limitations in mode-division-multiplexed FSO links. Using a multi-aperture single-mode transmitter, we demonstrate 140-Gbaud, three-mode, single-wavelength transmission, achieving up to net 3.6 Tb/s under diffraction.

**M1H.2 • 08:15** ★ Top-Scored
**Coherent Free-Space Optical Communications with Concurrent Turbulence Characterization in a Terrestrial Urban Link,** Vincent van Vliet[1], Menno van den Hout[1], Kadir Gümüs[1], Eduward Tangdiongga[1], Chigo Okonkwo[1]; [1]*Technische Universiteit Eindhoven, Netherlands.* We present a 19-day joint measurement of optical turbulence and coherent data communications over a 4.6 km urban FSO link, providing empirical insights into turbulence effects on the performance of fiber-coupled coherent communication systems.

## Room 515A

**08:00–09:45**
**M1I • DAS for Geoscience and Emerging Applicaions**
*Presider: Adonis Bogris, Greece*

**M1I.1 • 08:00** Invited
**Fiber-Optic Sensing for Cryosphere Research,** Andreas Fichtner[1], Fabian Walter[2], Thomas Hundson[1], Ariane Lanteri[1]; [1]*ETH Zurich, Switzerland;* [2]*Swiss Federal Research Inst. WSL, Switzerland.* Fiber-optic sensing constrains structure and processes of the icy parts of the Earth – the cryosphere. We summarize our long-term efforts and provide examples where fiber-optic sensing has led to fundamental new insights.

## Room 515B

**08:00–09:45**
**M1J • Hollow-Core Fiber Fabrication and Connectivity**
*Presider: Tristan Kremp; Lightera, USA*

**M1J.1 • 08:00** ★ Top-Scored
**Inline Measurement and Automated Feedback Control of Hollow Core Fiber Microstructure,** Leonard Budd[1], Seyed Reza Sandoghchi[2], Gregory Payne[2], Giorgio Maltese[2], Ali Shakiba[1], Bence Mocsai[2], Clinton Chris-Mba[2], Apostolos Zdagkas[2], Matt Williams[2], Naveen K. Baddela[1], Jaroslaw Rzegocki[1], Gregory Jasion[1], Rosdi Hassan[2], Austin Taranta[1], Eric Rodrigue Numkam Fokoua[2], Francesco Poletti[1,2]; [1]*Univ. of Southampton Optoelectronics Research Centre, UK;* [2]*Microsoft Azure Fiber, UK.* We report a method for non-destructively measuring DNANF hollow core fiber microstructure during fabrication. We combine this with a feedback loop to control the structure and fabricate a 20 km structurally uniform, low-loss DNANF.

**M1J.2 • 08:15**
**Impact of Higher-Order Modes on Mode Field Diameter Measurement in Hollow-Core Fibres,** hongmin Li[1]; [1]*State KeyLaboratory of Optical fibre and Cable Manufacture Technology, Yangtze Optical Fibre and Cable Joint Stock Ltd Co, China.* We systematically investigate the influence of higher-order modes on the mode field diameter measurement of hollow-core fibres using the $S^2$ technique. The effects of various experimental conditions such as the coupling pigtail, alignment condition, fibre configuration, and fibre end-face rotate are examined in detail.

## Room 518

**08:00–10:00**
**M1K • Advances in Continuous-Variable QKD Systems and Processing**
*Presider: Robert Woodward, Toshiba Europe Ltd-Cambridge Research, UK*

**M1K.1 • 08:00**
**Continuous-Variable Quantum Key Distribution Using Secure Multiple-Input Multiple-Output Algorithm,** Lu Fan[1], Xuesong Xu[1], Tianyu Zhang[1], Song Yu[1], Yichen Zhang[1]; [1]*Beijing Univ. of Posts and Telecommunications, China.* We report the security modeling for dynamic multiple-input multiple-output algorithms used in continuous-variable quantum key distribution, achieving a secret key rate of 49.77 Mbps over the 15km fiber link.

**M1K.2 • 08:15**
**538 Mb/s Integrated Continuous-Variable Quantum Key Distribution System,** Axl Bomhals[3], Adnan A. Hajomer[1], Cédric Bruynsteen[3], Aboobackkar Sidhique[3], Olena Kovalenko[2], Ivan Derkach[2], Vladyslav C. Usenko[2], Ulrik L. Andersen[1], Tobias Gehring[1], Xin Yin[3]; [1]*Department of Physics, Danmarks Tekniske Universitet, Denmark;* [2]*Department of Optics, Univerzita Palackeho v Olomouci Prirodovedecka fakulta, Czechia;* [3]*IDLab, Ghent Univ.-imec, Belgium.* We demonstrate a spectrally efficient 10 GBaud continuous-variable quantum key distribution (CVQKD) system with fully photonic-integrated transmitter and receiver, achieving a high asymptotic secret key rate of 538 Mb/s over a 10 km fiber link.

## Room 403A

### M1A • Data Center Interconnection—Continued

**M1A.3 • 08:30** ★ Top-Scored

**Field Experiments on Frame-Based Delay Measurement Using OpenZR+ Pluggable Transceivers: Enabling Latency-Managed IP-Over-DWDM for Data Center Interconnects,** Sae Kojima[1], Kazuya Anazawa[1], Hiroyuki Ishihara[1], Toru Mano[1], Hideki Nishizawa[1], Dmitrii Briantcev[2], Daniel C. Kilper[2], Marco Ruffini[2], Yoshiaki Sone[1], Koichi Takasugi[1]; *[1]NTT, Inc., Japan; [2]School of Computer Science and Statistics and School of Engineering, CONNECT Centre, Trinity College Dublin, Ireland.* We experimentally verified an in-service frame-based delay measurement method using OpenZR+ transceivers, enabling latency-managed IP-over-DWDM for datacenter interconnects with precision comparable to OTN and OTDR.

**M1A.4 • 08:45** Tutorial

**Convergence of Optical Networks and Computing: the Potential of Smart NICs With Pluggable Optics,** Filippo Cugini[1], Rana Abu Bakar[1], Francesco Paolucci[1], Juan J. Vegas Olmos[3], Andrea Sgambelluri[2], Piero Castoldi[2]; *[1]CNIT, Italy; [2]Scuola Superiore Sant'Anna, Italy; [3]NVIDIA, Denmark.* Advances in long-reach pluggable optics and programmable SmartNICs create new potential for tightly integrated optical–compute architectures. This paper reviews emerging research showing how such convergence reduces latency, boosts energy efficiency, and enables high-performance Telco architectures.

## Room 403B

### M1B • Datacenter WDM and Comb—Continued

**M1B.3 • 08:30**

**Super-Channel Transmission with Ultra-Compact Microring Modulators Achieving Net 612.9 Gbps per Polarization,** Erwan Weckenmann[1], Arman Safarnejadian[1], Alireza Geravand[1], Jean-Michel Vallée[1], Zibo Zheng[1], Simon Levasseur[1], Ming Zeng[1], Leslie Rusch[1], Wei Shi[1]; *[1]Université Laval, Canada.* We demonstrate the first Nyquist super-channel transmission using silicon microring-based I/Q modulators. A net bit rate of 612.9 Gbps per polarization is achieved back-to-back and exceeds 500 Gbps after 20 km using two wavelength sub-carriers.

**M1B.4 • 08:45**

**Bidirectional Full C-Band Transmission Over Hollow-Core Cable Using 400G ZR,** Yang Hong[1], Abdallah Ali[1], Morteza Kamalian-Kopae[1], Shahab Bakhtiari Gorajoobi[1], James Hooley[1], Colin Wallace[1], Jamie Gaudette[1], David Richardson[1], Benjamin J. Puttnam[1]; *[1]Microsoft, UK.* We report on bidirectional 64×400G C-band transmission over 107.5-km field-deployable HCF cable using 400G ZR and 34.5-dBm high-power amplifiers, demonstrating comparable transmission performance to measurements with unidirectional HCF and bidirectional back-to-back with equivalent loss links.

## Room 408A

### M1C • SDM and Multiband Transmission Systems—Continued

**M1C.2 • 08:30**

**Petabit-per-Second C+L Band Transmission Over a Field-Deployed 15-Mode Fiber Link,** Giammarco Di Sciullo[1,2], Ruben S. Luis[3], Menno van den Hout[4], Qi Wu[1], Pierre Sillard[5], Frank Achten[5], Robert Emmerich[6], Nicolas Braig-Christophersen[6], Benjamin J. Puttnam[3], Divya Shaji[1,2], Lucas Zischler[1,2], Andrea Marotta[1,2], Fabio Graziosi[1,2], Chiara Lasagni[7,2], Paolo Serena[7,2], Alberto Bononi[7,2], Georg Rademacher[8], Chigo Okonkwo[4], Colja Schubert[6], Ronald Freund[6], Jun Sakaguchi[3], Antonio Mecozzi[1,2], Hideaki Furukawa[3], Cristian Antonelli[1,2]; *[1]Universita degli Studi dell'Aquila, Italy; [2]CNIT National Laboratory of Advanced Optical Fibers for Photonics, Italy; [3]Kokuritsu Kenkyu Kaihatsu Hojin Joho Tsushin Kenkyu Kiko, Japan; [4]Technische Universiteit Eindhoven, Netherlands; [5]Prysmian, France; [6]Fraunhofer-Institut fur Nachrichtentechnik Heinrich-Hertz-Institut HHI, Germany; [7]Universita degli Studi di Parma, Italy; [8]Universitat Stuttgart, Germany.* We demonstrate the first C+L band transmission over a field-deployed 6.1 km-long 15-mode fiber, achieving a record decoded throughput of 1.06 Pb/s. This marks the first petabit-per-second-class transmission over any field-deployed fiber.

**M1C.3 • 08:45**

**Mode Loss Impact on Transmission Over a 15-Mode Multi-Mode Fiber Point-to-Point Link,** Stefano Gaiani[1,2], Besma Kalla[1,3], Ruben S. Luis[1], Daniele Orsuti[1], Menno van den Hout[3], Pierre Sillard[4], Thomas Bradley[3], Chigo Okonkwo[3], Paola Parolari[2], Alberto Gatto[2], Pierpaolo Boffi[2], Hideaki Furukawa[1]; *[1]National Inst. of Information and Communication Technology (NICT), Japan; [2]Politecnico di Milano, Italy; [3]Technische Universiteit Eindhoven, Netherlands; [4]Prysmian Group, France.* We evaluate the impact of failure-induced mode loss in a 15-mode MMF link. We show throughput penalties below 7% for transmitter-side failures, and between 10% and 39%, depending on the lost mode, for receiver-side failures.

## Room 408B

### M1D • LiDAR Systems and Narrow Linewidth Lasers—Continued

**M1D.3 • 08:30**

**Silicon Nitride LiDAR Chip With Minimal Back-Reflection for Timing Jitter Compensation,** Guan-Jie Huang[1], Chueh-Yu Chen[1], Wan-Chun Lin[1], Shih-Hsiang Hsu[1]; *[1]National Taiwan Univ of Science & Tech, Taiwan.* In the swept-source nonlinear correction implemented with the silicon-nitride-based LiDAR's auxiliary interferometer, degradation arising from strong reflections in the multimode interference region was effectively mitigated for 20-meter ranging by employing silicon-dioxide-based couplers exhibiting minimal back-reflection.

**M1D.4 • 08:45**

**Wafer-Scale Heterogeneously Integrated Self-Injection-Locked Lasers,** Igor Kudelin[1], Bowen Song[1], Kaustubh Asawa[1], Boqiang Shen[1], Yang Shen[1], Ali Dorche[1], Joel Guo[1], Jonathan Peters[1], Glenn Kim[1], Nathan Kim[1], Catherine Nguyen[1], Theodore Morin[1], Zeyu Zhang[1], Chong Zhang[1], Tin Komljenovic[1], Minh Tran[1]; *[1]Nexus Photonics, Inc, USA.* We present advances in the silicon nitride heterogeneous laser platform at telecom wavelengths and exploit multi-layer SiN in compact footprint to demonstrate narrow-linewidth, self-injection-locked lasers across 100-mm wafers with high yield suitable for mass production.

## Room 411

### M1E • Optical Signal Processing, Filtering, and Mode Division Multiplexing—Continued

**M1E.3 • 08:30**

**Silicon Photonic Integrated Polarization Synthesizer,** Yifan Zeng[1], Zhaoyu Lu[1], Senlin Zhang[1], Rui Zhu[1], Yang Chen[1], Yunchu Yu[1], Xingyu Zhang[1], Ke Zhang[1]; *[1]Silith Technology, Singapore.* This work presents an integrated polarization synthesizer on a silicon photonics platform. The single chip integrates full functionalities of detection, generation, tracking, and scrambling of optical polarization states, achieving a compact design and commercial-grade performance.

**M1E.4 • 08:45**

**On-Chip Programmable MZI-Based Fourier Synthesizer for Ultra-Broadband Kerr-Comb Equalization,** Songli Wang[1], Michael Cullen[1], Tobias Zypman[1], Swarnava S. Sanyal[1], Karl J. McNulty[1], Yuyang Wang[1,2], Xiang Meng[1], Michal Lipson[1], Alexander L. Gaeta[1], Keren Bergman[1]; *[1]Columbia Univ., USA; [2]Univ. of Connecticut, USA.* We equalize non-uniform Kerr comb line power using a single-chip programmable multi-arm MZI filter that synthesizes arbitrary passbands, and experiments show a path to lower DWDM receiver dynamic-range requirements by ≥ 16dB.

## Room 501ABC

### M1F • Advances in High-Speed Direct-Detection PON—Continued

**M1F.3 • 08:30**

**Real-Time 200G-PON US Transmission Over 20 km With Class D OPL and Quadruple PON Coexistence,** Joseph Zandueta[1,2], Fabienne Saliou[2], Dylan Chevalier[1,2], Georges Gaillard[2], Jérémy Potet[2], Gaël Simon[2], Laurent Bramerie[1], Philippe Chanclou[2], Monique Thual[1]; *[1]UMR 6082, Institut Fonctions Optiques pour les Technologies de l'Information, France; [2]Orange Research, France.* We experimentally demonstrate 200G-PON upstream (burst-mode) transmission over 20 km using 4×50 Gb/s Non-Return to Zero On-Off Keying (NRZ-OOK) channels, achieving Class D Optical Path Loss (OPL) and quadruple coexistence with legacy Passive Optical Networks (PONs).

**M1F.4 • 08:45**

**Variable Distance Digital CD Pre-Comp for 100G/λ C-Band IM-DD PON Including Common Broadcasted Header,** Hanane Kharbich[1], Giuseppe Rizzelli[1], Ivan Cano[2], Giuseppe Talli[2], Yanzhao Lu[3], Roberto Gaudino[1]; *[1]Politecnico di Torino, Italy; [2]Huawei Technologies Duesseldorf GmbH, Germany; [3]Huawei Technologies Co Ltd, China.* We extend our previous works on downstream 100G/λ C-band IM-DD PON using slot-by-slot CD precompensation by experimentally demonstrating a novel solution for supporting 0-20 km differential distance including a common header field.

## Room 502A

### M1G • Optical Computing—Continued

**M1G.2 • 08:30** ★ Top-Scored
**A Zero-Electrical-Power Silicon Photonic Ternary Content Addressable Memory Bank,** Stelios Simos[1], Theodoros Moschos[1], Stefanos Kovaios[1], Apostolos Tsakyridis[1], Miltiadis Moralis-Pegios[1], Isaac Johnson[2], Theo Rangarajan[2], Thalia-Dominguez Bucio[2], James Gates[2], Frederic Gardes[2], Nikos Pleros[1]; [1]*Aristoteleio Panepistimio Thessalonikis, Greece;* [2]*Univ. of Southampton, UK*. We demonstrate a silicon photonic 4x9 WDM ternary content addressable memory bank, that consumes zero-electrical power. Successful TCAM operation for 2-bit optical words at 20 Gb/s is experimentally presented.

**M1G.3 • 08:45**
**A Non-Volatile Heterogeneous Quantum Dot III-v/Si DFB Laser with Optical Memristive Behavior,** Stanley Cheung[2,1], Bassem Tossoun[1], Di Liang[3], Yuan Yuan[4], Yingtao Hu[1], Yiwei Peng[1], Geza Kurczveil[1], Raymond G. Beausoleil[1]; [1]*Hewlett Packard Labs, USA;* [2]*Electrical and Computer Engineering, NC State Univ., USA;* [3]*Electrical and Computer Engineering, Univ. of Michigan, USA;* [4]*Electrical Engineering, Northeastern Univ., USA*. We demonstrate non-volatile wavelength tuning (~ 46 pm) in quantum dot III-V/Si DFB lasers with the use of embedded $Al_2O_3$ memristors. This provides new opportunities for photonic memory application in non-volatile photonic systems.

## Room 502B

### M1H • High Speed Coherent FSO—Continued

**M1H.3 • 08:30**
**Field Demonstration of an SDN-Enabled 0.48 Tb/s Hybrid Coherent/IM-DD 0.75 km FSO/Fiber System,** Evrydiki Kyriazi[1], Panagiotis Toumasis[1], Argyris Ntanos[1], Aristeidis Stathis[1], Panagiotis Kourelias[1], Nikolaos Makris[2], Persefoni Konteli[2], Alkinoos Papageorgopoulos[2], George Kanellos[2], Dimitris Apostolopoulos[1], Hercules Avramopoulos[1], Giannis Giannoulis[1]; [1]*National Technical Univ. of Athens, Greece;* [2]*NKUA, Greece*. We experimentally demonstrate a hybrid coherent/IM-DD system enabling real-time reconfiguration of format, baud rate, wavelength, and path between fiber and 0.75 km FSO links, achieving 0.48 Tb/s, error-free operation, and sub-millisecond switching for resilient next-generation optical access networks.

**M1H.4 • 08:45** Invited
**Latest Development of High-Capacity Coherent FSO Systems for Terrestrial and Satellite Applications,** Marco A. Fernandes, Paulo P. Monteiro, Fernando P. Guiomar[1]; [1]*Instituto de Telecomunicacoes de Aveiro Portugal*. From inside-the-house to the satellite links, in this paper we show how Free-Space Optics (FSO) is paving the way for multi-terabit wireless communications, experimentally overcoming link alignment, challenging atmospheric conditions, and the Doppler effect in Ground-to-Earth links.

## Room 515A

### M1I • DAS for Geoscience and Emerging Applicaions—Continued

**M1I.2 • 08:30**
**Fiber Layout Inference via Environmental Acoustic Noise Similarity: a Field Trial,** Pedro Tovar[1], Zhiping Jiang[1], Yan Zhao[2], Zeyu Li[2], Zhenpeng Zhou[2]; [1]*Huawei Technologies Canada Co., Ltd., Canada;* [2]*Huawei Technologies Co Ltd, China*. This work presents the first field trial using DAS to map fiber layout without intentionally induced vibration. Key layout points could be identified by analyzing the similarity of ambient noise vibrations along the fiber cable.

**M1I.3 • 08:45**
**Near-Field Source Localization in Optical Fiber DAS With SSWF Signal Enhancement,** Yuhao Mei[1,2], Boyu Tan[1,2], Shuolong Zhu[1,2], Geng Chen[1,2], Hao Li[1,2], Zhijun Yan[1,2], Qizhen Sun[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, Huazhong Univ. of Science and Technology, China*. We propose an U-IoT sensing network based on Fiber-Optic DAS, with SSWF enhancing signals and array network enabling near-field localization. Experiments show 6.3 dB SNR improvement, as well as MVDR localization achieves 0.08 m and 5.04° errors.

## Room 515B

### M1J • Hollow-Core Fiber Fabrication and Connectivity—Continued

**M1J.3 • 08:30** Invited
**High-Performance Fusion Splicing Technique for Anti-Resonant Hollow-Core Fiber,** Songnian Fu[1], Cong Zhang[1], Yuwen Qin[1]; [1]*Guangdong Univ. of Technology, China*. Anti-resonant hollow-core fiber (AR-HCF) with low attenuation, low latency, and low nonlinearity undergoes rapid progress with field deployment. This paper elaborates on the AR-HCF fusion splicing technology and discusses its challenges and possible solutions.

## Room 518

### M1K • Advances in Continuous-Variable QKD Systems and Processing—Continued

**M1K.3 • 08:30**
**Simple Software-Defined Polarization-Diversity CV-QKD Heterodyne Receiver,** Samael Sarmiento-Hernández[1], Jeison Tabares[1], Sebastian Etcheverry[1]; [1]*LuxQuanta, Spain*. We present a CV-QKD heterodyne receiver with simple architecture based on 3×3 beam splitter and software-defined polarization diversity

**M1K.4 • 08:45**
**Demonstration of a Hybrid Free-Space/Fiber CV-QKD System for Bridging the Last-Mile Gap,** Tetsuo Kawakami[1], Tomoki Terasaki[1], Seigo Takahashi[1], Hiroki Kawahara[1], Toshihiko Okamura[1], Nato Ishii[1]; [1]*Nihon Denki Kabushiki Kaisha, Japan*. We demonstrate the feasibility of a hybrid CV-QKD system, which combines a 250m free-space optical channel with a 10km DWDM fiber channel. We reveal that the proposed system can be applied to metropolitan area networks.

## Room 403A

### M1A • Data Center Interconnection—Continued

Filippo Cugini is Head of Research Sector at CNIT, Pisa, Italy. His research interests include packet-optical infrastructures, network programmability, security and edge AI. He served as Coordinator of the EU-funded project SEASON (self-managed Sustainable high-capacity Optical Networks). He is co-author of 14 patents and >300 international publications.

## Room 403B

### M1B • Datacenter WDM and Comb—Continued

**M1B.5 • 09:00**
**2x30.4Tb/s Bidirectional 60.85-km Long Data Center Interconnect Using Low Loss Hollow Core Fiber and 800G ZR OSFP Modules,** Arnaud Dupas[1], Carina Castineiras[1], Haik Mardoyan[1], Peng Li[2], Lei Zhang[2], Jie Luo[2], Chengpeng Fu[3], Chifeng Hu[3], oriol bertran[1], abdelali el imadi[1], naseredin aramnejad[1], vishal gadiya[1], Jeremie Renaudier[1]; [1]*Nokia Corporation, France;* [2]*Yangtze Optical Fibre and Cable Joint Stock Ltd Co, China;* [3]*Accelink Technology Co Ltd, China.* We report on the bidirectional DCI transmission of 800G ZR channels over 60.85 km of Hollow Core Fiber achieving 2x30.4 Tb/s total throughput. We also show successful transmission over 121.7 km using high power amplifier.

**M1B.6 • 09:15**
**20.2Pb/s C+L-Band Wavelength Reconfigurable Real-Time Optical Network Applied in Inter Data-Center Transmission With 316 Switching Channels,** Linbojie Huang[1], Peng Sun[1], Longquan Dai[1], Juan Wu[1], Min Lin[1], Shijia Yan[1], Shangcheng Wang[1], Honglin Ji[1], Zichen Liu[1], Xu Zhang[1], Chao Li[1], Zhixue He[1], Shaohua Yu[1]; [1]*Pengcheng Laboratory, China.* We demonstrate a wavelength reconfigurable optical network node by utilizing a self-developed OXC equipment and commercial 800G real-time optical transceiver, achieving 20.2Pb/s switching capacity record with 316 channels over 6.2km hollow-core nested anti-resonant nodeless fiber.

## Room 408A

### M1C • SDM and Multiband Transmission Systems—Continued

**M1C.4 • 09:00**
**Broadband Long-Haul Weakly-Coupled 3-LP-Mode FMF Transmission Only Using Single-Mode Transceivers,** Chengbin Long[1,3], Gang Qiao[1], Yuyang Gao[2], Jiarui Zhang[1], Jian Cui[4], Siyuan Liu[1], Baolong Zhu[1], Wei Chen[1], Lei Shen[5], Jie Luo[5], Yongqi He[1], Zhangyuan Chen[1,3], Juhao Li[1,3]; [1]*Peking Univ., China;* [2]*Univ. of Science and Technology Beijing School of Computer and Communication Engineering, China;* [3]*Peng Cheng Laboratory, China;* [4]*Department of Networks, China Mobile Communications Group Co., Ltd., Beijing, China;* [5]*State Key Laboratory of Optical Fiber and Cable Manufacture Technology, China.* Based on weakly-coupled FMF and matched mode multiplexer/demultiplexer, we demonstrate 38-Tb/s MDM ($LP_{01}$/$LP_{02}$/$LP_{03}$) loop transmission over 1041.6 km only utilizing single-mode DP-QPSK transceivers, which may accelerate practical applications for broadband long-haul FMF and FM-MCF transmission.

**M1C.5 • 09:15**
**Numerical and Experimental Investigation of Multiband WDM Transmission Employing Backward Raman Pumping Over Hybrid SMF-MCF Links,** Kosuke Kimura[1], Shimpei Shimizu[1], Megumi Hoshi[1], Kohki Shibahara[1], Akira Kawai[1], Masanori Nakamura[1], Fukutaro Hamaoka[1], Takayuki Kobayashi[1], Yutaka Miyamoto[1]; [1]*Network Innovation Laboratories, NTT, inc., Japan.* We experimentally demonstrate good agreement between numerical estimation and measured results for on-off Raman gain, inter-core crosstalk, and GSNR in C+L-band transmission with backward Raman amplification over hybrid SMF-MCF links.

## Room 408B

### M1D • LiDAR Systems and Narrow Linewidth Lasers—Continued

**M1D.5 • 09:00**
**Ultrafast FMCW LiDAR With Micrometer Resolution Enabled by a Quantum Walk Comb Laser,** Bahareh Marzban[1], Laurenz Kulmer[1], Lucius Miller[1], Tobias Blatter[1], Alexander Dikopoltsev[1], Giacomo Scalari[1], Juerg Leuthold[1], Jerome Faist[1]; [1]*ETH Zurich, Switzerland.* We demonstrate FMCW LiDAR using a quantum walk comb laser, achieving 780μm resolution at nanosecond rates, and show multi-harmonic modulation enabling linear chirps up to 1.2THz bandwidth, paving the way to sub-150μm resolution.

**M1D.6 • 09:15**
**A Transceiver Optical Phased Array for Parallel Ranging Based on Grating-Lobe Demodulation,** Jie Li[1], Heming Hu[1], Ziming Wang[1], Weipeng Wang[1], Wenqiang Yue[1], Baisong Chen[1], Yingzhi Li[1], Huan Qu[1], Zihao Zhi[1], Haolun Du[1], Xianqi Pang[1], Guiyang Zhang[1], Xiangyi Sun[1], Yijie Lin[1], Qian Wang[2], Jinglei Qin[2], Mengjia Jin[2], Xiaolong Hu[1], Xueyan Li[1], Junfeng Song[1]; [1]*Jilin Univ., China;* [2]*YanDong MicroElectronic Technology Co, China.* We present a transceiver optical phased array incorporating grating-lobe demodulation, enabling parallel detection of multiple targets. An FMCW-based LiDAR system implementing this design enables simultaneous distance measurements in three directions and three-dimensional imaging of objects.

## Room 411

### M1E • Optical Signal Processing, Filtering, and Mode Division Multiplexing—Continued

**M1E.5 • 09:00**
**Ultra-Broadband Bidirectional Spectrometer for Parallel Detection,** Wanlu Zhang[1], Kangning Xu[2], Ting Yan[2], Liang Ming[2], Yuxiao Ye[2], Richard Penty[1], Qixiang Cheng[1,2]; [1]*Cambridge Univ., UK;* [2]*Glitterin Technology, China.* We present a bidirectional reconstructive spectrometer design employing a dualinput-dual-output strategy. This design enables parallel detection without external multiplexers and experimentally achieves a 1000–1750 nm operational bandwidth, paving the way for fully integrated parallel sensing.

**M1E.6 • 09:15**
**Linear Spectral Analysis Under Nonlinear Laser Frequency Sweeps,** Xuebing Zhang[1], Wenjing Tian[1], Peter Girouard[1], Megha Khokhar[1], Joonyoung Kim[1,2], Mathias Prost[2], Huaqing Qiu[2], Manuel Reza[2], Roelof Jansen[2], Marcus Dahlem[2], Dongjae Shin[1], Ruud Oldenbeuving[1]; [1]*Stichting imec Nederland, Netherlands;* [2]*Interuniversitair Micro-Elektronica Centrum, Belgium.* A linear spectral analysis approach under nonlinear frequency sweeps is proposed using an optical instantaneous frequency estimator. It is experimentally validated using a DFB laser and an integrated SiN microring resonator, achieving a test speed of 5μs.

## Room 501ABC

### M1F • Advances in High-Speed Direct-Detection PON—Continued

**M1F.5 • 09:00** Invited
**An Integrated 50G-PON and AI Framework for Digital Transformation in the Steel Industry,** Yuanqiu Luo[1], Dezhi Zhang[2], Qiang Cao[3], Frank Effenberger[1]; [1]*Futurewei Technologies Inc, USA;* [2]*State Key Laboratory of Optical Fiber and Cable Manufacture Technology, China Telecom Research Inst., China;* [3]*China Telecom Group Hebei Branch, China.* This paper explores a recently successful deployment of 50G-PON and AI in the steel manufacturing industry. Case studies on recycled steel classification and worker safety prove this integration can significantly boost operational efficiency and safety.

## Room 502A

### M1G • Optical Computing—Continued

**M1G.4 • 09:00**
**Experimental Demonstration of a 5-Gbaud Optical Full Adder and Subtractor for Phase-Encoded Signals,** Abdulrahman Alhaddad[6,1], Wing Ko[6], Muralekrishnan Ramakrishnan[6], Amir Minoofar[6], Huibin Zhou[6], Ahmed Almaiman[2], Zile Jiang[6], Hongkun Lian[6], Narek Karapetyan[6], Yingning Wang[6], Yue Zuo[6], Ruoyu Zeng[6], Moshe Tur[3], Jonathan Habif[4], Alan Willner[6,5]; [1]*Fouad Alghanim & Sons Group of Companies, Kuwait;* [2]*Electrical Engineering, King Saud Univ., Saudi Arabia;* [3]*Electrical Engineering, Tel Aviv Univ., Israel;* [4]*Information Sciences Inst., Univ. of Southern California, USA;* [5]*Department of Physics & Astronomy, Univ. of Southern California, USA;* [6]*Electrical Engineering, Univ. of Southern California, USA.* We experimentally demonstrate an optical full adder and full subtractor for 5-Gbaud phase-encoded signals using nonlinear wave mixing. The phase-encoded outputs are generated at different wavelengths and exhibit error-free logic results over 1536 symbols.

**M1G.5 • 09:15**
**Ultra-Compact on-Chip Metalens Fourier Processor for High-Density Photonic AI Computing,** Zhihao Ren[1,2], Yangyang Zhuge[1,2], Yuxin Liu[1], Daoye Zheng[1], Fujun Sun[3], Yan Yang[3], Chengkuo Lee[1,2]; [1]*National Univ. of Singapore, Singapore;* [2]*National Centre for Advanced Integrated Photonics, Singapore;* [3]*Chinese Academy of Sciences, China.* We demonstrate an ultra-compact on-chip metalens Fourier transform engine achieving ultrafast optical computing within a record-minimum footprint, enabling unprecedented computing density and speed for integrated photonic signal processing and next-generation AI hardware.

## Room 502B

### M1H • High Speed Coherent FSO—Continued

**M1H.5 • 09:15**
**Silicon Vector Optical Phased Array With Polarization Multiplexing and Wavelength Selectivity for 100 Gbps Free Space Coherent Optical Communication,** Xingyu Xu[1,2], Hexi Han[1,2], Ye Wang[2], Fang Wei[2], Kun Zhao[2], Quan Li[2], Yetian Huang[3], Yi Yan[2], Haiwen Cai[2], Peipei Hou[3], Jianfeng Sun[3]; [1]*Fudan Univ., China;* [2]*Zhangjiang Laboratory, China;* [3]*Shanghai Satellite Network Research Inst. Company Ltd, China.* We demonstrate a novel polarization multiplexing silicon vector optical phased array for 100 Gbps inter-satellite coherent communication, featuring wavelength-selective capability and enables coherent beam combining through independent control of phase and polarization.

## Room 515A

### M1I • DAS for Geoscience and Emerging Applicaions—Continued

**M1I.4 • 09:00**
**Submarine Communication Cable Networking for High-Precision Earthquake Location,** Bing Yue[1,2], Wenjin Huang[1], Tianrui Li[1], Fengmao Xie[1], Zicong Huang[1], Yifei Zhao[1], Yan Zheng[1], Shaoyi Chen[1], Yichang Wu[1,3], Zhaohui Li[1,4]; [1]*Sun Yat-Sen Univ. (CHINA), China;* [2]*Pengcheng Laboratory, China;* [3]*Department of Electrical and Electronic Engineering, The Hong Kong Polytechnic Univ. Faculty of Health and Social Sciences, Hong Kong;* [4]*Guangdong Provincial Key Laboratory of Optoelectronic Information Processing Chips and Systems & Southern Marine Science and Engineering Guangdong Laboratory (Zhuhai), Sun Yat-Sen Univ., China.* We introduced a submarine cable-network method for submarine earthquake location estimation, achieving a low estimation error of (±0.06872°N, ±0.07492°E). This method boosts coastal marine disaster warnings and fills the gap in long-term ocean earthquake monitoring.

**M1I.5 • 09:15** Invited
**Distributed Fiber Optic Sensing and the Future of Earthquake Hazards Research: Key Results From USGS Field Experiments,** Andrew J. Barbour[1], Jeffrey J. McGuire[1], Connie Stewart[2], James Atterholt[1], Theresa Sawi[1], Clara Yoon[1], Morgan P. Moschetti[1], Robert J. Skoumal[1]; [1]*U.S. Geological Survey, USA;* [2]*Cal Poly Humboldt, USA.* The U.S. Geological Survey (USGS) is evaluating how Distributed Acoustic Sensing (DAS) using existing fiber optic networks can benefit earthquake science. Notable results show that DAS accurately characterizes earthquake sources, improves early warning systems, and uncovers complexities in rupture and ground motion, offering a powerful tool to potentially transform earthquake hazards research and monitoring.

## Room 515B

### M1J • Hollow-Core Fiber Fabrication and Connectivity—Continued

**M1J.4 • 09:00**
**Fast, Low-Loss, and Field-Deployable Splicing of Anti-Resonant Hollow-Core Fibers,** Lipeng Feng[1], Wei He[2], Cong Zhang[2], Xishuo Wang[1], Wenzhe Chang[1], Zhengyu Liu[1], Jianping Li[2], Songnian Fu[2], Yuwen Qin[2], Chengliang Zhang[1]; [1]*China Telecom Research Inst. Beijing, China;* [2]*Guangdong Univ. of Technology, China.* We demonstrate an automated alignment method based on fiber side-view imaging for efficient hollow-core fiber splicing, achieving both a maximum loss of 0.05 dB within 97 seconds and 100% success ratio across 30 independent trials.

**M1J.5 • 09:15** Invited
**Making Hollow Core Fibers Compatible With Current Fiber Infrastructure,** Radan Slavik[1], Matej Komanec[2], Francesco Poletti[1]; [1]*Univ. of Southampton, UK;* [2]*Ceske vysoke uceni technicke v Praze, Czechia.* We will discuss challenges and solutions for accommodating emerging hollow core fibers in telecom systems to benefit from their advantages such as low attenuation, low nonlinearity, and chromatic dispersion, broadband transmission, low back-scattering, and low latency.

## Room 518

### M1K • Advances in Continuous-Variable QKD Systems and Processing—Continued

**M1K.5 • 09:00**
**Demonstration of a Cross-Encoded RFI QKD System in a Field-Deployed Multi-Core Fiber,** Massimo Giacomin[1], Julian Morales Traktenberg[1], Matias Ruben Bolanos[1], Giammarco Di Sciullo[2], Tetsuya Hayashi[3], Cristian Antonelli[2], Giuseppe Vallone[1], Paolo Villoresi[1], Costantino Agnesi[1]; [1]*Universita degli Studi di Padova, Italy;* [2]*Universita degli Studi dell'Aquila, Italy;* [3]*Sumitomo Denki Kogyo Kabushiki Kaisha, Japan.* This work showcases the robustness of a novel Reference-Frame-Independent Quantum Key Distribution apparatus integrated in an uncoupled-core 8-core fiber deployed in L'Aquila, Italy, coexisting with classical traffic in adjacent cores within the same telecom band.

**M1K.6 • 09:15**
**High-Dimensional Time-bin Processing via Chirped Phase Modulation for Dense Frequency Multiplexing in Quantum Networks,** Philip Rübeling[1], Robert Johanning[1], Jan Heine[1], Samuel Duran[1], Oleksandr Marchukov[1], Michael Kues[1]; [1]*Leibniz Universität Hannover, Germany.* We demonstrate quantum information processing of dense frequency-multiplexed high-dimensional time-bin entangled photons over 25 km of single-mode fiber. Our approach leverages off-the-shelf fiber components to enable high-bandwidth quantum networking for quantum cryptography and distributed quantum computing.

## Room 403A

### M1A • Data Center Interconnection—Continued

## Room 403B

### M1B • Datacenter WDM and Comb—Continued

**M1B.7 • 09:30** Invited
**Optical Architecture and Interconnection for AI/ML Networks,** Cedric F. Lam[1]; [1]*Google LLC, USA.* We share a decade of experience in using optics to scale AI/ML infrastructures and look into the future.

## Room 408A

### M1C • SDM and Multiband Transmission Systems—Continued

## Room 408B

### M1D • LiDAR Systems and Narrow Linewidth Lasers—Continued

## Room 411

### M1E • Optical Signal Processing, Filtering, and Mode Division Multiplexing—Continued

**M1E.7 • 09:30** Invited
**Withdrawn.**

## Room 501ABC

### M1F • Advances in High-Speed Direct-Detection PON—Continued

**M1F.6 • 09:30** ★ Top-Scored
**Fast-Convergent T/2-Spaced Joint Clock Recovery and Adaptive Equalization for High-Speed Burst-Mode Flexible PON Under Large Sampling Clock Frequency Offsets,** Yanlu Huang[1], Yanni Ou[1], Liyan Wu[1], Shangya Han[1], Kai Jin[1], Mingyang Guo[1], Kun Xu[1]; [1]*Beijing Univ. of Posts and Telecommunications, China.* A proposed T/2-spaced joint clock recovery and equalization scheme enables 50–100 Gb/s PON bursts recovery with only 18ns preambles and accelerated convergence method under 100ppm frequency offset, achieving only 0.4dB PAM4 sensitivity penalty.

**M1F.7 • 09:45**
**Rényi Divergence-Based Nonlinear OLT-Side Tomlinson-Harashima Precoding for 100G FTN PON,** Geyang Wang[1,3], Hao Deng[2], Xianwei Cheng[3], Zelu Wang[1], Hon Ki Tsang[1], Liankuan Chen[1], Roberto Proietti[4], S.J.Ben Yoo[3]; [1]*The Chinese Univ. of Hong Kong, Hong Kong;* [2]*South China Univ. of Technology, China;* [3]*Univ. of California Davis, USA;* [4]*Politecnico di Torino, Italy.* We propose low-complexity FTN PONs using Rényi divergence-based universal nonlinear Tomlinson-Harashima precoding. The single OLT-sideprecoder experimentally demonstrates effectiveness for equalizing ONUs residing at different distances simultaneously and realizes up to 4dB sensitivity gain.

## Room 502A

### M1G • Optical Computing—Continued

**M1G.6 • 09:30** Invited

**Photonics for AI, AI for Photonics: a Bidirectional Path to Scalable and Fabrication-Robust Design,** Odile Liboiron-Ladouceur[1]; [1]*Electrical and Computer Engineering, McGill Univ., Canada.* Advances in artificial intelligence (AI) and photonics are converging to enable efficient computing systems. This paper highlights multidisciplinary progress integrating photonic interconnects, mode-division multiplexing, and AI-assisted correction of fabrication variations toward compact, energy-efficient photonic circuits.

## Room 502B

### M1H • High Speed Coherent FSO—Continued

**M1H.6 • 09:30** Invited

**High-Capacity Urban Terrestrial Free-Space Optical Communication Links at km-Scale,** Vincent van Vliet[1], Menno van den Hout[1], Eduward Tangdiongga[1], Chigo M. Okonkwo[1]; [1]*Technische Universiteit Eindhoven, Netherlands.* Free-space optical communication links can enable high-capacity wireless connectivity in urban areas. We discuss the feasibility, challenges and recent demonstrations of high-capacity free-space optical links at kilometer-scale.

## Room 515A

### M1I • DAS for Geoscience and Emerging Applicaions—Continued

## Room 515B

### M1J • Hollow-Core Fiber Fabrication and Connectivity—Continued

## Room 518

### M1K • Advances in Continuous-Variable QKD Systems and Processing—Continued

**M1K.7 • 09:30** Invited

**Scalable Continuous-variable Quantum Key Distribution,** Imran Khan[1]; [1]*KEEQuant GmbH, Germany.* Continuous variable quantum key distribution (CV-QKD) leverages coherent telecom components, enabling photonic integration and compatibility with optical networks. We report commercial CV-QKD implementations and highly advanced chip-scale integration results, plus milestones toward scalable network integration.

## Room 403A

**10:30–12:30**
**M2A • Silicon Photonics Modulators**
*Presider: Claudia Hoessbacher; Polariton Technologies Ltd, Switzerland*

**M2A.1 • 10:30** ★ Top-Scored
**A 256 Gb/s Silicon Euler Microring Modulator With 3 THz FSR and >67 GHz Bandwidth,** Yuchen Yin[1], Aoxue Wang[2], Jiajian Chen[3], Yichen Xu[1], Weilu Wu[1], Xinyi Hu[1], Jinlong Xiang[1], Youlve Chen[1], Zhenyu Zhao[1], An He[1], Zongheng Weng[2], Yaotian Zhao[4], Wei Chu[4], Ting Wang[3], Yikai Su[1], Xuhan Guo[1]; *[1]Shanghai Jiao Tong Univ., China; [2]Fudan Univ., China; [3]Chinese Academy of Sciences Inst. of Physics, China; [4]Zhangjiang Laboratory, China.* We demonstrate an O-band silicon Euler microring modulator with a 3 THz FSR and >67 GHz EO bandwidth. The inductive-peaking design achieves a 256 Gb/s PAM-4 data rate, confirming its capabilities for next-generation optical interconnects.

**M2A.2 • 10:45**
**Ultra-High Bandwidth Silicon Microring Modulator With T-Coil Inductive Peaking for >400 Gbps Transmission,** Shenlei Bao[2.1], Yihao Yang[2.1], Chao Cheng[2.1], Xianglin Bu[2.1], Jintao Xue[2.1], Wenfu Zhang[2.1], Binhao Wang[2.1]; *[1]Univ. of Chinese Academy of Science, China; [2]Xi'an Inst. of Optics and Precision Mechanics, China.* We present a silicon microring modulator with a T-Coil, achieving a 1 dB electro-optic bandwidth exceeding 110 GHz. Driven with 1 $V_{pp}$, it supports 416 Gbps PAM4 transmission with a TDECQ of 2.88 dB.

**M2A.3 • 11:00**
**An O-Band Silicon Micro Ring Modulator for 200G/l Applications With 1.6THz FSR,** Michal Rakowski[2], Teodor Stanev[1], Hanyi Ding[1], James Garofolo[1], Andy Stricker[1], Qidi Liu[1], Abdelsalam Aboketaf[2], Michelle Zhang[2], Ryan Sporer[2], Helen Wong[2], Siwei Zeng[2], Bradley Orner[3], Yusheng Bian[2], Bob Mulfinger[2], Rick Carter[2]; *[1]GlobalFoundries, USA; [2]Globalfoundries Inc Malta, USA; [3]GlobalFoundries Inc, USA.* We report a micro ring modulator for 200G/λ applications with ER>3.5dB and 3dB electro optical bandwidth of 55 GHz and 70 GHz from 2 Vpp and 3 Vpp respectively and discuss device performance across different operating points.

## Room 403B

**10:30–12:30**
**M2B • IM/DD for Datacenter**
*Presider: Fabio Bottoni; Cisco Photonics Italy Srl, Italy*

**M2B.1 • 10:30** Invited
**200G LPO: Design Challenges and Latest Test Data,** Eric M. Kimber[1], Edward Frlan[2]; *[1]Semtech Limited, UK; [2]Semtech Corporation, USA.* Linear Pluggable Optics (LPO) is a promising technology to reduce power consumption at 200 Gb/s. This paper will review the benefits, requirements and challenges of implementing LPO technology at 200 Gb/s.

**M2B.2 • 11:00** ★ Top-Scored
**A 280 Gbps Optical Transceiver With Monolithically Integrated 110 GHz Silicon Microring Modulators and 110 GHz Germanium Photodetectors,** Xingyu Liu[2.1], Xu Wang[2.1], Fangchen Hu[1], Zixuan Cai[2.1], Wei Chu[1], Haibin Zhao[2], Haiwen Cai[1], Fengxin Yu[1], Xiao Hu[1]; *[1]Zhangjiang Laboratory, China; [2]Fudan Univ. School of Information Science and Technology, China.* We demonstrate a 280 Gbps optical link using a silicon depletion-type microring modulator and a germanium photodetector, both with 3dB bandwidth over 110 GHz and fabricated on 300 mm silicon photonic platform.

## Room 408A

**10:30–12:30**
**M2C • Next-generation Optical Transmission Systems**
*Presider: Masanori Nakamura, NTT Network Innovation Laboratories Japan*

**M2C.1 • 10:30** Invited
**Next-Generation Coherent Optical Transmission Systems and Practical Optimizations,** Wenting Yi[1], Zhe Li[1], Philippe Jenneve[1], Miquel Mestre[1], Xue Huang[2], Jonas Geyer[1], Christian Rasmussen[1]; *[1]Cisco Systems Inc, USA; [2]Cisco Systems Inc, USA.* We review the evolution of coherent optics from embedded systems to digital coherent pluggables. Practical optimization trade-offs in coherent pluggables are then discussed focusing on balancing performance and power consumption.

**M2C.2 • 11:00**
**Fast and Accurate ML-Based Nonlinear Interference Estimation Including SRS and PDL for Ultra-Wideband Transmissions,** Leonardo Sorensen Braga[1], Amirhossein Ghazisaeidi[1]; *[1]Nokia Bell Labs France, France.* We provide millisecond-scale NLI variance estimation including Stimulated Raman Scattering, Polarization-Dependent Loss, with or without dispersion management. We achieve fast and robust performance over the space of possible optical configurations covered through the dataset.

## Room 408B

**10:30–12:30**
**M2D • Reconfigurable Devices and Optical Switches**
*Presider: Francesco Morichetti; Politecnico di Milano, Italy*

**M2D.1 • 10:30**
**Waveguide Superlattices With Artificial Gauge Field for High-Performance Thermo-Optic Switching,** Xuelin Zhang[1], Jiangbing Du[1], Ke Xu[2,3], Zuyuan He[1]; *[1]Shanghai Jiao Tong Univ., China; [2]Harbin Inst. of Technology, China; [3]Peng Cheng Laboratory, China.* We demonstrate a 1 × 8 thermo-optic switch using waveguide superlattices with artificial gauge field, showing a loss of 1.96 dB, crosstalk <−20 dB, and phase-shifter power consumption of 2.52 mW/π.

**M2D.2 • 10:45**
**Curved Tunable Directional Couplers Empower Ultralow-Crosstalk, Low-Loss Optical Switch Fabrics,** Peng Bao[1], Jing Zhang[2], Günther Roelkens[2], Richard Penty[1], Qixiang Cheng[1]; *[1]Univ. of Cambridge, UK; [2]Universiteit Gent, Belgium.* We present a compact curved tunable directional coupler for correcting power imbalance in Mach-Zender Interferometers, empowering an ultra-compact footprint, ultralow-crosstalk, low-loss 4×4 switch fabric with <−50dB crosstalk and <1.5dB on-chip loss.

**M2D.3 • 11:00** Invited
**High Port Count Silicon Photonic MEMS Circuit Switch,** Tae Joon Seok[1]; *[1]nEye.ai, USA.* Integrating MEMS on silicon photonics enhances optical circuit switches with ultra-low power and high scalability. This paper explores the potential and requirements of silicon photonic MEMS OCS, including switching speed, power, polarization, and loss.

## Room 411

**10:30–12:30**
**M2E • Multi-mode Fiber Devices, EDFA Gain Dynamics and Optical Signal Processing**
*Presider: Filipe Ferreira; Univ. College London, UK*

**M2E.1 • 10:30** Invited
**High-Power Single-Frequency Multimode Fiber Amplifier with Suppressed Nonlinearity and Controlled Output Profile,** Stefan Rothe[2.1], Chun-Wei Chen[2,3], Peyman Ahmadi[4,2], KyeoReh Lee[2], Kabish Wisal[5], Mert Ercan[2], Nathan Vigne[2], A. Douglas Stone[5], Hui Cao[2]; *[1]Universiteit Twente, Netherlands; [2]Applied Physics Department, Yale Univ., USA; [3]Department of Physics, Univ. of Bath, UK; [4]Coherent, USA; [5]Department of Physics, Yale Univ., USA.* We demonstrate a 503 W single-frequency multimode-fiber laser amplifier with suppressed nonlinearity, 82% slope efficiency, and focused output beam via input wavefront shaping. The superior performance highlights the potential of multimode-amplification for high-power coherent fiber lasers.

**M2E.2 • 11:00**
**Toward High-Speed Channel-Specific Gain Shaping: Modelling and Control of an EDFA With a Built-in Dynamic Gain Equalizer,** Lixian Wang[1], Aria Moaven[1], Hamed Rabanni[1], Zhiping Jiang[1]; *[1]Huawei Technologies Canada, Canada.* Dynamic gain equalizers enhance EDFA flexibility but complicate control. We propose a physics-embedded neural network enabling one-shot, channel-specific gain shaping with 0.3 dB maximum error at 99.73 percentile.

## Room 501ABC

**10:30–12:30**
**M2F • Novel Architectures and Intelligence for Future Access Networks**
*Presider: Luca Valcarenghi; Scuola Superiore Sant'Anna, Italy*

**M2F.1 • 10:30**
**Advancing Explainability Through a SHAP-Guided Adaptive Windowing Framework,** Yuxiao Wang[1], Sourav Mondal[1], Ye Pu[1], Elaine Wong[1]; *[1]Univ. of Melbourne, Australia.* For the first time, a SHapley Additive exPlanations-guided adaptive windowing long short-term memory framework is proposed to satisfy stringent latency requirements of human-to-machine applications over 50G-PON. Results show a 46.8% reduction in inference time and 15.1% in delay.

**M2F.2 • 10:45** Invited
**AI-Orchestrated Access Transport Networks for 6G,** Paola Iovanna[1], Giulio Bottari[1]; *[1]Ericsson, Italy.* AI-driven orchestration enables dynamic service provisioning in 6G Xhaul transport networks, supporting critical and AI-training traffic. This ensures end-to-end connectivity meets differentiated requirements while allowing for economically viable network monetization.

## Room 502A

**10:30–12:30**
**M2G • Panel: Scaling Networks for the AI Era: From Data Centers to Wide Area Networks**

**Organizers:**
Ashwin Gumaste, *Microsoft, USA*
Behnam Shariati, *Fraunhofer Inst. Nachricht henrich-Hertz, Germany*
Jesse Simsarian, *Nokia, USA*
Anbin Wang, *Alibaba Group, China*
Kang Ping Zhong, *Hong Kong Polytechnic Univ., Hong Kong*

**Speakers:**
Michael DeMerchant, *Lumentum, Canada*
Chongjin Xie, *PhotonicX AI, USA*
Shikui Shen, *China Unicom, China*
Arash Vakili, *Meta, USA*
Yawei Yin, *Microsoft, USA*
Zhizhen Zhong, *Netpreme, USA*

The explosive growth of GPU-centric AI, especially training large language models (LLMs), is driving massive bandwidth demands within data centers (DCs), across DC interconnects (DCIs), and over wide area networks. As LLM training expands beyond single sites, distributed training will further increase networking requirements. Machine-to-machine traffic now exceeds user traffic, ushering in an era of networks built for AI.

This panel will examine optical networking challenges and solutions to scale networks for AI in different regions: low-latency scale-out DC networks, optical switching, spatial division multiplexing to scale DCI beyond fiber Shannon limits, and distributed AI inference at the edge.

The key questions to address in this panel are:

- Will the AI-driven bandwidth explosion continue?
- What AI workloads dominate traffic for now and the future?
- How will network architectures adapt to machine-driven traffic?
- What scaling solutions fit each network region?
- How will optical interconnects and spatial multiplexing and switching evolve?

The panel will be divided into two topics.

Session I, Scaling Inside DC (Scale out)
Session II, Scaling Between DC (DCI)

## Room 502B

**10:30–12:30**
**M2H • Panel: Satellite Optical Networks: Avoiding Vendor Lock-in Through Interoperability**

**Organizers:**
Kasia Balakier, *European Space Agency, UK*
Kevin Shortt, *Airbus Defence & Space GmbH, Germany*
Todd Ulmer, *MIT Lincoln Laboratory, USA*

**Speakers:**
Michael Butterfield, *DARPA, USA*
Don Cornwell, *Amazon, USA*
Harald Hauschildt, *ESA, Netherlands*
David Macky, *mBryonics Ltd., Ireland*
Julie Smith, *US Air Force Research Laboratory, USA*

Given the dynamic nature of satellite constellations, the topology of the optical network amongst the satellites will be changing as often as every few minutes. This operational reality, in turn, means that at any given moment a vendor's terminal on one satellite may have to connect to a terminal from another vendor on another satellite. As with the early days of the terrestrial fiber industry, there are a number of emerging specifications and standards aimed at unifying and providing guidelines for device and equipment suppliers for satellite-based optical networks. A comprehensive specification, e.g. future standard(s), to ensure interoperability and consistent operation of the network is required, as new satellites replace older satellites through the natural evolution of the constellation. Following in the footsteps of the terrestrial market, interoperability plays a key role not only in ensuring operational resiliency but also avoids vendor lock-in, a key benefit for operators and customers alike.

The key discussions to address in this panel are:

- Existing specifications and standards for optical satellite communication, e.g. SDA, ESTOL, CCSDS
- Interoperability verification between laser communication terminal (LCT) suppliers
- Interoperability at PAT level, physical layer, data and link management layer
- Interoperability between constellations
- How do emerging technologies (e.g. coherent transceivers for space) complicate (or simplify) the standardization problem?

## Room 515A

**10:30–12:30**
**M2I • 6G and Radio Over Fiber**
*Presider: Roberto Llorente, Universitat Politecnica de Valencia, Spain*

**M2I.1 • 10:30** Invited
**Next-Generation Optical Fronthaul for High Speed Wireless Links,** Maria Morant[1]; [1]*Nanophotonics Technology Center, Universitat Politecnica de Valencia, Spain*. This paper reviews large-capacity optical fronthaul implementations using radio-over-fiber (RoF) to meet the requirements of 5G and beyond-5G wireless communications including MIMO, photonic beamforming, optical millimeter-wave generation and multi-core fiber (MCF) transmission.

**M2I.2 • 11:00**
**Non-Orthogonal Analog RoF Fronthaul Using Chirp Diversity and Dispersion-Induced Power Fading Without Successive Interference Cancellation,** Dangui Huang[1], Yixiao Zhu[1], Lina Man[1], Yikun Zhang[1], Yilin Qiu[1], Weisheng Hu[1]; [1]*Shanghai Jiao Tong Univ., China*. We propose non-orthogonal-multiple-access A-RoF fronthaul using chirp diversity and dispersion-induced power fading without successive interference cancellation. We experimentally demonstrate 64-QAM co-delivery over 10/30 km and 15/25 km SSMF, supporting massive and flexible user access.

## Room 515B

**10:30–12:30**
**M2J • Hollow-Core Fiber Monitoring and Sensing**
*Presider: Lauren Dallachiesa; Nokia Bell Labs, USA*

**M2J.1 • 10:30** Invited
**Low Intermodal Interference and Low Loss Hollow Core Fibres,** Peng Li[1], Guoqun Chen[1], Hongmin Li[1], Jun Chu[1], Yaping Liu[1], Liyan Zhang[1], Lei Zhang[1], Jie Luo[1]; [1]*Yangtze Optical Fibre and Cable Joint Stock Ltd Co, China*. A novel gap tube assisted-support tube-antiresonant hollow core fibre with optimized 4-fold offset-angle gap tube structure achieves less than 0.1 dB/km loss and better than -60 dB/km IMI, suitable for long-haul transmissions.

**M2J.2 • 11:00**
**Backscattering Characterization in Hollow-Core Fibers: Isolating Air-Molecule and Surface Scattering Origins via Direct and Coherent OTDR Techniques,** Atsushi Nakamura[1], Jumpei Hayakawa[1], Hiroyuki Iida[1], Kunihiro Toge[1]; [1]*NTT, Inc., Japan*. Combining direct and coherent optical time domain reflectometry, we isolate scattering origins in anti-resonant hollow-core fibers under identical conditions, providing insights for loss analysis, surface uniformity evaluation, and atmospheric diagnostics.

## Room 518

**10:30–12:30**
**M2K • QKD Real-World Deployments**
*Presider: Natalia Herrera Valencia; Heriot-Watt Univ., UK*

**M2K.1 • 10:30** Invited
**Developments in Quantum Networking in the UAE,** James A. Grieve[1]; [1]*Technology Innovation Inst., United Arab Emirates*. Overview of the UAE's Quantum Communications activities, focusing on the development of QKD solutions at TII. With a portfolio including entanglement-based BBM92 and a passive-state BB84 variant, we anticipate the development of complex fiber-based networks in Abu Dhabi and beyond.

**M2K.2 • 11:00**
**Experimental Demonstration of 374.4 Tbps Classical Communications Coexisting With Quantum Key Distribution Over 100 km 7-Core Fiber,** Weiwen Kong[1], Tianqi Dou[1], Zhenhua Li[1], Yuheng Xie[1], Lei Shen[2,6], Jun Chu[2,6], Song Gao[3], Nan Lu[4], Xuewei Kan[4], Yaoxian Gao[5], Yongmei Sun[5], Shibiao Tang[3], Jianjun Tang[1]; [1]*China Telecom Research Inst., China;* [2]*Yangtze Optical Fibre and Cable Joint Stock Ltd Co, China;* [3]*QuantumCTek Corporation Limited, China;* [4]*ZTE corporation, China;* [5]*Beijing Univ. of Posts and Telecommunications Inst. of Information Photonics and Optical Communications, China;* [6]*Optical valley laboratory, China*. We experimentally demonstrate QKD coexistence with 374.4 Tbps classical communications over 100 km 7-core fiber for the first time, achieving 28 dBm coexistence power and about 4 kbps secure key rate, enabling scalable QKD deployment.

## Room 403A

### M2A • Silicon Photonics Modulators—Continued

**M2A.4 • 11:15**
**A 16×128 Gbps DWDM Wavelength-Locked Silicon Photonic Microring Transmitter Enabled by a Quantum-Dot Comb Laser,** Xianglin Bu[1], Shujie Pan[2], Shenlei Bao[1], Junjie Yang[3], Chao Cheng[1], Jintao Xue[1], Wenfu Zhang[1], Siming Chen[2], Binhao Wang[1]; [1]*State Key Laboratory of Ultrafast Optical Science and Technology, Xi'an Inst. of Optics and Precision Mechanics, Chinese Academy of Sciences, China;* [2]*Laboratory of Solid State Optoelectronics Information Technology, Inst. of Semiconductors, Chinese Academy of Sciences, China;* [3]*HS Photonics Co., Ltd., Xiangjiang Science & Technology Innovation Base, China*. We demonstrate a 2 Tbps/fiber (16×128 Gbps) DWDM silicon photonic transmitter enabled by a quantum-dot mode-locked laser with 100 GHz spacing, where wavelength locking ensures precise alignment of microring wavelengths to the comb lines.

**M2A.5 • 11:30**
**Low-Voltage, Complex-DSP-Free 200G PAM4 / 140G OOK Operation of Si Photonic Crystal Slow-Light Modulator With Built-in EO Equalizer,** Keisuke Kawahara[1,2], Tai Tsuchizawa[3], Noritsugu Yamamoto[3], Yuriko Maegami[3], Koji Yamada[3], Nobuhiko Nishiyama[1,4], Toshihiko Baba[2]; [1]*Tokyo Kagaku Daigaku, Japan;* [2]*Yokohama Kokuritsu Daigaku, Japan;* [3]*Kokuritsu Kenkyu Kaihatsu Hojin Sangyo Gijutsu Sogo Kenkyujo, Japan;* [4]*Photonics Electronics Technology Research Association (PETRA), Japan*. Built-in EO equalizer extended the Si slow-light Mach–Zehnder modulator bandwidth to 80 GHz, achieving DSP-free 112-Gb/s low-voltage OOK and 180-Gb/s PAM4 operation, further reaching 200 Gb/s with a low-complexity DSP.

## Room 403B

### M2B • IM/DD for Datacenter—Continued

**M2B.3 • 11:15**
**A 336Gb/s/Lane 2.47pJ/b Integrated Transmitter With Silicon Photonic TW-MZM and BW-Boost High-Linearity Driver,** Ruogu Deng[1,3], Erse Jia[2], Yizhou Xu[3], Han Liu[1,3], Jun Li[2], Jingbo Wang[1,3], Bolun Cui[1,3], Guike Li[1,3], Jian Liu[1,3], Zhao Zhang[1,3], Haiwen Cai[2], Wei Chu[2], Fenghe Yang[2], Nan Qi[1,3], Liyuan Liu[1,3]; [1]*Inst. of Semiconductors, Chinese Aca, China;* [2]*Zhangjiang Laboratory, China;* [3]*Univ. of Chinese Academy of Sciences, China*. A hybrid-integrated optical transmitter comprising of a SiPh TW-MZM wire-bond with co-designed BW-boosted driver in SiGe BiCMOS is presented. Experimental results demonstrate 336Gb/s/lane PAM-8 optical eye diagrams at 2.47pJ/bit power consumption.

**M2B.4 • 11:30**
**Ferroelectric Nematic Glass-Based Silicon Photonics Modulator for Net 400 Gbps IM/DD Transmission,** KAIBO ZHANG[1], Li-Yuan Chiang[2], Ching-Wen Huang[2], Charles St-Arnault[1], Benton Qiu[1], Jerome Jahn[2], James Christensen[2], Santiago Bernal[1], Codey Nacke[1], Pao-Chieh Huang[2], Neda Bathaei[2], Aleksandar Nikic[1], Yixiang Hu[1], Cory Pecinovsky[2], Chirag Patel[2], Pavel Savechenkov[2], Morten Nissov[2], Mark Harrison[2], Gianlorenzo Masini[2], David V. Plant[1]; [1]*McGill Univ., Canada;* [2]*Polaris Electro-Optics Inc, USA*. We demonstrate a record net 400Gbps IMDD data transmission using a hybrid-integrated silicon and ferroelectric nematic glass modulator. Transmission of 200Gbaud PAM6 and 168Gbaud PAM8 is achieved below SD25-FEC over 100m of SSMF.

## Room 408A

### M2C • Next-generation Optical Transmission Systems—Continued

**M2C.3 • 11:15**
**Real-Time Unrepeatered Transmission of 400G/800G/1.2T Over 726.1km/611.9km/436.1km HCF Only Using EDFA,** Lipeng Feng[1], Anxu Zhang[1], Peng Li[2], Yuan Gao[5], Hailin Yang[3], Lei Zhang[5], Wenzhe Chang[1], Xishuo Wang[1], Zhengyu Liu[1], Jie Luo[5], Xiaoli Huo[1], Tao Ma[4], Songnian Fu[1], Chengliang Zhang[1]; [1]*China Telecom Research Inst., China;* [2]*Yangtze Optica Fibre and Cable Joint Stock Limited Company (YOFC), China;* [3]*Guangdong Univ. of Technology, China;* [4]*China Telecom Corporation Limited, China;* [5]*Yangtze Optical Fibre and Cable Joint Stock Ltd Co, China*. We demonstrate record unrepeatered transmissions of 400G/800G/1.2T over 726.1km/611.9km/436.1km HCF by only using high-power EDFA, confirming that the HCF link with the simplest structure achieves substantial reach extension over the SSMF link with complex structure.

**M2C.4 • 11:30**
**Analytical QoT Model for Bi-Di Single-Fiber Point-to-Multipoint DSCM Coherent Systems,** Esteban Paz[1,2], Giuseppe Parisi[1], Pablo Torres-Ferrera[1], Tiago Silvério[1,2], Sasipim Srivallapanondh[1], Miquel Masanas[1], Luis Velasco[2], Sezer Erkilinc[3], Roberto Magri[4], Antonio Napoli[3]; [1]*Nokia Solutions And Networks Holdings, Germany;* [2]*Universitat Politecnica de Catalunya, Spain;* [3]*Nokia Solutions and Networks Oy, UK;* [4]*Ericsson Ltd, Italy*. We experimentally validate a transmission model for single-fiber/laser bidirectional links in next-generation mobile transport with point-to-multipoint coherent transceivers. The model achieves 0.3dB accuracy in 90% of cases, enabling reliable performance prediction and network optimization.

## Room 408B

### M2D • Reconfigurable Devices and Optical Switches—Continued

**M2D.4 • 11:30** Invited
**Programmable Photonic Arrays Based on Silicon Photonic MEMS With Femtowatt-Level Standby Power,** Kyoungsik Yu[1]; [1]*Korea Advanced Inst of Science & Tech, Korea (the Republic of)*. We discuss programmable chip-scale photonic arrays based on silicon photonic MEMS phase shifters and tunable couplers. Ultra-low-power reconfigurability enables scalable programmable integrated photonics for energy-efficient optical signal processing, computing, and communication applications.

## Room 411

### M2E • Multi-mode Fiber Devices, EDFA Gain Dynamics and Optical Signal Processing—Continued

**M2E.3 • 11:15**
**Bridging Static Modeling and Real-Time Control: a Hybrid AI-Physics Approach for EDFA Gain Dynamics,** Zujun Xu[1], Arslan Anjum[1], Haitao Sun[1], Lixian Wang[1], Zhiping Jiang[1]; [1]*Huawei, Canada*. We propose a real-time dynamic EDFA gain optimization method assisted by machine learning model. The proof-of-concept experiments show greatly improved gain dynamics throughout the entire channel add/drop process.

**M2E.4 • 11:30**
**One-to-Ten Multicast of Self-Injection Locking Laser With Sub-kHz Linewidth Enabled by Cross Phase Modulation,** Huabei Liu[2], Quanxin Na[1], Qijie Xie[1], Dongwei Zhuang[1], Chunyang Ma[1], Lei Wang[1], Zhixue He[1], Liyang Shao[2]; [1]*Pengcheng Laboratory, China;* [2]*Southern Univ. of Science and Technology Shenzhen Inst. for Quantum Science and Engineering, China*. we have demonstrated generation of coherent multi-wavelength optical source with low frequency noise via cross-phase modulation. A self-injection locking laser with 100-Hz linewidth is efficiently replicated to 10 wavelengths at a space of 75 GHz.

## Room 501ABC

### M2F • Novel Architectures and Intelligence for Future Access Networks—Continued

**M2F.3 • 11:15**
**TinyML-Empowered Human-to-Machine Applications Over Future Access Networks,** Xiangyu Yu[1], Sourav Mondal[1], Lihua Ruan[2], Yuxiao Wang[1], Elaine Wong[1]; [1]*Univ. of Melbourne, Australia;* [2]*Pengcheng Laboratory, China*. We integrate Tiny machine learning models into optical access networks supporting H2M applications, reducing energy consumption by up to ~97%, and round-trip delay by up to ~190 us.

**M2F.4 • 11:30** Tutorial
**From Copper to Fiber-to-the-Room: The Evolution of In-Home Networks for the Era of Immersive Applications,** Elaine Wong[1]; [1]*Univ. of Melbourne, Australia*. This tutorial examines the evolution of in-home/building networks, tracing the transition from copper-based data-centric connectivity to fiber-based immersive capability, highlighting architectural, latency, and capacity challenges shaping next-generation in-home/building networks for future experiential services.

## Room 502A

### M2G • Panel: Scaling Networks for the AI Era: From Data Centers to Wide Area Networks—Continued

## Room 502B

### M2H • Panel: Satellite Optical Networks: Avoiding Vendor Lock-in Through Interoperability—Continued

## Room 515A

### M2I • 6G and Radio Over Fiber—Continued

**M2I.3 • 11:15**
**A High-Power 4-Channel Analog Optical Transceiver Supporting Minimalist Base Station With Photodiode-Drive Antenna in Mobile Fronthaul,** Yu Xia[1], Hui Rong[1], Xiaoyang Liu[1], Chuanming Huang[1], Zhi Hu[1], Kai Xu[1], Qi Yang[1], Mengfan Cheng[1], Deming Liu[1], Lei Deng[1]; *[1]Huazhong Univ. of Science and Technology, China*. We propose a high-power four-channel analog optical transceiver that can support a photodiode-drive antenna, and demonstrate a real-time fiber-wireless transmission of a 400 MHz bandwidth 5G-NR-256QAM signal, achieving an EVM below 2.5%.

**M2I.4 • 11:30** Invited
**Analog Radio-Over-Fiber for 6G,** Tianyu Jiang[1,2], Carlos Daniel Fontes Da Silva[3], Kristaps Rubuls[4], Armands Ostrovskis[4,5], Dan Li[1,2], Anders Djupsjöbacka[2], Sandis Spolitis[4], Wei-Ping Huang[7], Jakub Zverina[8], Leos Halmo[8], Rui Hou[7], Stefan Dahlfort[7], Lu Zhang[6], Vjaceslavs Bobrovs[4], Xianbin Yu[6], Edson Porto da Silva[3], Rafael Puerta[7], Xiaodan Pang[4,6], Oskars Ozolins[4,2]; *[1]Kungliga Tekniska Hogskolan, Sweden; [2]RISE Research Inst.s of Sweden AB, Sweden; [3]Universidade Federal de Campina Grande, Brazil; [4]Rigas Tehniska universitate Datorzinatnes un informacijas tehnologijas fakultate, Latvia; [5]Keysight Technologies Deutschland GmbH, Germany; [6]Zhejiang Univ., China; [7]Telefonaktiebolaget LM Ericsson, Sweden; [8]Argotech a.s., Czechia*. 6G demands high linearity, low EVM, and strong ACLR performance from ARoF. This talk reviews recent advances, assesses dynamic-range limits over distance, and examines how digital predistortion can extend A-RoF capability for future 6G architectures.

## Room 515B

### M2J • Hollow-Core Fiber Monitoring and Sensing—Continued

**M2J.3 • 11:15**
**First Demonstration of Distributed Sensing Capability of NANF Hollow-Core Fiber,** Shuyan Chen[1,2], Zhiyong Zhao[1], Peng Li[3], Lei Zhang[3], Ming Tang[1], Chao Lu[2]; *[1]Huazhong Univ of Science and Technology, China; [2]The Hong Kong Polytechnic Univ., Hong Kong; [3]Yangtze Optical Fibre and Cable Joint Stock Ltd Co, China*. We demonstrate, for the first time, high-performance distributed sensing of strain, temperature and bending in hollow-core NANF using OFDR with customized signal processing at 4 cm spatial resolution.

**M2J.4 • 11:30**
**Field Study on Phase and Polarization Dynamics of Deployed Anti-Resonant Hollow Core Fiber Cable for Vibration Sensing,** Jian Fang[1], Ming-Fang Huang[1], Scott Kotrla[2], Jeffrey A. Mundt[2], Ting Wang[1], Yoshiaki Aono[3]; *[1]NEC Laboratories America Inc., USA; [2]Verizon Communications Inc, USA; [3]NEC Corporation, Japan*. We report the first field study of the phase and polarization dynamics of deployed anti-resonant hollow core fiber cable in a data center interconnect for real-world vibration sensing, revealing enhanced phase sensitivity and significantly faster polarization angular rate compared with standard single mode fibers.

## Room 518

### M2K • QKD Real-World Deployments—Continued

**M2K.3 • 11:15**
**Coexistence Field Trial of 1092 nm Quantum Link, Coherent 400 GbE, and 5G Services,** Zehao Wang[1], Denton Wu[2], Mingzhe Han[1], Mika A. Zalewski[2], Ana L. Ferrari[2], Yuanheng Xie[2], Norbert M. Linke[3,1], Tingjun Chen[1]; *[1]Duke Univ., USA; [2]Duke Quantum Center, USA; [3]Joint Quantum Inst., USA*. Coexistence of 1092 nm quantum, coherent 400 GbE, and 5G radio signals is experimentally demonstrated in a field trial, identifying overlapping operational ranges and demonstrating the feasibility of simultaneous quantum-classical signal transmission.

**M2K.4 • 11:30**
**Global-Scale Information-Theoretic Secure Communication Using QKD and Distributed Symmetric Key Establishment,** Rodrigo S. Tessinari[1], Robert I. Woodward[1], Jacob Johannsson[2], Stefano N. Altimari[2], Matthew Taylor[2], Andrew J. Shields[1]; *[1]Toshiba Europe Ltd- Cambridge Research, UK; [2]Quantum Bridge Tecnologies Inc., Canada*. We propose and demonstrate a new network architecture for global-scale information-theoretic secure communication, combining QKD and Distributed Symmetric Key Establishment (DSKE), including the extension of draft emerging standards for vendor-interoperable quantum key relay (ETSI 020).

## Room 403A

### M2A • Silicon Photonics Modulators—Continued

**M2A.6 • 11:45**
**A Compact Mach-Zehnder Modulator in 300 mm Silicon Photonic Platform Towards 400Gbps/Lane Transmission,** Fenghe Yang[1], Erse Jia[1], Ying Wang[1], Xinran Zhao[1], Weisheng Wang[1], Haiwen Cai[1], Wei Chu[1]; [1]*Zhangjiang Laboratory, China*. A 400 Gbps compact (500 μm) Mach-Zehnder modulator is demonstrated in a 300 mm silicon photonic platform, achieving a median insertion loss of 2.4 dB, and a median bandwidth of 94.7 GHz at 1310 nm.

**M2A.7 • 12:00** Invited
**Si Microring Resonator Modulators at >200Gb/s,** David Patel[1]; [1]*NVIDIA Corp, USA*. We review the progression in development of all-silicon based microring resonator modulators for high bitrates. Trade-offs and challenges are explored.

## Room 403B

### M2B • IM/DD for Datacenter—Continued

**M2B.5 • 11:45** ★ Top-Scored
**O-Band Silicon-Plasmonic Resonant Ring Modulator Demonstrating Net-Rates of 400 Gbps,** Samuel Hess[1], Laurenz Kulmer[1], Chenrui Xu[1], Tobias Blatter[1], Vladimir Shadymov[2], Matthew Garrett[2], Benedikt Baeuerle[2], Wolfgang Heni[2], Claudia Hoessbacher[2], Oskars Ozolins[3,4], Juerg Leuthold[1]; [1]*ETH Zurich, Inst. of Electromagnetic Fields (IEF), Switzerland;* [2]*Polariton Technologies AG, Switzerland;* [3]*Inst. of Photonics, Electronics and Telecommunications, Riga Technical Univ., Latvia;* [4]*RISE Research Inst.s of Sweden AB, Sweden*. We demonstrate the first silicon-photonics plasmonic O-band resonant ring modulator with on-chip losses of 2.2dB, reaching net 400Gbps by employing PAM8 signaling. We show improved temperature stability compared to pure SiPh rings, lowering control efforts.

**M2B.6 • 12:00** Invited
**Technologies for 400G/Lane IM/DD Interconnects,** Anna Tatarczak[1], Roberto Rodes[1], Andrei Kaikkonen[1], Young-Kai Chen[1], Julie Eng[1]; [1]*Coherent Corp, USA*. We review optoelectronic technologies enabling 400-Gbps-per-lane intensity modulation / direct-detection interconnects. We analyze system-level challenges for next generation 400-Gbps data-center links, including channel bandwidth, signal-to-noise ratio, power budget, and integration.

## Room 408A

### M2C • Next-generation Optical Transmission Systems—Continued

**M2C.5 • 11:45** ★ Top-Scored
**Real-Time C+L Band Transmission of 64 Tb/s With 1 Tb/s Single-Carrier Channels Over 1260 km,** Stefano Colombo[1], Matthew Nouchi[1], Sergey Ten[2], Lidia Galdino[2]; [1]*Cisco Systems Inc., Italy;* [2]*Corning Incorporated, UK*. We demonstrate real-time 64×1 Tb/s transmission over 1260km with variable ultra-long spans up to 160km. The 64Tb/s is enabled by ultra-low-loss, large effective area fiber, optimized hybrid Raman/EDFA amplification design combined with system level optimization.

## Room 408B

### M2D • Reconfigurable Devices and Optical Switches—Continued

**M2D.5 • 12:00**
**Pixelated NOEM Grating for Wavelength-Selective Switching and Spectral Shaping in ROADM Systems,** Weixin Liu[1], Siyu Xu[1], Chengkuo Lee[1]; [1]*National Univ. of Singapore, Singapore*. We introduce a pixelated nano-opto-electro-mechanical (NOEM) grating for on-chip wavelength-selective switching and spectral shaping. The NOEM grating achieves nanosecond reconfiguration and >100 nm bandwidth tuning, enabling high-speed reconfigurable optical add-drop in WDM systems.

**M2D.6 • 12:15**
**O-Band SiPh 2x2x2λ Polarization Diversity Optical Switch with PDL ≤ 0.5dB,** Xiangwei Kong[1], Evan Chansky[1], Xinhong Du[1], Aaron Wissing[1], Rittik Mitra[1], Samuel Fuchs[1], Mohamed Elfouly[1], Larry Coldren[1], Adel Saleh[1], Clint Schow[1]; [1]*Univ. of California Santa Barbara, USA*. We demonstrate an O-band silicon photonics 2x2x2λ wavelength selective switch (WSS) based on Coupled Ring Resonators (CRR). The optical switch achieves a record-low average polarization dependent loss (PDL) of 0.41dB.

## Room 411

### M2E • Multi-mode Fiber Devices, EDFA Gain Dynamics and Optical Signal Processing—Continued

**M2E.5 • 11:45**
**A 4×40 GBaud Femtojoule Kerr All-Optical Switch Based on Silicon-Organic Hybrid Nanocavities,** Yizheng Chen[1], Xiaoyan Gao[1], Haodong Yang[2], Jianhua Ning[3], Yilun Wang[1], Wenchan Dong[2], Lei Lei[3], Jing Xu[2], Xinliang Zhang[1]; [1]*Wuhan National Laboratory for Optoelectronics, Huazhong Univ. of Science and Technology, China;* [2]*School of Optical and Electronic Information, Huazhong Univ. of Science and Technology, China;* [3]*Shenzhen Univ., China*. A multi-channel optical Kerr switch based on silicon-organic hybrid nanocavities is demonstrated, achieving 4×40 GBaud operation with a minimum switching energy of 52 fJ/bit per channel and error-free performance, enabling scalable photonic signal processing.

**M2E.6 • 12:00** Invited
**Harnessing Spatial and Dispersion Diversity: Multicore and Few-Mode Fibers for Advanced Signal Processing,** Sergi Garcia[1], Mario Annier González[1], Ivana Gasulla Mestre[1]; [1]*Universitat Politècnica de València, Spain*. We summarize recent advances in dispersion-diversity SDM fibers enabling tunable optical and microwave processing, demonstrating fiber designs and validating key functionalities while highlighting their scalability and potential to implement compact, energy-efficient photonic distributed processors.

## Room 501ABC

### M2F • Novel Architectures and Intelligence for Future Access Networks—Continued

Elaine Wong is Redmond Barry Distinguished Professor at the University of Melbourne. Her current research interests are focussed on advancing optical communication and networking technologies to enable human–machine immersive applications. Elaine currently serves on the IEEE Comsoc Emerging Technologies Committee. She is a former elected member of the IEEE Photonics Society Board of Governors and past Chair of the IEEE Comsoc Optical Networking Technical Committee. Elaine previously served as General Chair of the Optical Fiber Communication Conference (OFC) 2025 and has held editorial roles on several leading journals, including IEEE Network, IEEE/Optica Journal of Optical Communications and Networking, and IEEE/Optica Journal of Lightwave Technology. She is a Fellow of Optica and Engineers Australia.

## Room 502A

### M2G • Panel: Scaling Networks for the AI Era: From Data Centers to Wide Area Networks—Continued

## Room 502B

### M2H • Panel: Satellite Optical Networks: Avoiding Vendor Lock-in Through Interoperability—Continued

## Room 515A

### M2I • 6G and Radio Over Fiber—Continued

**M2I.5 • 12:00**
**Experimental Demonstration of Lightweight Linear Filter-Based Nonlinear Precompensation in Analog Radio-Over-Fiber Transmission,** Ryoji Ito[1], Takaki Sugiyama[1], Daisuke Hisano[1], Hirofumi Sasaki[2], Akihiro Maruta[1], Ken Mishina[1]; [1]*The Univ. of Osaka, Japan;* [2]*NTT, Inc., Japan.* We propose a novel compensation method for nonlinear distortion in analog radio-over fiber transmission systems applicable to high-frequency band wireless communication. We demonstrate the validity of the proposed method through numerical simulations and experiments.

**M2I.6 • 12:15**
**Improved Performance of Seamlessly Converged Fiber-MmWave Transmission Systems by Iterative SSBI Mitigation-Enabled Global Linearization,** Bing Lu[1,2], Xueling Liu[1], Wei Jin[2], Jiaxiang He[2], Md Saifuddin Faruk[2], Xingwen Yi[2], Fawzi Abdelhamid Gonem[2], Roger Giddings[2], Jianming Tang[2]; [1]*Chongqing Univ of Posts & Telecomm, China;* [2]*School of Computer Science and Engineering, Bangor Univ., UK.* Iterative SSBI mitigation-enabled global linearization is first experimentally demonstrated in 3.556Gb/s, 25km fiber-mmWave-converged systems, offering >51.4% DSP complexity reductions and similar transmission performances, mmWave frequency tuning ranges and radio transmission coverages, compared to Kramers-Kronig receivers.

## Room 515B

### M2J • Hollow-Core Fiber Monitoring and Sensing—Continued

**M2J.5 • 11:45**
**Characterization of Multi-Path Interference of 10-km Hollow Core Fiber Using Swept Wavelength Interferometry,** Nicolas K. Fontaine[1], Stefano Grillanda[1], Roland Ryf[1], Lauren Dallachiesa[1], David Neilson[1], Haoshuo Chen[1], Mikael Mazur[1], Peng Li[2], Lei Zhang[2], Jie Luo[2], Shuhai Li[2], Sezer Erkilinc[3], Aditya Kakkar[3], Walid Wakim[3], Daniel Peterson[3]; [1]*Nokia Bell Labs, USA;* [2]*Yangtze Optical Fibre and Cable Joint Stock Ltd Co, China;* [3]*nokia, USA.* We measure the impulse response of a 10-km support-tube hollow core fiber (ST-HCF) showing the effects of higher-order mode propagation and multi-path interference. A linear split-step simulation validates both the measurement and model.

**M2J.6 • 12:00** Invited
**Backscatter Signatures for Monitoring Antiresonant Hollow-Core Fibers,** Eric Rodrigue Numkam Fokoua[1]; [1]*Azure Fiber & AI, Microsoft EMEA, UK.* This talk examines backscattering mechanisms in hollow-core fibers and advanced reflectometry for accurate characterization. We present insights and challenges in monitoring fiber integrity—critical for practical deployment and unlocking performance gains in next-generation optical networks.

## Room 518

### M2K • QKD Real-World Deployments—Continued

**M2K.5 • 11:45**
**Hong Kong Quantum Network With Chip-Based QKD System for Cybersecurity,** Xiaopeng Wang[1,2], Hao Yu[1,2], Xinjie Zhang[1,2], Liwang Lu[2], Wei Wang[1,2], Yaxi Yan[2], Kang Ping Zhong[2], Shihai Sun[3], Hong Cai[1,2], Alan Pak Tao Lau[1,2], Aiqun Liu[1,2]; [1]*Research Inst. for Quantum Technology, The Hong Kong Polytechnic Univ., Hong Kong;* [2]*Department of Electrical and Electronic Engineering, The Hong Kong Polytechnic Univ., Hong Kong;* [3]*School of Electronics and Communication Engineering, Sun Yat-Sen Univ., China.* We demonstrated a Hong Kong metropolitan field test of a silicon photonic polarization-encoded quantum key distribution (QKD) system,achieving 45.73 kbps secure key rate over 55.41 km (27.7 dB loss) metropolitan fiber networks.

**M2K.6 • 12:00**
**Deep Reinforcement Learning-Based Quality-of-Service Assurance for Digital Twin-Enabled Satellite Quantum Key Distribution Networks,** Jingjing Liu[1], Xiaosong Yu[1], Jian Yang[1], Dungu Jin[1], Avishek Nag[2], Yongli Zhao[1], Jie Zhang[1]; [1]*Beijing Univ. of Posts and Telecommunications, China;* [2]*Univ. College Dublin, Ireland.* Quality-of-service assurance over digital twin-enabled satellite quantum key distribution networks with deep reinforcement learning is proposed. This approach can reduce the service blocking rate by more than 70% compared to the benchmarks.

**M2K.7 • 12:15**
**Quantum key Distribution Network Deployed Over 100 km in a Real-World Environment,** Lecaron Nathan[1], Yoann Pelet[1], Grégory Sauder[1], Clément Courde[2], Anthony Martin[1], Sébastien Tanzilli[1], Olivier Alibart[1]; [1]*Institut de physique de Nice, France;* [2]*Alpes Maritimes, GeoAzur, France.* We demonstrate a 100 km entanglement-based quantum key distribution link with full automation and stability, bridging terrestrial and satellite-compatible infrastructures for future large-scale quantum networks.

## Room 403A

**14:00–16:00**
**M3A • AI Failure and Anomaly Detection in Optical Networks**
*Presider: Massimo Tornatore; Politecnico di Milano, Italy*

**M3A.1 • 14:00** Invited
**Dynamic ML Models for Evolving Networks: What, Where and How?,** Aleksandra Knapinska[1], Marija Furdek[2]; [1]*Politechnika Wroclawska, Poland;* [2]*Chalmers tekniska hogskola AB, Sweden.* Modern networks and attacks evolve rapidly, challenging deployed ML models. We address performance degradation of offline-trained models in post-failure traffic prediction and threat detection by proposing data-stream-based updating strategies for real-time optical network security evolution.

**M3A.2 • 14:30**
**A Unified Siamese Learning Framework for Zero-Day Anomaly Detection and Classification in Optical Networks,** Carlos Natalino[1], Flávia Pessoa Monteiro[2], Paolo Monti[1]; [1]*Chalmers Univ. of Technology, Sweden;* [2]*Universidade Federal do Oeste do Para, Brazil.* A multi-similarity Siamese neural network unifies zero-day anomaly detection and one-shot classification in optical networks, achieving over 99% accuracy and instant adaptability across lightpaths and unseen anomaly types without any retraining.

## Room 403B

**14:00–16:00**
**M3B • Digital and Analog Signal Processing**
*Presider: Nebojsa Stojanovic; Huawei Technologies Co Ltd, Germany*

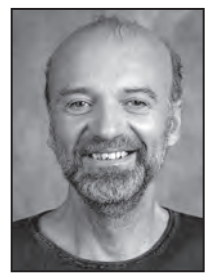
**M3B.1 • 14:00** Invited
**Modulation Formats and Advanced DSP for Next-Generation Data Center Intraconnects,** Tom Wettlin[1], Stefano Calabro[1], Nebojsa Stojanovic[1], Maxim Kuschnerov[1]; [1]*Huawei Technologies Duesseldorf GmbH, Germany.* We discuss feasibility, challenges and technology options for next-generation 400Gb/s/lane optical IM/DD systems. We conclude that a careful selection of system parameters and DSP is required.

**M3B.2 • 14:30**
**Optics-Inspired Kolmogorov–Arnold Fully-Convolutional Equalizer for High-Speed VCSEL-MMF Optical Interconnects,** Yuting Xu[1,2], Zhaopeng Xu[1], Chuanchuan Yang[3], Yuping zhao[3]; [1]*Pengcheng Laboratory, China;* [2]*Peking Univ. Shenzhen Graduate School, China;* [3]*Peking Univ. Department of Electronics, China.* We propose optics-inspired Kolmogorov–Arnold fully-convolutional network (OIKA-FCN) for equalization in high-speed VCSEL-MMF IM/DD links. Hybrid Gaussian–tanh–cosine activations are designed to better emulate optical nonlinearities and interference, delivering superior performance compared with baselines.

## Room 408A

**14:00–16:00**
**M3C • Ultra-wideband Transmission Systems**
*Presider: Andrea D'Amico; NEC Laboratories America Inc., USA*

**M3C.1 • 14:00** Tutorial
**Toward Ultra-Wideband Optical Infrastructure: Challenges in Modeling and Deploying Multiband Transmission,** Vittorio Curri[1]; [1]*Politecnico di Torino, Italy.* This tutorial explores the modeling and deployment challenges of ultra-wideband optical infrastructure, examining multiband transmission, physical-layer impairments, amplification constraints, and system design trade-offs essential for scaling future networks beyond conventional C-band limits.



Telecommunications Full Professor at Politecnico di Torino with 25+ years in fiber-optic communications, optical networking, and AI-driven network control. Founder of the Open PLANET Lab, early promoter in multiband and digital-twin research. Fellow of IEEE, Optica, and AAIA, advancing open, sustainable, and physically aware optical networks.

## Room 408B

**14:00–16:00**
**M3D • Optical Phased Arrays, Free Space Beams, and Metasurface Devices**
*Presider: Sagi Mathai; HPE Labs, USA*

**M3D.1 • 14:00**
**Circular-Grating Optical Phased Array for on-Chip Tunable OAM Beam Generation,** Jinling Guo[1], Weilun Zhang[1], Mingjie Zou[1], Xinliang Zhang[1], Yu Yu[1]; [1]*Wuhan National Laboratory for Optoelectronics & School of Optical and Electronic Information, Huazhong Univ. of Science and Technology, China.* We demonstrate an on-chip OAM generator based on a circular-grating optical phased array (OPA) with programmable angular phase control. Stable multi-order OAM beams are experimentally observed across 1500–1630 nm.

**M3D.2 • 14:15**
**Multi-Aperture Coherent Beam Analyzer Implemented by an Integrated Mesh of Mach–Zehnder Interferometers,** Lorenzo Zerboni[1], Samuele De Gaetano[1], Riccardo Benegiamo[1], Eleonora Gubello[1], Francesco Zanetto[1], Andrea Melloni[1], Francesco Morichetti[1]; [1]*Politecnico di Milano, Italy.* An integrated mesh of Mach–Zehnder interferometer is proposed as a multi-aperture coherent beam analyzer to perform optical wavefront mapping, spatial coherence estimation and phase drifts compensation in joint communication and sensing applications.

**M3D.3 • 14:30** Invited
**Integrated Optical Phase Arrays for Terrestrial Free-Space Optical Communication,** Tymon Barwicz[1], Ondrej Čierny[1], Marc de Cea Falco[1], Greg Allan[1], Danielius Kramnik[1], Sanam Mozaffari[1], Michael Caverley[1], Jean-Laurent Plateau[1], Andrei Kazmierski[2], Devin Brinkley[1]; [1]*Taara Connect, Inc., USA;* [2]*X the Moonshot Factory, Google LLC, USA.* We review the distinctive challenges of terrestrial free-space optical communication and their mitigation using integrated optical phase arrays (OPAs). We analyze design tradeoffs and present an OPA integrated on-chip and packaged into a functional module.

## Room 411

**14:00–16:00**
**M3E • Optical Amplifiers for Space Division Multiplexing**
*Presider: Victor Kopp; Chiral Photonics Inc, USA*

**M3E.1 • 14:00** Invited
**Advances in Pump Delivery and Recycling for High-Efficiency Multicore Erbium-Doped Fiber Amplifiers,** Haoshuo Chen[1], Roland Ryf[1], Nicolas K. Fontaine[1], Kim Kwangwoong[1], Tam Huynh[1], Ells Burrows[1], Xiaonan Xu[1], Lauren Dallachiesa[1], Mikael Mazur[1], Hirotaka Sakuma[2], Takemi Hasegawa[2], Tetsuya Hayashi[2], David Neilson[1]; [1]*Nokia Bell Labs, USA;* [2]*Sumitomo Electric Industries, Ltd., Japan.* We present recent breakthroughs in multicore EDFA efficiency enabled by direct pump delivery via multiplane light conversion and cavity-assisted pump recycling. Together, these approaches enhance pump utilization, simplify integration, and achieve record power-conversion performance across 4- and 7-core amplifiers.

**M3E.2 • 14:30** Invited
**Multicore Amplifiers for Submarine Networks,** Hitoshi Takeshita[1]; [1]*NEC Corporation, Japan.* The first application of multicore fiber is in submarine cable systems. However, multicore amplifiers for submarine applications must overcome more challenges than their terrestrial counterparts due to constraints on available power and installation space.

## Room 501ABC

**14:00–16:00**
**M3F • Optical Switching for AI Networking**
*Presider: Daniel Pérez-López; iPRONICS Programmable Photonics S.L., Spain*

**M3F.1 • 14:00** Invited
**Recent Advancements in Optical Circuit Switches for AI Applications,** Kevin Yasumura[1], Jill D. Berger[1], David S. Funk[1], Nate Klein[1], Howard Lee[1], Scott McCauley[1], Sundar Rajan[1], Erick Tuttle[1], Yan Zhang[1], Hong Liu[1]; [1]*Google LLC, USA.* We present two generations of in-house developed optical circuit switches for Google's AI applications. We discuss their design, manufacturing, and use in multiple generations of TPU accelerator superpods.

**M3F.2 • 14:30**
**Experimental Demonstration of O-Band 4×4x8λ Wavelength Selective Switch at 100Gbps/λ for Data Center Networks,** Boyang Zheng[1], Marijn Rombouts[1], Robert Palmer[2], Giuseppe Talli[2], Nicola Calabretta[1]; [1]*Technische Universiteit Eindhoven Department of Electrical Engineering, Netherlands;* [2]*Huawei Technologies Duesseldorf GmbH, Germany.* We experimentally demonstrate modular polarization-independent O-band 4×4x8λ WSS using 400GHz 8-channel photonic integrated flat-top AWG and SOA array. Results show <3.5dB fiber-to-fiber loss, <–37dB crosstalk, OSNR>42dB, and 0.8dB power penalty for 100Gb/s-PAM4 data channel.

## Room 502A

**14:00–16:00**
**M3G • Panel: High-Speed Optical Modulators for Intra-Data Center Links: Unlocking 400 Gb/s and Beyond per Lane**

**Organizers:**
Hideyuki Nasu, *Furukawa Electric Co., Ltd, Japan*
Janet Chen, *NVIDIA, USA*
Mizuki Shirao, *Mitsubishi Electric Corporation, Japan*
Wei Shi, *Université Laval, Canada*

**Speakers:**
Claudia Hoessbacher, *Polariton, Switzerland*
Patrick Lo, *AMF, Singapore*
Matthew Sysak, *Lumentum, USA*
Sheng Kai Yeh, *TSMC, Taiwan*
Shiyoshi Yokoyama, *Kyushu Univ., Japan*
Han Yun, *OpenLight, USA*

The bandwidth of the latest switch ASIC has reached at 200 Gb/s per lane. The next target of 400 Gb/s per lane is anticipated to be deployed in the industries around 2028. So far, several optical device candidates have been reported to achieve 400 Gb/s per lane and beyond, and their practical implementation is becoming a reality. In this panel session, we focus on transmitter technologies with IM-DD formats in datacenters. Different material systems for modulation devices have been reported for 200G baud PAM4, such as TF LN, PLZT, BTO, InP, SiPh, and plasmonic modulators. Device candidates will be selected, and their experts will elaborate on the prospects for higher speed modulation capability and their advantages. The speakers will also discuss key factors, including power consumption, scalability for over 400 Gb/s, mechanical size, form factors, and integration capability.

The key discussions to address in this panel are:

- Critical performance FOMs supporting 200 Gbaud+
  - Bandwidth, Vπ, loss
  - Footprint – Bandwidth density
  - How much pJ/bit can be realized?
- Manufacturability
  - Throughput
  - Yield
- Compatibility with next-generation systems, such as CPO/NPO/LPO
- Most critical challenges
- Roadmap

## Room 502B

**14:00–16:00**
**M3H • Visible Light and Optical Wireless Communication**
*Presider: Boon Ooi; King Abdullah Univ of Sci & Technology, Saudi Arabia*

**M3H.1 • 14:00**
**Experimental Demonstration of Kilometer-Scale Low-Complexity Multi-Gigabit VLC,** Isaac N. Osahon[1], Hossien Eldeeb[1], Sina Babadi[1], Othman Younus[1], Mohamad Ghaddar[1], Iman Tavakkolnia[1], Harald Haas[1]; *[1]LiFi R&D Centre, Univ. of Cambridge, UK.* We demonstrate a 1.2-km visible light communication (VLC) link achieving 6 Gb/s using a 450-nm laser with 0.1-W optical power, representing the longest reported multi-gigabit IM/DD VLC transmission with simple optical hardware.

**M3H.2 • 14:15**
**Demonstrating 80 Gb/s Optical Wireless Communication Using a Multi-Aperture VCSEL and a Multi-Mode Fiber-Coupled Receiver for Next-Generation LiFi Connectivity,** Hossein Kazemi[1], Othman Younus[1], Isaac N. Osahon[1], Nikolay Ledentsov[2], Ilya Titkov[2], Nikolay Ledentsov[2], Harald Haas[1]; *[1]Univ. of Cambridge, UK; [2]VI Systems GmbH (VIS), Germany.* We demonstrate a 940 nm single-mode multi-aperture VCSEL-based optical wireless link achieving >80 Gb/s data rates at <5 mW optical power, enabling ultra-high-speed, energy-efficient LiFi for next-generation networks.

**M3H.3 • 14:30** ★ Top-Scored
**516Tb/s MIMO-Free Mode/Wavelength Division Multiplexing Optical Wireless Communication System,** Chao Li[1], Xumeng Liu[1], Yunhong Liu[1], Peng Sun[1], Songyuan Hu[1], Zichen Liu[1], Zhixue He[1], Shaohua Yu[1]; *[1]Peng Cheng Laboratory, China.* We proposed and experimentally demonstrated a mode/wavelength division multiplexing optical wireless communication (MDM/WDM-OWC) system over 1.8m free-space link. A record capacity of 516Tb/s is successfully achieved enabled by S+C+L-band 319λ and MIMO-free 3-mode MUX/DeMUX.

## Room 515A

**14:00–16:00**
**M3I • Symposium: Beyond the Atmosphere: Architectures and Technologies for Optical Space Communication I**
*Presiders: Jörg-Peter Elbers, Adtran Networks SE, Germany and Randy Giles, Optica, USA*

**M3I.1 • 14:00** Invited
**Advances in Laser Communication for Satellite Constellations,** Joe Ponsetto[1]; *[1]SpaceX, USA. Review of recent advances in optical inter-satellite links at SpaceX. Significant strides have been made in the performance, reliability, and manufacturability of the laser terminals, as well as the management of the laser mesh network.*

**M3I.2 • 14:30** Invited
**Tbps-Scale Crosslink, Feeder and Relay Links,** Hamid Hemmati[1]; *[1]Viasat, USA.* Laser communications technology has moved far beyond its experimental roots and is now routinely used in operational systems. Today it is widely used in intersatellite links between LEO sats at about 200 Gbps data rates, as well as LEO-to-GEO and LEO and GEO to ground at tens of Gbps. Links between GEO sats and MEO-to-GEO and LEO are expected soon. It is expected that these rates will scale by orders of magnitude within a couple of decades.

## Room 515B

**14:00–16:00**
**M3J • Fiber Sensing I**
*Presider: Jeremie Renaudier; Nokia Bell Labs, France*

**M3J.1 • 14:00**
**SNSPD-Assisted Φ-OTDR for Zero-Touch Deployment of Amplifier-Free Distributed Acousto-Optic Sensing in PONs,** Bernhard Schrenk[1], Florian Honz[1]; *[1]Austrian Inst. of Technology, Austria.* We employ a high-sensitivity Geiger-mode detector to overcome power-splitting loss in PONs, demonstrating the acquisition of a drop-side acousto-optic signature behind a 1:32 power-splitter through a centralized DAS interrogator – without optical amplifier.

**M3J.2 • 14:15**
**Integrated OFDR-Based mHz-Level Distributed Vibration Sensing and Coherent Communication System,** Bowen Yin[1], Shuyan Chen[1], Siyu Chen[1], Mingming Zhang[1], Zhiyong Zhao[1], Ming Tang[1]; *[1]Huazhong Univ. of Science and Technology, China.* We demonstrate, for the first time, a residual carrier modulation-based integrated OFDR and communication system using shared LFM transmitter, achieving 3.4-cm spatial resolution and 0.001-Hz-level distributed vibration sensing over 20-km transmission link with 38-Gbaud DP-16QAM.

**M3J.3 • 14:30**
**High-Resolution Fiber Sensing on Field Deployed Fiber With Laser Stabilization for Enhanced Sensitivity,** Rajiv Boddeda[1], Adrish Sahu[1], Christian Dorize[1], Arnaud Dupas[1], Pierre brochard[2], Haik MARDOYAN[1], Carina Castineiras[1], Jeremie Renaudier[1]; *[1]Nokia Bell Labs, France; [2]Silentsys, France.* We demonstrate distributed acoustic sensing on deployed buried cable leveraging laser frequency stabilization and probing code optimization. Our results confirm the capability to accurately localize weak events with high resolution and sensitivity over 80 km.

## Room 518

**14:00–16:00**
**M3K • Machine-Learning Assisted Design and Optimization**
*Presider: Yi Cai; Soochow Univ., China*

**M3K.1 • 14:00**
**Physics-Guided Scientific Discovery in EDFA Gain Modeling: a Closed-Form Parameterization Approach,** Yu Zelai[1], Xiao Luo[1], Xiaotian Jiang[1], Shengnan Li[1], Wenbin Chen[1], Min Zhang[1], Danshi Wang[1]; *[1]Beijing Univ. of Posts & Telecom, China.* Leveraging a physics-guided scientific discovery method, we proposed a closed-form EDFA gain model, achieving competitive extrapolation accuracy (MAE<0.35 dB) in variable output powers and cross-device adaptation, with less data and lower complexity than neural networks.

**M3K.2 • 14:15**
**Dual-Timescale Meta-Learning for Few-Shot and Online EDFA Gain Prediction in Optical Network,** Yang Weijie[1], Chunyu Zhang[3], Min Zhang[1], bing ye[2], Danshi Wang[1]; *[1]Beijing Univ. of Posts & Telecom, China; [2]3State Key Laboratory of Mobile Network and Mobile Multimedia Technology, China; [3]2School of Intelligence Science and Technology, Univ. of Science and Technology, China.* We propose a dual-timescale meta-learning framework for EDFA gain prediction that achieves rapid adaptation to new EDFA devices using only 4 samples and a prediction error of 0.19 dB, while enabling online learning and calibration.

**M3K.3 • 14:30** Invited
**Machine Learning Tools for Modeling and Optimization in Optical Communications and Optical Computing,** Francesco Da Ros[3], Isidora Teofilovic[3], Sergio Hernandez Fernandez[3], Metodi Yankov[2], Christophe Peucheret[1], Darko Zibar[3]; *[1]Universite de Rennes, France; [2]Ciena Denmark, Denmark; [3]Danmarks Tekniske Universitet, Denmark.* Machine learning-based data-driven modeling provides key tools for optimizing optical systems. Here we review three paradigms - purely data-driven (black-box), purely physics-driven (white-box), and physics-informed data-driven (grey-box) - highlighting challenges and potentials.

## Room 403A

### M3A • AI Failure and Anomaly Detection in Optical Networks—Continued

**M3A.3 • 14:45**
**First Demonstration of Autonomous Fault Diagnosis With AI-Embedded Optical Modules in Passive WDM Systems for Front-Haul Network,** XINYU CHEN[1], Zixi Liu[1], Liuyan Han[1], yuan yuan[2], Ke Wang[2], Dechao Zhang[1], Han Li[1]; *[1]China Mobile Research Inst., China; [2]Wuxi Taclink Optoelectronics Technology Co., Ltd., China.* We demonstrate an intelligent module-level fault diagnosis solution for passive WDM front-haul networks, achieving 92.4% overall accuracy in classifying four critical fault types and distinguishing whether they originate from the common or channel port side.

**M3A.4 • 15:00**
**Proactive Optical Network Defense: Leveraging Large Language Models for Failure Prediction and Maintenance,** Cheng Xing[1], Chunyu Zhang[2], Min Zhang[1], Zhuo Liu[3], Danshi Wang[1]; *[1]Beijing Univ. of Posts & Telecom, China; [2]Univ. of Science and Technology Beijing, China; [3]China Mobile Communications Corporation, China.* An LLM-based failure prediction and proactive defense framework is proposed, which enables multivariate failure prediction and generates defense recommendations, achieving 97.61% accuracy and superior BLEU scores compared to existing methods.

**M3A.5 • 15:15**
**Multi-Factor Conditional DDPM for High-Fidelity Data Augmentation in Optical Network Soft Failure Diagnosis,** Guangye Cheng[1], Keyuan Yang[1], Yu Yang[1], Yun Wang[1], Changjian Ke[1,2]; *[1]School of Optical and Electronic Information, Huazhong Univ. of Science and Technology, China; [2]Wuhan National Laboratory for Optoelectronics, Huazhong Univ. of Science and Technology, China.* We propose a multi-factor conditional denoising diffusion probabilistic model (DDPM) for data augmentation. Using 10% of the training data, it achieves over 90% of the soft failure diagnosis performance relative to the full training dataset.

## Room 403B

### M3B • Digital and Analog Signal Processing—Continued

**M3B.3 • 14:45**
**Low-Complexity Circle-Solving and Shift-Augmented Equalizer for 200-Gb/s Skew-Enabled VSB Direct-Detection,** Yikun Zhang[1], Yixiao Zhu[1], Dangui Huang[1], Guangying Yang[1], Qunbi Zhuge[1], Weisheng Hu[1]; *[1]Shanghai Jiao Tong Univ., China.* We propose a low-complexity and high-performance algorithm using circular-based SSBI extraction and shift-augmented FFE (CSE-SFFE), achieving 200-Gb/s VSB PAM-4 direct-detection transmission over 80-km SSMF with 35% BER reduction or 33% multiplication reduction compared with FFE.

**M3B.4 • 15:00**
**Simple Adaptive Scheme for Test-Pattern Generation in LR-FEC Inner Code With Chase-2 Decoding,** Shuto Yamamoto[1], Shuto Sugawara[1], Etsushi Yamazaki[1]; *[1]Network Innovation Laboratories, NTT, Inc., Japan.* We propose an efficient and adaptive soft-decision-decoding scheme based on a simple reliability indicator for received signals. The proposed scheme reduces the number of test patterns by over 70% without performance degradation.

**M3B.5 • 15:15**
**Mitigation of FWM in High-Speed IM/DD Systems Using DD-LMS Equalizer Aided by Orthogonal Bias Terms,** Leyan Fei[1], Yicheng Xu[1], Yixiao Zhu[1], Yongxin Sun[1], Haiyun Xin[2], Weisheng Hu[1], Qunbi Zhuge[1]; *[1]Shanghai Jiao Tong Univ., China; [2]Huawei Technologies Co Ltd, China.* We propose a bias-aided DD-LMS (BADD-LMS) equalizer to mitigate four-wave mixing in high-speed IM/DD systems. A receiver sensitivity improvement of 2dB is experimentally demonstrated in 112Gb/s per lane PAM4 WDM transmission.

## Room 408A

### M3C • Ultra-wideband Transmission Systems—Continued

**M3C.2 • 15:00** ★ Top-Scored
**135.5 Tb/s O-Band + 201.4 Tb/s SCL-Band Bidirectional WDM Transmission Over a Field Deployed G.652.D Fibre System,** Jiaqian Yang[1], Romulo Aparecido[1], Eric Sillekens[1], Mindaugas Jarmolovicius[1], Ronit S. Sohanpal[1], Zelin Gan[1], Ruben S. Luis[2], Vitaly Mikhailov[3], Jiawei Luo[3], David DiGiovanni[3], Polina Bayvel[1], Robert Killey[1]; *[1]Univ. College London, UK; [2]Kokuritsu Kenkyu Kaihatsu Hojin Joho Tsushin Kenkyu Kiko, Japan; [3]Lightera Laboratories, USA.* We demonstrate a record bidirectional GMI throughput of 135.51Tb/s O-band+201.39Tb/s SCL-band over 39km of field-deployed fibre using 16.53THz/16.70THz O/SCL-band signals, doped fibre amplifiers and less than 20dBm total optical power at both fibre ends.

**M3C.3 • 15:15** ★ Top-Scored
**Ultra-Wideband Transmission Systems From an Energy Perspective: Which Band is Next?,** Ronit S. Sohanpal[1], Mindaugas Jarmolovicius[1], Jiaqian Yang[1], Eric Sillekens[1], Romulo Aparecido de Paula Junior[1], Vitaly Mikhailov[2], Jiawei Luo[2], David DiGiovanni[2], Ruben S. Luis[3], Hideaki Furukawa[3], Robert Killey[1], Polina Bayvel[1]; *[1]Univ. College London, UK; [2]Lightera Labs, USA; [3]National Inst. of Information and Communications Technology, Japan.* Measuring the power efficiency of the state-of-the-art OESCL-band amplifiers, we show that 1000 km OESCL-band systems can achieve 2.98× greater throughput for +48% higher energy-per-bit compared to CL-band transmission only.

## Room 408B

### M3D • Optical Phased Arrays, Free Space Beams, and Metasurface Devices—Continued

**M3D.4 • 15:00** Invited
**Functional Metasurface Devices for High-Speed Communication and Computing,** Takuo Tanemura[1]; *[1]Univ. of Tokyo, Japan.* We demonstrate Si, InP, and plasmonic metasurfaces embedded with organic electro-optic materials enabling >Gbps modulation, and a compact surface-normal receiver integrating Si metasurfaces with ultrafast InGaAs membrane photodetectors capable of detecting 240-Gbps 64QAM signals.

## Room 411

### M3E • Optical Amplifiers for Space Division Multiplexing—Continued

**M3E.3 • 15:00** ★ Top-Scored
**Multicore Native Bidirectional 4-Core Multicore EDFA With Back Reflection Circuit for Submarine Repeaters,** Hitoshi Takeshita[1], Yusuke Shimomura[1], Wakako Maeda[1]; *[1]NEC Corporation, Japan.* A demonstration of all key MCF-based modules for bidirectional MC-EDFA, including back reflection circuits, has been completed. The feasibility of improving bidirectional MC-EDFA spatial efficiency for submarine cables by eliminating fiber-based FIFOs was also confirmed.

**M3E.4 • 15:15**
**Low-Loss and Broadband MDL Compensation Using LPFG With Higher-Order Cladding-Mode Coupling,** Yoko Yamashita[1,2], Masaki Wada[1], Takanori Sato[2], Takumi Kimura[2], Taiji Sakamoto[1], Taro Iwaya[1], Kunimasa Saitoh[2], Takashi Matsui[1], Kazuhide Nakajima[1]; *[1]NTT, Inc., Japan; [2]Hokkaido Univ., Japan.* We demonstrated low-loss, broadband MDL compensation using femtosecond-laser-inscribed LPFG in two-mode fiber, reducing DMA from 3.2 to 0.17 dB with less than 0.2 dB insertion loss and reducing MDL penalty to below 1 dB.

## Room 501ABC

### M3F • Optical Switching for AI Networking—Continued

**M3F.3 • 14:45**
**A 4,096×4,096 Strictly Non-Blocking Optical Circuit Switch Delivering 819.2 Tb/s via Space-and-Wavelength Routing,** Koki Mano[1], Taisei Sekizuka[1], Takuma Kuno[1], Hiroshi Hasegawa[1], Yojiro Mori[2,1]; *[1]Nagoya Univ., Japan; [2]Toyota Technological Inst., Japan.* We propose non-blocking OCS architecture that combines space and wavelength routing, employing star couplers to avoid cascaded loss. Simulations show scalability, and experiments demonstrate 4,096×4,096 switching delivering 819.2 Tb/s in a single switching layer.

**M3F.4 • 15:00** ★ Top-Scored
**Reconfiguration-Aware Direct-Connect AI Cluster Using Spatial-and-Wavelength-Selective Switching,** Brett C. George[1], Weiyang Wang[2], Zhenguo Wu[1,3], Yuyang Wang[1,4], Xiang Meng[1], Manya Ghobadi[2], Keren Bergman[1]; *[1]Electrical Engineering, Columbia Univ., USA; [2]Computer Science, Massachusetts Inst. of Technology, USA; [3]NVIDIA Corp, USA; [4]Electrical Engineering, Univ. of Connecticut, USA.* We present a fully reconfiguration-aware direct-connect AI cluster by integrating a spatial-and-wavelength-selective switch with the Linux network stack. We demonstrate simultaneous network reconfiguration with bulk transfers of 6.4-TBytes and multitenant training of four ResNet-18 instances.

**M3F.5 • 15:15**
**Training-Phase-Aware Optical Circuit Switching Reconfiguration for Large Language Model,** Fangxiao Dong[1,2], Aakash Patel[3], Robert Kleijnen[3], Tongyun Li[1], James Myers[2], Richard Penty[1], Qixiang Cheng[1]; *[1]Univ. of Cambridge, UK; [2]Interuniversitair Micro-Elektronica Centrum, UK; [3]Interuniversitair Micro-Elektronica Centrum, Belgium.* We propose a phase-aware optical network that employs OCSs to dynamically reconfigure into phase-optimal topologies, while leveraging Rabenseifner's/Bruck mappings and slot amortisation, achieving 37.5% faster communication over static optical networks under established LLM training configurations.

## Room 502A

### M3G • Panel: High-Speed Optical Modulators for Intra-Data Center Links: Unlocking 400 Gb/s and Beyond per Lane—Continued

## Room 502B

### M3H • Visible Light and Optical Wireless Communication—Continued

**M3H.4 • 14:45**
**Experimental Demonstration of Fractional Vortex Communications With Free-Space Propagation,** Zhenyu Wan[1], Guofeng Yan[1], Min Yan[1], Bing Han[1], Jian Wang[1]; [1]*Huazhong Univ of Science and Technology, China*. We report the first experimental demonstration of fractional vortex (de)multiplexing with free-space propagation that overcomes the degradation of phase singularities during propagation by performing *k*-space mode demodulation, enabling mode orthogonality maintenance and detection efficiency enhancement.

**M3H.5 • 15:00** Tutorial
**Visible Light Communication:Device, System and Applications,** Nan Chi[1]; [1]*Fudan Univ., China*. This review surveys high-speed visible light communication advances, including new materials/devices, applications in space/marine/data-center interconnects, and AI-assisted channel modeling and signal processing.

Professor Nan Chi is the excutive dean of College of Future Information Technology, Fudan University, China. She is the author or co-author of more than 400 papers and has been cited more than 17000 times. Her current research interests include optical fiber communication and visible light communication. She is a fellow of the OPTICA.

## Room 515A

### M3I • Symposium: Beyond the Atmosphere: Architectures and Technologies for Optical Space Communication I—Continued

**M3I.3 • 15:00** Invited
**Secure Space Communication using Packet-Optical Networking,** Andreas Iselt[1]; [1]*Rivada Space Networks*, Germany. Combining optical intersatellite links with scalable high speed routing and intelligent resource control for LEO networks enables end-to-end network services completely routed in space without gateways. They provide secure, sovereign and truly global connectivity with low latency.

## Room 515B

### M3J • Fiber Sensing I—Continued

**M3J.4 • 14:45**
**Interconnected Counter-Propagating Recirculating Loops for Integrated Sensing and Communication Long-Haul Emulation,** Junyu Wu[1], Zexu Liu[1], Lei Liu[1,2], Honglin Ji[3], William Shieh[1,2]; [1]*Westlake Univ., China;* [2]*Westlake Inst. for Optoelectronics, China;* [3]*Pengcheng Laboratory, China*. We demonstrate a counter-propagating recirculating loop with high-loss loopbacks as a lab platform for ultra-long-haul integrated sensing and communication, which is validated by the co-propagation of 15×32-GBaud PDM-QPSK signals with a 2.36-km-spatial-resolution DAS over 1688.6-km-SSMF.

**M3J.5 • 15:00** Tutorial
**Fiber Optics Sensing: Technology & Applications,** Ezra Ip[1], Yue-Kai Huang[1], Fatih Yaman[1], Junqiang Hu[1], Ming-Fang Huang[1], Shaobo Han[1], Jian Fang[1], Tingfeng Li[1], Sarper Ozharar[1], Yoshiaki Aono[2], Koji Asahi[2], Ting Wang[1]; [1]*NEC Laboratories America Inc., USA;* [2]*NEC Corporation, Japan*. Distributed fiber-optic sensing (DFOS) over terrestrial and submarine cables enables low-cost environmental monitoring to enhance public safety, facilitate smarter cities, and is a valuable scientific research tool. We review DFOS technologies and recent experimental results.

Ezra Ip received his B.E. (Hons) in Electrical & Electronics Engineering from the University of Canterbury, New Zealand, and his M.S. and Ph.D. in Electrical Engineering from Stanford University, USA. He is currently a senior researcher in the Optical Networking and Sensing Department at NEC Laboratories America.

## Room 518

### M3K • Machine-Learning Assisted Design and Optimization—Continued

**M3K.4 • 15:00**
**Neural-Network-Based Nonlinear Digital Pre-Distortion for Electronically-Multiplexed DACs,** Lukas Rapp[1], Xi Chen[3], Di Che[2]; [1]*Massachusetts Inst. of Technology, USA;* [3]*Nokia Bell Labs, USA*. We propose a neural-network-based nonlinear digital pre-distortion framework for electronically multiplexed DACs. Our experimental results show > 1.4-dB RF SNR improvement, which leads to a single λ IM-DD system with a net rate up to 600 Gb/s.

**M3K.5 • 15:15**
**Neural Network Optimized Spike Encoding for Power-Efficient and High-Speed Spiking Neural Network Equalization in IM/DD Systems,** Shuangxu Li[1], Georg Böcherer[1], Stefano Calabro[1]; [1]*Huawei Technologies Duesseldorf GmbH, Germany*. A neural network spike encoder paired with a spiking neural network equalizer is proposed for an IM/DD link. It achieves a 1.7dB gain over a linear equalizer, offering a low-spike-rate, energy-efficient solution for neuromorphic hardware.

## Room 403A

### M3A • AI Failure and Anomaly Detection in Optical Networks—Continued

**M3A.6 • 15:30**
**Conditional Denoising Diffusion Probabilistic Model for Trustworthy Failure Prediction in Optical Networks,** Qian Guo[1], Chunyu Zhang[2], Xue Xiao[1], Min Zhang[1], Yang Tao[1], Xunjie Jiang[3], Danshi Wang[1]; *[1]Beijing Univ. of Posts and Telecommunications, China; [2]Univ. of Science and Technology Beijing, China; [3]China United Network Communications Co Ltd, China.* A CDDPMT-based trustworthy failure prediction scheme is proposed in optical networks, which can not only achieve F1 score up to 97.42%, but also provides explicit confidence and uncertainties quantification for the predictions to assist decision-making.

**M3A.7 • 15:45**
**Experimental Demonstration of Online Learning-Based Concept Drift Adaptation for Failure Detection in Optical Networks,** Yousuf Moiz Ali[1], Jaroslaw Prilepsky[1], Joao Pedro[2,3], Antonio Napoli[4], Sasipim Srivallapanondh[4], Sergei K. Turitsyn[1], Pedro Freire[1]; *[1]Aston Univ., UK; [2]Nokia Oy, Portugal; [3]Instituto de Telecomunicacoes Lisboa, Portugal; [4]Nokia Oy, Germany.* We present a novel online learning-based approach for concept drift adaptation in optical network failure detection, achieving up to a 70% improvement in performance over conventional static models while maintaining low latency.

## Room 403B

### M3B • Digital and Analog Signal Processing—Continued

**M3B.6 • 15:30**
**200-Gbaud Single-Wavelength Direct-Detection Transmission Over 75 km C-Band SSMF Using a PIC-Based Recurrent Spectrum Slicer,** Hao Liu[1], Kostas Sozos[2], Isidora Teofilovic[3], Suttikarn Wantee[1], Kyle Bottrill[1], Stéphane Malhouitre[4], Stéphanie garcia[4], George Sarantoglou[5], Peter Bienstman[6], Benoit Charbonnier[4], Charis Mesaritakis[5], Caterina Vigliar[3], Francesco Da Ros[3], Adonis Bogris[2], Periklis Petropoulos[1]; *[1]Optoelectronics Research Centre, Univ. of Southampton, UK; [2]Department of Informatics and Computer Engineering, Univ. of West Attica, Greece; [3]DTU Electro, Technical Univ. of Denmark, Denmark; [4]CEA-Leti, Univ. of Grenoble Alpes, France; [5]Department of Biomedical Engineering, Univ. of West Attica, Greece; [6]Ghent Univ./imec, Belgium.* We demonstrate C-band IM/DD transmissions of 160-GBaud (175-GBaud) PAM-4 over 50 km (25 km) and 200-GBaud OOK over 75 km, with dispersion-induced power fading effectively mitigated by a silicon-photonic recurrent optical spectrum slicer, achieving a dispersion tolerance up to 2.4 × $10^5$ GBd*ps/nm.

**M3B.7 • 15:45**
**On the Transceiver Nonlinear Compensation Enhancing Power Budget in Amplifierless DCN Coherent Systems,** Trung-Hien Nguyen[1], Sami Mumtaz[1], Celestino Sanches Martins[1], Kayol Mayer[1], Zhihang Wu[1], Haoyang Qiu[1], Abel Lorences-Riesgo[1], Gabriel Charlet[1]; *[1]Optical Communication Technology Lab., Huawei Technologies France SAS, France.* We experimentally demonstrate transceiver nonlinear compensation combining transmitter pre-distortion and receiver post-compensation to enhance the power budget in 20 km SSMF amplifierless 150 GBaud CS-256QAM coherent 1.6T DCN systems, showing 6 dB power budget extension.

## Room 408A

### M3C • Ultra-wideband Transmission Systems—Continued

**M3C.4 • 15:30**
**Design Consideration of Lumped Raman Amplifiers in S-Band Multi-Span Transmission to Minimize Transmission Performance Impairments,** hiroyuki irie[2], Kyousuke Sone[2], Shun Okada[2], Yu Tanaka[2], Shigehiro Takasaka[1], Jyunji Yoshida[1], Takeshi Hoshida[2]; *[1]Furukawa Denki Kogyo Kabushiki Kaisha, Japan; [2]1Finity Inc., Japan.* Transmission performance impairments in 3-span transmission using S-band lumped Raman amplifiers were analyzed experimentally and numerically, and a design guideline in view of chromatic dispersion of lumped Raman amplifiers was derived through systematic simulations.

**M3C.5 • 15:45**
**A Hybrid ISRS IS-EGN Model: Combining a Closed-Form Power Profile With Numerical Importance Sampling,** Giuseppe Parisi[1], Pablo Torres-Ferrera[1], Tiago Silvério[1], Antonio Napoli[1]; *[1]Nokia Solutions and Networks Oy, Germany.* We introduce a semi-analytical method for evaluating the Inter-Channel Stimulated Raman Scattering (ISRS) for C+L band systems exploiting EGN model, designed for high computational efficiency. The formulation's accuracy matches with pre- viously published results.

## Room 408B

### M3D • Optical Phased Arrays, Free Space Beams, and Metasurface Devices—Continued

**M3D.5 • 15:30**
**Flat-Top Beam Shaping in the Far-Field Using on-Chip Fourier-Transform Optical Phased Arrays,** heming hu[1], Jie Li[1], Wenqiang Yue[1], Ziming Wang[1], Weipeng Wang[1], Huan Qu[1], Baisong Chen[1], Yingzhi Li[1], Zihao Zhi[1], xianqi pang[1], Haolun Du[1], Guiyang Zhang[1], Qian Wang[2], Jinglei Qin[2], Mengjia Jin[2], Quanxin Na[3], Qijie Xie[3], Xiaolong Hu[1], Junfeng Song[1,3]; *[1]Jilin Univ., China; [2]YanDong MicroElectronic Technology Co, China; [3]Pengcheng Laboratory, China.* We demonstrate a passive optical phased array (OPA) chip that can achieve on-chip Fourier transform, ultimately generating square beams in the far field and realizing compact beam shaping without the need for external lenses.

**M3D.6 • 15:45**
**Slanted-Grating-Enabled Lens-Free Switch Array for Structured Light Imaging,** Yuan Qiqi[1], Danye Wang[1], Chen Yitao[1], Xu Weihan[1], Lu Liangjun[1,2], Xinwan Li[1], Jianping Chen[1,2], Linjie Zhou[1,2]; *[1]State Key Laboratory of Advanced Optical Communication Systems and Networks, Shanghai Jiao Tong Univ., China; [2]SJTU-Pinghu Inst. of Intelligent Optoelectronics, Shanghai Jiao Tong Univ., China.* We present a lens-free, solid-state structured light imaging system utilizing a 1×64 optical switch array of large-aperture slanted grating antennas. This design removes the constraints of conventional lens-assisted or optical phased arrays illuminators, enabling a large FOV of 100°×8° without limitations on active alignment or aliasing side lobes.

## Room 411

### M3E • Optical Amplifiers for Space Division Multiplexing—Continued

**M3E.5 • 15:30**
**Improved Power Efficiency in Cladding-Pumped Multi-Core Amplifier by Distributed Nonuniform Bend Control,** Taiji Sakamoto[1], Masaki Wada[1], Ryota Imada[1], Kazuhide Nakajima[1]; *[1]NTT Access Service Systems Laboratories, Japan.* We demonstrate enhanced power conversion efficiency (PCE) in a cladding-pumped 4-core fiber amplifier by optimizing the longitudinal bend profile, achieving an approximately 1.08-fold improvement and a record-high PCE of 18.2%.

**M3E.6 • 15:45**
**Exceeding 10% Pump-Conversion Efficiency for Weakly Coupled Four-Core EDFA With Optimized Cladding Profile,** Masaki Wada[1], Taiji Sakamoto[1], Nobutomo Hanzawa[1], Kouhei Omoto[1], Asa Kiuchi[1], Takashi Matsui[1], Kazuhide Nakajima[1]; *[1]NTT Access Network Service Systems Laboratories, Japan.* We designed a deeply center-depressed cladding structure to enhance the core-to-cladding ratio and pump density in a four-core EDF. It achieved 10.2% PCE, the highest among weakly coupled multicore EDFAs in the C-band.

## Room 501ABC

### M3F • Optical Switching for AI Networking—Continued

**M3F.6 • 15:30** Invited
**Optical Switching for AI Factories,** Giannis Patronas[1], Nikos Terzenidis[1], Petr Lapukhov[1], Dimitris Syrivelis[1], Eitan Zahavi[1], Craig Thompson[1], Athanasios Fevgas[1], David King[1], Julie Bernauer[1], Elad Mentovich[1], Paraskevas Bakopoulos[1]; *[1]NVIDIA Corporation, Greece.* As advances in AI drive productivity, the need for expansive GPU clusters rises. Meeting this demand calls for unprecedented bandwidth, improved energy efficiency and robust network fabrics. We examine optical switching as an architectural response.

## Room 502A

### M3G • Panel: High-Speed Optical Modulators for Intra-Data Center Links: Unlocking 400 Gb/s and Beyond per Lane—Continued

## Room 502B

### M3H • Visible Light and Optical Wireless Communication—Continued

## Room 515A

### M3I • Symposium: Beyond the Atmosphere: Architectures and Technologies for Optical Space Communication I—Continued

A discussion will follow the presentations.

## Room 515B

### M3J • Fiber Sensing I—Continued

## Room 518

### M3K • Machine-Learning Assisted Design and Optimization—Continued

**M3K.6 • 15:30**
**Circular Reservoir-Computing–Assisted Hybrid Equalizer for Joint Linear/Nonlinear Compensation in 106-Gb/s PAM4 IM/DD Optical Links,** govind sharan yadav[1], Benedictus Y. Widhianto[2], Sheng-Yuan Zheng[1], Chun-Yen Chuang[2], Kai-Ming Feng[1], Jyehong Chen[2], Young-Kai Chen[3]; [1]*Inst. of Communications Engineering, National Tsing Hua Univ., Taiwan;* [2]*Department of Photonics, National Yang-Ming Chiao Tung Univ., Taiwan;* [3]*Coherent/II-VI, Pittsburgh, USA.* We experimentally demonstrate a novel low-complexity Circular RCH-EQ for 106-Gb/s PAM4 IM/DD links, achieving 98% sparsity and outperforming linear and Volterra equalizers across nonlinear regimes with scalable, energy-efficient implementation for short-reach optical interconnects.

**M3K.7 • 15:45**
**Experimental Investigation on Information Rate and Achievable Security in Y-00 Cipher Transmission Using $2^{14}$ (=16,384)-Level Probabilistically Shaped QAM,** Ryosuke Matsumoto[1,4], Ken Tanizawa[2], Alireza Derkani[4], Fausto Gomez-Agis[3], Jeffrey Lee[3], Aaron Albores-Mejia[3], Satoshi Suda[1], Chigo Okonkwo[4,3], Fumio Futami[2]; [1]*AIST, Japan;* [2]*Tamagawa Univ., Japan;* [3]*CUbIQ Technologies, Netherlands;* [4]*Eindhoven Univ. of Technology (TU/e), Netherlands.* We experimentally demonstrate Y-00 cipher transmission on an FPGA prototype, achieving 0.8-dB shaping gain using an encrypted PS-16,384QAM signal. High security is confirmed with the eavesdropper detection failure probability reaching as high as 99%.

## 14:00–16:00
## M3Z • Demo Zone and ML Challenge

**M3Z.1**
**Demonstration of Customer-Owned and Carrier-Controlled Coherent Pluggables Using Ownership-Aware YANG Models,** Angela Mitrovska[1,2], Hussein Zaid[1], Behnam Shariati[1], Pooyan Safari[1], Johannes Fischer[1], Ronald Freund[1,2]; *[1]Fraunhofer-Institut fur Nachrichtentechnik Heinrich-Hertz-Institut HHI, Germany; [2]Technische Universitat Berlin, Germany.* We demonstrate a governed control framework that validates NETCONF operations against customer-defined policies using augmented YANG models and dataspace connectors, enabling carrier control of customer-owned coherent pluggables within a live IPoWDM setup.

**M3Z.2**
**Open-Source Telemetry Plane for Integrating Optical Sensing With Network Orchestration: ML-Aided Alerts for Proactive Restoration,** Renato Ambrosone[1], Gulmina Malik[1], Riccardo Schips[1], Stefano Straullu[2], Francesco Aquilino[2], Antonino Nespola[2], Emanuele E. Virgillito[1], Vittorio Curri[1]; *[1]Politecnico di Torino, Italy; [2]Fondazione LINKS, Italy.* We demonstrate an open-source real-time telemetry plane unifying SOP-based fiber sensing with optical telemetry and network orchestration. Queue-backed streaming feeds an ML-aided classifier for early alerts, enabling proactive restoration.

**M3Z.3**
**Digital Twin-Driven Disaggregated Optical Network Reconfiguration and Optimization With Automated Conflict Resolution,** Dmitrii Briantcev[1], Deborsi Basu[2], Shuang Xie[1], Agastya Raj[2], Peyman Pahlevanzadeh[2], Harry Leddy[1], Johannes Halbach[1], Venkata Virajit Garbhapu[2], Daniel C. Kilper[1], Marco Ruffini[2], Merim Dzaferagic[2]; *[1]School of Engineering, The Univ. of Dublin Trinity College, Ireland; [2]School of Computer Science and Statistics, The Univ. of Dublin Trinity College, Ireland.* We demonstrate a digital twin-enabled optical controller for disaggregated optical networks operating on a lab-based metro mesh network with conflict detection and resolution for QoT optimization and dynamic route and wavelength assignment.

**M3Z.4**
**Demonstration of an on-Prem Conversational AI Assistant for Unified Network Operations and Observability,** Hussein Zaid[1], Behnam Shariati[1], Pooyan Safari[1], Aydin Jafari[1], Johannes Fischer[1], Ronald Freund[1,2]; *[1]Fraunhofer HHI, Germany; [2]Technische Universitat Berlin, Germany.* We demonstrate an on-prem LLM-based multi-agent system exposing a friendly UI to empower network admins to manage inventory, service provisioning, configurations and telemetry of IP/Optical infrastructures, and to generate observability dashboards for seamless reporting.

**M3Z.5**
**Scaling Optical Testbed Data Space for Data Sharing Across Vendor and Organizational Boundaries,** Angela Mitrovska[1,2], Yusuke Hirota[3], Vignesh Karunakaran[4,5], Agastya Raj[6], Sugang Xu[3], Taiga Suzuki[3], Aydin Jafari[1], Nikhil Dsilva[4], Behnam Shariati[1], Yuki Yoshida[3], Achim Autenrieth[4], Marco Ruffini[6], Pooyan Safari[1], Johannes Fischer[1], Ronald Freund[1,2], Yoshinari Awaji[3], Thomas Bauschert[5]; *[1]Fraunhofer-Institut fur Nachrichtentechnik Heinrich-Hertz-Institut HHI, Germany; [2]Technische Universitat Berlin, Germany; [3]National Inst of Information & Comm Tech, Japan; [4]Adtran Networks SE, Germany; [5]Technische Universitat Chemnitz, Germany; [6]Trinity College Dublin School of School of Computer Science and Statistics, Ireland.* We demonstrate a data-sharing platform enabling on-demand sovereign data exchange across optical testbeds and system vendors to support ML development and predictive maintenance, through advanced vendor-, anonymization-, and purpose-based governance controls.

**M3Z.6**
**Intent-Driven Slicing Across Federated Compute and Optical Transport Networks,** Aristotelis Kretsis[1,2], Polizois Soumplis[1,2], Ramon Casellas[3], RENATO AMBROSONE[4], Riccardo Schips[4], Vittorio Curri[4], Pablo A. Robles[5], Oscar G. De Dios[5], Antonio Buendia Lopez[6], Francisco Moreno Muro[6], Konstantinos (Kostas) Christodoulopoulos[2], Konstantinos Yiannopoulos[2,8], Antonino Nespola[7], Emmanouel Varvarigos[1,2]; *[1]School of Electrical and Computer Engineering, Ethniko Metsobio Polytechneio, Greece; [2]Inst. of Communication and Computer Systems, Greece; [3]CTTC/CERCA, Spain; [4]Politecnico di Torino, Italy; [5]Telefonica de Espana, Spain; [6]E-Lighthouse, Spain; [7]Fondazione LINKS, Italy; [8]Department of Informatics and Telecommunications, Panepistemio Peloponnesou, Greece.* We demonstrate intent-driven orchestration unifying federated compute and disaggregated optical transport. A Service Orchestrator translates 3GPP intents into coordinated placement and QoT-validated transport slices, enabling zero-touch deployment on a multi-vendor testbed.

**M3Z.7**
**Demonstration of Remote Robotic Control by Industrial Protocol Softwarization Over 117 km All Photonics Network,** Yushi Koyasako[1], Shumpei Kawaguchi[1], Hiroshi Ou[1], Tomoya Hatano[1], Tatsuya Shimada[1]; *[1]NTT Corporation, Japan.* We present a software-defined industrial architecture that virtualizes industrial protocol functions on general-purpose servers to improve flexibility and interoperability. We demonstrate remote robotic control of heterogeneous robot arms over a 117 km All Photonics Network.

**M3Z.8**
**Distributed Intelligence Framework With Privacy-Preserving Features for FTTR Network Monitoring and Automation,** Massimiliano Sica[2,1], Mihail Balanici[2], Muhammad Rehan Raza[2], Behnam Shariati[2], Johannes Fischer[2], Ronald Freund[2,1]; *[1]Technische Universitat Berlin, Germany; [2]Fraunhofer-Institut fur Nachrichtentechnik Heinrich-Hertz-Institut HHI, Germany.* This work demonstrates a novel distributed intelligence framework for fiber-to-the-room networks, designed to collect telemetry data locally and utilize them for autonomous network reconfiguration and management, while ensuring data confidentiality and compliance with privacy regulations.

**M3Z.9**
**Live Demonstration of Optical Connection Switching by APN-Transceiver and No Wavelength Dependance APN-Splitter for Distributed Access Network,** Yuya Saito[1], Naoki Umezawa[1], Yasuhiro Takizawa[1], Manabu Kotani[1], Shinya Ito[1], Koyama Shinichi[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 APN-T and no wavelength dependence APN-S. Our demonstration shows an innovative architecture to apply APN practically to distributed access systems.

**M3Z.10**
**Autonomous Capacity Scaling in Optical Metro Access Networks via Hierarchical SDN Control: a Demonstration,** Luca Vettori[1], Ricardo Martínez[1], Ramon Casellas[1], Francisco J. Vilchez[1], Josep Maria Fàbrega[1], Ricard Vilalta[1], Raül Muñoz[1]; *[1]CTTC, Spain.* Telemetry is foundational for multi-layer SDN automation operations enabling real-time state awareness. This demonstration showcases a hierarchical controller exploiting cross-domain telemetry data to autonomously trigger optical-layer capacity upgrades and resolve congestion, ensuring service assurance.

**M3Z.11**
**Energy-Efficient Multiband Metro Network Emulator With Physical-Layer-Impairment-Aware Digital Twin,** Takashi Miyamura[1,2], Satoru Okamoto[1], Masahiko Jinno[1,3], Naoaki Yamanaka[1]; *[1]Keio Univ., Japan; [2]Senshu Univ., Japan; [3]Kagawa Univ., Japan.* We demonstrate an OpenROADM-based network emulator with physical-layer-impairment-aware Digital Twin achieving near-real-time and highly accurate Raman-tilt prediction for energy-efficient multiband metro networks. 200-channel C+L multiband network operation is demonstrated.

**M3Z.12**
**Demonstration of a 50-Gbit/s Quantum Random Number Generator Prototype Based on Vacuum Fluctuations,** Ken Tanizawa[1], Kentaro Kato[1], Fumio Futami[1]; *[1]Tamagawa Univ., Japan.* We live demonstrate the stable real-time operation of a spatially multiplexed 50-Gbit/s quantum random number generator housed in a 2U chassis. Unpredictable random numbers, certified in accordance with NIST SP 800-90B, are output via dual 25G-SFP modules.

**M3Z.13**
**Autonomous Intent-Driven Optimization of PONs: a Vendor-Agnostic DRL Demonstration,** Lucas M. Inglés[1,2], Luiz Anet Neto[1], Claudina Rattaro[2], Michel Morvan[1], Alberto Castro[2], Loutfi Nuaymi[1]; *[1]IMT Atlantique, France; [2]Universidad de la Republica Uruguay, Uruguay.* We demonstrate a Deep Reinforcement Learning application for autonomous T-CONT configuration in passive optical networks. Using DDQN, we achieve vendor-agnostic dynamic upstream-latency optimization in a fixed–mobile convergence use case.

**M3Z.14**
**Distributed Evaluation for Optical-Electronic Hybrid Networking in Large-Scale AI Data Center,** yaping yang[1], Jiayi Tu[1], Rentao Gu[1], Yuefeng Ji[1]; *[1]Beijing Univ. of Posts and Telecommunications, China.* Enabled by a Raspberry-Pi cluster emulating vGPUs and optical-electronic switching behaviors, we present the first distributed, lightweight evaluation platform for ten-thousand-GPU optical-electronic hybrid networking in AI data centers, evaluated by GPT-22B training by SimAI framework.

**M3Z.15**
**AI Agent-Driven Network-Aware Decentralized Compute Resource Brokering,** Sarvesh S. Bidkar[1], Aditya Gudal[1], Lawrence Drabeck[1], Jesse E. Simsarian[1], Bart Theeten[1], Manzoor A. Khan[1]; *[1]Nokia Bell Labs, USA.* We demonstrate an AI-agent driven platform integrating IP+optical network orchestration with decentralized GPU compute sharing, enabling intelligent resource allocation based on network latency, throughput, and cost optimization for artificial intelligence workloads.

**M3Z.16**
**Exploiting ETSI TeraFlowSDN to Control Innovative Optical Networks,** Andrea Sgambelluri[1,2], Michael Enrico[3], Lluis Gifre[4], Pablo A. Robles[5], Waleed Akbar[4], Raul Muñoz[4], Oscar G. De Dios[5], Nicola Sambo[1], Filippo Cugini[2]; *[1]Scuola Superiore Sant'Anna, Italy; [2]Consorzio Nazionale Interuniversitario per le Telecomunicazioni, Italy; [3]Huber+Suhner AG, Switzerland; [4]Centre Tecnologic de Telecomunicacions de Catalunya, Spain; [5]Telefonica I+D, Spain.* This paper highlights the key functionalities of a optical controller based on TeraFlowSDN in the context of IPoWDM flex-grid and multi-granular scenarios. Live interaction will be offered to the audience while enabling heterogeneous optical connectivity services.

## 14:00–15:30
## Dataset and Machine Learning Challenge

**M3M.1 • 14:00 Dataset**
**Dataset for Traffic Monitoring Using Distributed Acoustic Sensing in Busy Traffic Environments,** Yinghuan Li[1], Jingming Zhang[1], Changyuan Yu[1], Jipeng Liu[2], Yaxi Yan[1], Alan Pak Tao Lau[1]; [1]*Department of Electrical and Electronic Engineering, The Hong Kong Polytechnic Univ., Hong Kong;* [2]*Department of Industrial and Systems Engineering, The Hong Kong Polytechnic Univ., Hong Kong.* Distributed acoustic sensing (DAS) with existing telecommunication infrastructure has become an innovative traffic monitoring solution. We provide a dataset in a busy challenging traffic environment as a benchmark to advance algorithms for smart city applications.

**M3M.2 • 14:15 Dataset**
**Experimental Semiconductor Optical Amplifier Dataset for Machine Learning,** Alan Yuan[1], Chenxi Tan[1], Seb J. Savory[1]; [1]*Department of Engineering, Univ. of Cambridge, UK.* We provide an experimentally measured dataset for two SOAs, including gain, spectral and nonlinear characteristics across different input powers, injection currents and temperatures. We demonstrate a machine learning application using Gaussian Process Regression.

**M3M.3 • 14:30 Dataset**
**An Open-Source MmWave Analog Radio-Over-Fiber Dataset Enabling Machine Learning Applications,** Qianyi Zhao[1], Christina Lim[1], Ampalavanapillai Nirmalathas[1]; [1]*Department of Electrical and Electronic Engineering, Univ. of Melbourne, Australia.* We present the first open-source mmWave analog radio-over-fiber dataset (28-30 GHz signal over 0-10km SMF). We provide transmitted/ received QAM waveforms and baseline ML equalizers for validation and benchmark.

**M3M.4 • 14:45 Dataset**
**Open-Source Data for Multi-Domain Network Monitoring and Sensing in Optical and Wireless Networks,** SEN SHEN[1], Xueqing Zhou[1], Wanxin Zhao[1], Ruizhi Yang[1], Vaigai Yokar[1], Shuangyi Yan[1], Dimitra Simeonidou[1]; [1]*Univ. of Bristol, UK.* We propose a cross-domain telemetry architecture for optical and wireless networks, and collect multi-source datasets, supporting AI engines and network DTs. The released datasets provide insights for QoT estimation, fibre sensing and multi-domain network optimisation.

The Machine Learning Challenge Finalists will give demonstrations following the Dataset presentations.

## Room 403A

**16:30–18:30**
**M4A • QoT and AI Based Digital Twins**
*Presider: Massimo Tornatore; Politecnico di Milano, Italy*

**M4A.1 • 16:30** Invited
**Practical Strategies Leveraging AI and Digital Twins for the Design and Management of Future Optical Networks,** Camille Delezoide[1], Ambashri Purkayastha[1,2], Patricia Layec[1]; *[1]Nokia Bell Labs, France; [2]SAMOVAR, Télécom SudParis, Institut Polytechnique de Paris, France.* This paper explores operationally reliable combinations of IA and physics through digital twins to optimize optical networks. Key methodologies and applications are discussed, addressing security, scalability, automation and sustainability.

**M4A.2 • 17:00**
**Agnostic QoT Probing via Receiver-Side ASE Loading in a Production Metro for Transparent Datacenter Exchange,** RENATO AMBROSONE[1,2], Andrea D'Amico[2], Stefano Straullu[3], Matteo Colantonio[4], Gloria Vuagnin[4], Paolo Bolletta[4], Francesco Aquilino[3], Vittorio Curri[1]; *[1]Politecnico di Torino, Italy; [2]NEC Laboratories America Inc, USA; [3]Fondazione LINKS, Italy; [4]Consortium GARR, Italy.* We demonstrate agnostic QoT probing for datacenter exchange in a metro network via receiver-side ASE loading. Knowing BER telemetry and the progressive ASE load, the device estimates GSNR, enabling IPoWDM operations and digital-twin calibration.

## Room 403B

**16:30–18:30**
**M4B • Optical Engines**
*Presider: Ying Zhao; Aloe Semiconductor Inc., USA*

**M4B.1 • 16:30** Invited
**Integrated Optical I/O Chiplets for Bandwidth Scaling in AI Infrastructure,** Thomas Liljeberg[1]; *[1]Intel Corporation, USA.* We present a review of advances in Silicon Photonics technology to enable high-density, power-efficient optical I/O chiplets. The presentation will address key device level results, as well as progress towards deployment of fully integrated solutions.

**M4B.2 • 17:00** ★ Top-Scored
**A 256 Gb/s DWDM Optical I/O in a 3D-Stacked EIC/PIC Silicon Photonics Platform,** Nandish Mehta[1], Angad Rekhi[1], Nikola Nedovic[1], Sanquan Song[1], Benjamin Lee[1], Georgios Kalogerakis[1], Li Xu[1], Brian Zimmer[1], Steve Tell[1], Yoshi Nishi[1], Xi Chen[1], Ward Lopes[1], Trey greer[1], Tom Gray[1]; *[1]NVIDIA Research, NVIDIA Corporation, USA.* We present an (8+1)x32 Gb/s/λ DWDM optical I/O comprising eight data and one bandpass-filtered forwarded-clock lane in a 3D-stacked 7 nm EIC/65 nm PIC Silicon-photonics platform. It achieves $7.14\times10^{-14}$ BER and 1.33Tb/s/mm² areal bandwidth density.

## Room 408A

**16:30–18:30**
**M4C • Optical Parametric and Raman Amplifiers**
*Presider: Kenneth Kin-Yip Wong; Univ. of Hong Kong, Hong Kong*

**M4C.1 • 16:30** Tutorial
**Optical Parametric Amplifiers and Their Applications,** Peter A. Andrekson[1]; *[1]Chalmers Tekniska Högskola, Sweden.* I will review the basics of optical parametric amplifiers based on highly nonlinear fibers and on silicon-nitride waveguides along with applications such as sensitive receivers for deep-space transmission links and broadband amplification for widely tunable lasers.

Andrekson is a professor at Chalmers University, in Sweden. His research interests include many aspects of communications including optical amplifiers, nonlinear propagation, and all-optical functionalities. He is a Fellow of Optica, the IEEE, the Royal Swedish Academy of Engineering Sciences (IVA), and a distinguished professor of the Swedish research council.

## Room 408B

**16:30–18:30**
**M4D • Heterogeneous Integrated Devices**
*Presider: Mizuki Shirao; Mitsubishi Electric Corporation, Japan*

**M4D.1 • 16:30** Invited
**Membrane III-v Photonic Devices for Chip-to-Chip Interconnection,** Tatsurou Hiraki[1,2], Takuro Fujii[1,2], Takuma Aihara[1,2], Yoshiho Maeda[1,2], Tadashi Minotani[1,2], Norio Sato[1,2], Tomonari Sato[1,2], Shinji Matsuo[2]; *[1]Device Innovation Center, NTT, Inc., Japan; [2]Device Technology Labs, NTT, Inc., Japan.* Membrane III–V photonic devices on silicon provide strong optical confinement, small footprints, and low capacitance, enabling energy-efficient, high-speed modulators and lasers that support dense chip-to-chip interconnects for sustaining advanced AI performance at scale.

**M4D.2 • 17:00**
**IQ Modulators With Two Segments Using InP/SOI Chip-on-Wafer Bonding Process for Optical DAC,** Hajime Tanaka[1,2], Naotaka Kasuya[1,2], Taichi Misawa[2], Yohei Sobu[1,3], Shuntaro Maeda[5], Kento Komatsu[1,2], Naoko Inoue[1,2], Takehiko Kikuchi[1,2], Takuya Mitarai[1,2], Shun Kimura[1,2], Naoki Fujiwara[1,2], Nobuhiko Nishiyama[1,4], Takuo Tanemura[5], Shinsuke Tanaka[1,3], Hideki Yagi[1,2]; *[1]Photonics Electronics Technology Research Association, Japan; [2]Sumitomo Denki Kogyo Kabushiki Kaisha, Japan; [3]1Finity .Inc, Japan; [4]Electrical and Electronic Engineering, Tokyo Kagaku Daigaku, Japan; [5]School of Engineering, Tokyo Daigaku, Japan.* We fabricated IQ modulators consisting of two segments using InP/Si chip-on-wafer bonding. Electrical/optical 3-dB bandwidth is approximately 60 GHz (Vπ: 5.4 V). The symbol rate up to 64 GBaud is demonstrated in 16QAM operation using optical DAC.

## Room 411

**16:30–18:30**
**M4E • Few-Mode and Multi-Mode Fiber**
*Presider: Jin-Xing Cai; SubCom LLC, USA*

**M4E.1 • 16:30** Invited
**Few-Mode Fibers: Why Do They Still Matter?,** Pierre Sillard[1]; *[1]Prysmian, France.* We review the key aspects of few-mode fiber technology, including density, capacity, cost and cable deployment, and show that few-mode fibers continue to be highly relevant.

**M4E.2 • 17:00**
**S, C and L-Band Characterization of a Differential Mode Delay Compensated Few-Mode Fiber Link,** Julian Schneck[1], Nicolas Fontaine[2], Mikael Mazur[2], Kazuhiko Aikawa[3], Simon Abdani[1], Wolfgang Vogel[1], Georg Rademacher[1]; *[1]Universitat Stuttgart, Germany; [2]Nokia Bell Labs, USA; [3]Kabushiki Kaisha Fujikura Sakura Jigyosho, Japan.* We characterize wavelength-dependent differential mode delay compensation in a three-mode fiber across 1480-1620 nm in an anechoic chamber. Swept wavelength interferometry reveals modal delay suppression characteristics, demonstrating effective DMD mitigation for spatial division multiplexing applications.

## Room 501ABC

**16:30–18:15**
**M4F • Photonic Interconnects for Scalable AI**
*Presider: Angelina Totovic; Celestial AI, Greece*

**M4F.1 • 16:30** ★ Top-Scored
**1024x1024 All-to-All Interconnect Thin-CLOS-LION System Using 64 Lambda Routing on Athermal 64x64 ULCF AWGRs,** S. J. Ben Yoo[1,2], Bart Fondeur[3], Michael Jin[3], Airon Zhang[3], Zheng Chen[3], Ashok Balakrishnan[3]; *[1]Univ. of California Davis, USA; [2]E O Lawrence Berkeley National Laboratory, USA; [3]Enablence, Inc, USA.* We design, integrate, and test 1024x1024 All-to-All Interconnect Thin-CLOS-LION system using 64 lambda routing on athermal 64x64 Uniform-Loss-Cyclic-Frequency AWGRs. The system-wide loss and crosstalk as low as 7.5 dB and -24 dB have been achieved.

**M4F.2 • 16:45**
**Accelerating LLM Training in Optical AI Clusters With Asynchronously-Invoked Hitless in-Job Partial TPE,** Yuxuan Dou[1], Zeyu Li[1], Xuexia Xie[1], Xiaoliang Chen[1], Zuqing Zhu[1]; *[1]Univ. of Science and Technology of China, China.* We propose a generic framework for an optical AI cluster to perform in-job partial reconfiguration of OCS' across communication phases in LLM training. By dynamically adapting inter-rack topology to time-varying traffic matrix of training, our proposal enhances utilization of otherwise idle connections and effectively accelerates GPT-2 training.

**M4F.3 • 17:00**
**All-Optical Analog AllReduce and Digital Switching Using a Silicon Hybrid Computing-Switching Optical Processor,** Ryotaro Konoike[1], Kazuhiro Ikeda[1], Takeru Amano[1], Guangwei Cong[1]; *[1]National Inst. of Advanced Industrial Science and Technology (AIST), Japan.* We propose and experimentally demonstrate all-optical AllReduce operation by dynamically configuring a 4×4 silicon optical switch, which is a fundamental collective operation on xPU clusters. Our results lead to future ultra-low-power and low-latency AI datacenter.

## Room 502A

**16:30–18:30**
**M4G • Panel: Probabilistic Amplitude Shaping after 10 Years: Where Are we Now and What is to Come?**

**Organizers:**
Stella Civelli, *CNR-IEIIT, Italy*
David Millar, *Nokia, USA*

**Speakers:**
Georg Böcherer, *Ciena, Germany*
Ian Robers, *Ciena, USA*
Junho Cho, *Nokia, USA*
Marco Secondini, *Scuola Superiore Sant'Anna, Italy*
Olga Vassilieva, *1Finity Americas, Inc., USA*

Since its introduction a decade ago, probabilistic amplitude shaping (PAS) has evolved from a topic of academic interest to a mainstream, near ubiquitous technology adopted across a wide range of optical systems — from traditional long-haul deployments to compact pluggable transceivers.

In this panel, we will reflect on the progress made over the past ten years, examine the state-of-the-art in both research and products, and explore opportunities for future developments.

The key discussions to address in this panel are:

- The evolution of shaping algorithms and key implementations of PAS;
- Considerations for hardware implementation of probabilistic shaping, including complexity, parallelism, and latency;
- Shaping for pluggable DSP implementations and standardized PAS algorithms;
- PAS-enabled capabilities and future research directions, such as its application to non-AWGN channels (e.g., unamplified links and nonlinear channels) and its interactions with other system components (e.g., forward error correction and carrier phase recovery).

## Room 502B

**16:30–18:30**
**M4H • Practical Demonstrations of THz Communications**
*Presider: Xianbin Yu; Zhejiang Univ., China*

**M4H.1 • 16:30** ★ Top-Scored
**Demonstration of 104-GBaud/λ Digital Subcarrier Multiplexing 317-GHz THz Signal Wireless Delivery Based on Photonics-Aided Technologies,** Jianyu Long[1], Jianjun Yu[1], Xiongwei YANG[2], Ying Wu[1], Ying Wang[1], Qinyi Zhang[1], Yifan Chen[1], Weiping Li[1], Kaihui Wang[1], Wen Zhou[1], Yi Wei[2], Feng hao[2], Jianguo Yu[3], Chen Jiang[1], Shaozhi Deng[4], Ningsheng Xu[1]; [1]*Fudan Univ., China;* [2]*Xi'an Univ. of Posts and Telecommunications, China;* [3]*Beijing Univ. of Posts and Telecommunications, China;* [4]*Sun Yat-Sen Univ., China*. We experimentally demonstrate a record-breaking 104-GBaud/λ ultra-wideband photonics-aided THz-over-fiber transmission at 317 GHz over 25-km SSMF and 1-m wireless distance, achieving a unprecedented net rate of 374.4 Gbps/λ/polarization.

**M4H.2 • 16:45**
**Ultralow-Nonlinearity THz Signal Transmission Over PBG HCF for Low-Latency, High-Power Fiber–Wireless Links,** Pham Tien Dat[1], Yuki Yoshida[1], Keizo Inagaki[1], Toshimasa Umezawa[1], Naokatsu Yamamoto[1], Atsushi Kanno[2], Tetsuya Kawanishi[3], Kouichi Akahane[1], Kazunori Mukasa[4], Satoru Okamoto[5], Hiroyuki Tsuda[5], Naoaki Yamanaka[5]; [1]*NICT, Japan;* [2]*Nagoya Inst. of Technology, Japan;* [3]*Waseda Univ., Japan;* [4]*Lightera Japan Co., Ltd.,, Japan;* [5]*Keio Univ., Japan*. We demonstrate the ultralow nonlinearity of HCF for high-speed THz data transport and stable LO distribution, successfully delivering 100-Gb/s data and stable LO signal in the 300-GHz band at launch powers up to 29 dBm over a 3.9-km PBG-HCF link.

**M4H.3 • 17:00**
**DBPSK Communication in THz-Band Using Waveguide-Type Mach-Zehnder Interferometer-Based Receiver,** Koichi Takiguchi[1], Katsuhiro Kawamura[1]; [1]*Department of Electrical and Electronic Engineering, Ritsumeikan Univ., Japan*. We report wireless DBPSK communication in the 300 GHz-band. We directly demodulated a 20 Gbit/s DBPSK signal in the THz-domain using a hollow waveguide-type asymmetric Mach-Zehnder interferometer fabricated with a 3D printer and metal plating.

## Room 515A

**16:30–18:30**
**M4I • Symposium: Beyond the Atmosphere: Architectures and Technologies for Optical Space Communication II**
*Presiders: Kevin Shortt, Airbus Defence & Space GmbH, Germany and Fernando Pedro Pereira Guiomar, Universidade de Aveiro, Portugal*

**M4I.1 • 16:30** Invited
**MDA Space Solutions for Communications, Robotic Infrastructure Servicing and Geo Intelligence Imaging Applications,** Rob Singh[1]; [1]*MDA Space, Canada*. MDA Space has been architecting satellite constellation solutions for communications, robotic infrastructure servicing, and geo intelligence imaging applications. MDA Space continues to adopt and innovate our current and emerging optical capability to provide optically interconnection solutions.

**M4I.2 • 17:00** Invited
**Optical Networks in Orbit,** Ewald Schrap[1]; [1]*Voyager Technologies, USA*. Optical networks in orbit are opening opportunities that can only be realized if industry moves from a TRL to a broader CRL approach. Technical and commercial foresight is required for broad adoption and economic success.

## Room 515B

**16:30–18:30**
**M4J • Fiber Sensing II**
*Presider: Annika Dochhan; Christian-Albrechts Universität zu Kiel, Germany*

**M4J.1 • 16:30**
**Automatic Telecommunication Facility Position Mapping on DAS Traces Using Vibration Coupling Factor Analysis,** Hiroshi Takahashi[1], Masahiko Abe[1], Yoshifumi Wakisaka[1], Chihiro Kito[1], Keisuke Murakami[1], Daisuke Iida[1], Kunihiro Toge[1]; [1]*NTT, Inc., Japan*. We propose a technique using the vibration coupling factor analysis to automate telecommunication facility position mapping on DAS traces. The proposed method is demonstrated to have accuracy of about 6m.

**M4J.2 • 16:45**
**DSP Frame Pilot Sequence-Enabled Vibration Phase Detection Using Digital Coherent Receivers With 100-kHz ECLs,** Hao Zhou[3], Fan Yang[3], Wen Zuo[1], Du Tang[4], Hengying Xu[2], Chenglin Bai[2], Yaojun Qiao[3]; [1]*ZTE Corporation, China;* [2]*Liaocheng Univ., China;* [3]*Beijing Univ. of Posts and Telecommunications, China;* [4]*China Academy of Information and Communications Technology, China*. A DSP frame pilot sequence-enabled vibration phase detection scheme is proposed using 100-kHz ECLs-embedded coherent receivers. In experiment, we provided similar 0.09-rad sensitivity as fitting-FOC-based schemes, but saved $\sim$87.5\% complexity.

**M4J.3 • 17:00**
**Multi-Tech Sensing on Live Telecom Fiber: Comparing Phase and State-of-Polarization for Cable-Safety Monitoring,** Federico Notarstefano[4,1], Cecilia Clivati[1], Simone Donadello[1], Emanuele E. Virgillito[4], Rudi Bratovich[2], Raffaele Corsini[2], Marianna Hovsepyan[3], Francesco Carpentieri[3], Vittorio Curri[4]; [1]*Istituto Nazionale di Ricerca Metrologica, Italy;* [2]*SM-Optics, Italy;* [3]*Open Fiber, Italy;* [4]*Politecnico di Torino, Italy.* We present a sensing testbed on a live telecom fiber combining phase and polarization analysis. An unsupervised autoencoder-based pipeline detects deformations, quantitatively comparing sensitivity and performance of the two approaches for intelligent, large-scale cable-safety monitoring.

## Room 518

**16:30–18:30**
**M4K • Fiber Monitoring and Modeling**
*Presider: Georg Bocherer; Ciena, Germany*

**M4K.1 • 16:30**
**Extending Longitudinal Performance Monitoring to Hollow Core Fiber Systems: Feasibility and Implementation,** Choloong Hahn[1], Yunfan Xu[2], Xianchao Guan[2], Luo Han[2], zhiping jiang[1]; [1]*Huawei Technologies Canada, Canada;* [2]*Huawei Technologies Co Ltd, China*. We present the first experimental validation of longitudinal power monitoring on a hollow core fiber (HCF) span, confirming its effectiveness by exploiting nonlinearities in embedded solid-core segments despite HCF's inherently negligible nonlinearity.

**M4K.2 • 16:45**
**Detection and Localization of Slow SOP Changes via Longitudinal DGD Monitoring,** Choloong Hahn[1], Jun Ho Chang[1], Qingyi Guo[1], Zhiping Jiang[1]; [1]*Huawei Technologies Canada, Canada*. We demonstrate, for the first time, the detection and localization of slow SOP changes solely with coherent receivers by analyzing time delay variations between orthogonal polarizations using longitudinal DGD monitoring.

**M4K.3 • 17:00**
**PIDT: Physics-Informed Digital Twin for Optical Fiber Parameter Estimation,** Zicong Jiang[1], Magnus Karlsson[2], Erik Agrell[1], Christian Häger[1]; [1]*Electrical Engineering, Chalmers tekniska hogskola AB, Sweden;* [2]*Microtechnology and Nanoscience, Chalmers tekniska hogskola AB, Sweden*. We propose physics-informed digital twin (PIDT): a fiber parameter estimation approach that combines a parameterized split-step method with a physics-informed loss. PIDT improves accuracy and convergence speed with lower complexity compared to previous neural operators.

## Room 403A

### M4A • QoT and AI Based Digital Twins—Continued

**M4A.3 • 17:15**
**Policy-Driven Conformal Prediction for Trustworthy QoT Estimation,** Kiarash Rezaei[1], Omran Ayoub[2], Paolo Monti[1], Carlos Natalino[1]; [1]*Chalmers Tekniska Högskola, Sweden;* [2]*Scuola universitaria professionale della Svizzera italiana, Switzerland*. We propose Conformal QoT, a policy-driven framework that combines statistically guaranteed QoT estimation with operational decision policies, enabling reliable lightpath-feasibility predictions under domain shift and improving accuracy from 92% to 99.6% on open datasets.

**M4A.4 • 17:30** ★ Top-Scored
**A Topology-Scalable Foundation Model for Network-Level QoT Estimation Using a Variable-Length Transformer,** yao zhang[1], Xiao Luo[1], Shengnan Li[1], Wenbin Chen[1], Min Zhang[1], Danshi Wang[1]; [1]*Beijing Univ. of Posts & Telecom, China*. We build a topology-scalable foundation model using transformer with variable-length inputs for reliable network-level QoT estimation, achieving zero-shot prediction with 0.68dB MAE and up to 96% error reduction through fast few-shot fine-tuning on unseen topologies.

## Room 403B

### M4B • Optical Engines—Continued

**M4B.3 • 17:15**
**16-Wavelength 800-Gbps Bidirectional Link Over Single-Mode Fiber Using Microring Transceivers,** Rishi Anand[1], Reza Baghdadi[1], Zachariah Boynton[1], Ryan Braid[1], Pierre L. Cantin[1], Jim Carr[1], Clifford Chao[1], Utsav Dave[1], Carlos Dorta-Quinones[1], George Eng[1], Zhipeng Fan[1], Zhuoran Fang[1], Bryce Gardiner[1], Dominic Goodwill[1], Elliot Greenwald[1], Fen Guan[1], Shashank Gupta[1], Brian Jones[1], Ranjit Khela[1], Tony Kopa[1], Nikhil Kumar[1], Jay Krishnankutty[1], Yanke Li[1], Kuang Liu[1], Andrew Lints[1], Yongchao Liu[1], Ian Macfarlane[1], Natalia Mauge[1], Adam Mendrela[1], Mitul Modi[1], Manooch Mohsenian[1], Nicolas Monier[1], Marianne Nourzad[1], Xing Pan[1], Hsuan-Tung Peng[1], Mihika Prabhu[1], Stephen Roybal[1], Sandeep Sane[1], Nick Sarkis[1], Alexander J. Sludds[1], Anant Thakar[1], Cliff Ting[1], Geoffrey Tu[1], Mykhailo Tymchenko[1], Hao Yang[1], Kaushik Patel[1], Joyce Poon[1], Ritesh Jain[1], Darius Bunandar[1], Nicholas Harris[1]; [1]*Lightmatter, USA*. We report the first 16-wavelength bidirectional link with an aggregate data rate of 800Gbps in a single optical fiber using XSR SerDes. The microring-based transceiver shows robust performance over polarization and temperature aggression.

**M4B.4 • 17:30**
**A 224-Gb/s Si-Photonic WDM Transmitter With Code-Based Calibration for Simultaneous OMA Locking and RLM Optimization,** Daewon Rho[1], Seung-Jae Yang[1], Yongjin Ji[1], Jae-Koo Park[2], Woo-Young Choi[1]; [1]*Electric and Electronic Engineering, Yonsei Univ., Korea (the Republic of);* [2]*Memory Division, DRAM Design Teams, Samsung Electronics Device Solutions, Korea (the Republic of)*. This paper demonstrates a Si photonic WDM transmitter using four cascaded microring modulators (MRMs) with co-integrated driver ICs. An on-chip code-based calibration simultaneously locks OMA and optimizes RLM through heater tuning and driver adaptation. The automated scheme enables stable 224-Gb/s operation without external DSP or FPGA.

## Room 408A

### M4C • Optical Parametric and Raman Amplifiers—Continued

**M4C.2 • 17:30** Invited
**Multi-Band Raman Amplification: Progress and Challenges,** Wladek Forysiak[1,2], Mingming Tan[2], Dini Pratiwi[2], Aleksandr I. Donodin[2], Shabnam Noor[2], Shekhar Saxena[2], Ian Phillips[2]; [1]*Univ. of Bristol, UK;* [2]*Aston Univ., UK*. Ultra-wideband and multi-band transmission is driving renewed interest in optical amplification beyond the well-established C/L-bands supported by EDFAs. We review recent progress in optical fiber Raman amplification technologies, with a particular focus on transmission applications.

## Room 408B

### M4D • Heterogeneous Integrated Devices—Continued

**M4D.3 • 17:15**
**High L-Band Responsivity of Compact InP-on-Si Coherent-Receiver PICs via Chip-on-Wafer Bonding,** Takuya Okimoto[1,2], Takuya Mitarai[1,2], Yohei Sobu[1,3], Shuntaro Maeda[5], Shun Kimura[1,2], Takehiko Kikuchi[1,2], Naoko Inoue[1,2], Naoki Fujiwara[1,2], Nobuhiko Nishiyama[1,4], Takuo Tanemura[5], Shinsuke Tanaka[1,3], Hideki Yagi[1,2]; [1]*Photonics Electronics Technology Research Association, Japan;* [2]*Sumitomo Denki Kogyo Kabushiki Kaisha, Japan;* [3]*1finity Inc., Japan;* [4]*Tokyo Kagaku Daigaku, Japan;* [5]*Tokyo Daigaku Daigakuin Kogakukei Kenkyuka Denkikei Kogaku Senko, Japan*. We demonstrate high L-band responsivity in compact InP-on-Si coherent-receiver PICs, each with a footprint of only 1.2 mm$^2$. A receiver module using these PICs exhibits robust back-toback OSNR tolerance for dual-polarization 100-GBaud 16-QAM signals.

**M4D.4 • 17:30**
**Truly-Differential Drive of TFLN TWE-MZM by Linear SiGe Driver in a Co-designed Hybrid Integrated Assembly,** Alessandro Aimone[1], Philipp Thomas[2], Callum Deakin[2], Kim Kwangwoong[2], Tam Huynh[2], Xi Chen[2], Mark Earnshaw[2], Yves Baeyens[2], Shahriar Shahramian[2], Nicolas Fontaine[2]; [1]*Nokia Bell Labs, Germany;* [2]*Nokia Bell Labs, USA*. We present a hybrid assembly of a SiGe driver and TFLN modulator, featuring a novel differential driving scheme achieving low $V_\pi L$ = 1.1 Vcm. We demonstrate 140 GBd PAM-8 modulation with 1.4 pJ/bit energy consumption.

## Room 411

### M4E • Few-Mode and Multi-Mode Fiber—Continued

**M4E.3 • 17:15**
**Raman Gain Profiling and Distributed Raman Amplification in a Field-Deployed 15-Mode Graded-Index Multimode Fiber,** Divya A. Shaji[4], Julian Schneck[1], Lucas Zischler[4], Giammarco Di Sciullo[4], Ruben S. Luis[2], Pierre Sillard[3], Hideaki Furukawa[2], Luca Palmieri[5], Georg Rademacher[1], Antonio Mecozzi[4], Cristian Antonelli[4]; [1]*Universitat Stuttgart, Germany;* [2]*Kokuritsu Kenkyu Kaihatsu Hojin Joho Tsushin Kenkyu Kiko, Japan;* [3]*Prysmian Cables et Systemes France SAS, France;* [4]*Universita degli Studi dell'Aquila, Italy;* [5]*Universita degli Studi di Padova Dipartimento di Ingegneria Industriale, Italy*. We evaluate the Raman gain properties of a 15-mode, field-deployed graded-index fiber. Single-mode group pumping yields 6.5-dB mode-differential gain with gain below 8.4-dB when pumping the fundamental mode and nearly-uniform gain when pumping higher-order modes.

**M4E.4 • 17:30**
**Experimental Characterization of a Weakly-Guiding Ring-Core Fiber That Supports 24 OAM Modes Including Radial High-Order Modes With low Loss and Crosstalk,** Zhouxuan Tang[1], Mutian Xu[1], Quanhao Niu[1], Lei Shen[2], Lei Zhang[2], Jie Luo[2], Jian Wang[1]; [1]*Huazhong Univ of Science and Technology, China;* [2]*Yangtze Optical Fibre and Cable Joint Stock Ltd Co, China*. We design, fabricate and experimentally characterize a weakly-guiding triple-ring ring-core fiber that supports 24 orbital angular momentum modes including radial high-order ones with low loss and crosstalk, showing its potential for advancing high-capacity fiber-optic communications.

## Room 501ABC

### M4F • Photonic Interconnects for Scalable AI—Continued

**M4F.4 • 17:15**
**High-Speed Optical Alternate Switching Between the Networks for Expert/Tensor and Data Parallelism,** Kenji Mizutani[1], Ryugo Iwami[1], Tatsuya Usuki[1], Kiyo Ishii[1], Ryosuke Matsumoto[1], Takashi Inoue[1], Keijiro Suzuki[1], Kazuhiro Ikeda[1], Shu Namiki[1]; [1]*National Inst. of Advanced Industrial Science and Technology, Japan*. We propose an efficient architecture that leverages the deterministic and alternate communication patterns of parallel AI processing and demonstrate high-speed control of silicon photonic switches and one-sided communication with <2-µs overhead after optical path establishment.

**M4F.5 • 17:30**
**Single Microcomb Source for Ultra-Scalable Datacenters for Dense Deep Neural Network Workloads,** Arjun Kurur[1], Silas L. Hedeboe[1], Christian K. Schou[1], Oliver M. Larsen[1], Sarah-Michelle M. Hammer[2], Yang Liu[1], Haoyang Tan[1], Deming Kong[1], Flora Karpat[1], Yi Zheng[1], Yangjing Zhao[1], Max Franke[2], Minhao Pu[1], Kresten Yvind[1], Metodi Yankov[3], Søren O. Forchhammer[1], Michael Galili[1], David J. Moss[4], Stefan Schmid[2], Leif Oxenløwe[1]; [1]*DTU Electro, Denmark;* [2]*Technische Universitat Berlin, Germany;* [3]*Ciena corporation, Denmark;* [4]*Swinburne Univ. of Technology, Australia*. We propose an optical datacenter network architecture for artificial intelligence, leveraging a single microcomb, with comb-lines distributed depending on the workload. The microcomb can support 120 Pbit/s and in excess of one million GPUs.

## Room 502A

### M4G • Panel: Probabilistic Amplitude Shaping after 10 Years: Where Are we Now and What is to Come?—Continued

## Room 502B

### M4H • Practical Demonstrations of THz Communications—Continued

**M4H.4 • 17:15**
**Toward Practical Photonic THz Links: Field Demonstration of Beam Alignment for Real-Time Wireless Fronthaul at 300 GHz,** Minkyu Sung[1], Sang-Rok Moon[1], Sooyeon Kim[1], Sungmin Cho[1], Wonkyoung Lee[1], Heuk Park[1], Seoug-Hwan Kim[1], Joon Ki Lee[1], Seung-Hyun Cho[1]; [1]*Electronics and Telecommunications Research Inst., Korea (the Republic of).* We report a field demonstration of THz beam alignment enabling a real-time photonic-based 300-GHz wireless fronthaul link, achieving 25-GbE eCPRI NRZ transmission over a 200-m wireless distance with a BER of $1.5\times10^{-4}$.

**M4H.5 • 17:30**
**Real-Time Simplified Coherent Photon-Assisted 322GHz Terahertz Signals Transmission Over 30-m Wireless Using Parallel Kramers-Kronig Receiver and FPGA Operation,** Long Zhang[1], Zhu Min[1], Jianjun Yu[1], Zhang Jiao[1], Wang Yikai[2], Cai Yuancheng[1], Lei Mingzheng[1], Chen Xingyu[1], Wang Yunwu[1], Junjie Ding[1]; [1]*Purple Mountain Laboratories, China;* [2]*Southeast Univ., China.* We have experimentally demonstrated, for the first time, FPGA-based real-time simplified coherent photon-assisted 322GHz terahertz transmission using parallel Kramers-Kronig receiver with 27 Gb/s 16QAM DMT signals over 30-m wireless link, which is expected to become a feasible solution for simplifying coherent reception in fiber-terahertz links.

## Room 515A

### M4I • Symposium: Beyond the Atmosphere: Architectures and Technologies for Optical Space Communication II—Continued

**M4I.3 • 17:30** Invited
**Spaceborne Optical Networks,** John Jacob[1,2]; [1]*Cisco Systems Inc, USA;* [2]*Acacia Communications Inc, USA.* Spaceborne optical networks are a growing market for today's component suppliers. Meeting demand for network components in space means providing hardware that is suitable for this environment.

## Room 515B

### M4J • Fiber Sensing II—Continued

**M4J.4 • 17:15**
**Train Flow Sensing and Positioning via in-Service Polarization Reuse Over Bidirectional Optical Fibre Transmission Systems,** Wanxin Zhao[1,2], SEN SHEN[1], Yiran Teng[1], Vaigai Yokar[1], Ali Mehrpooya[1], Xiaoguang Zhang[2], Lixia Xi[2], Shuangyi Yan[1], Dimitra Simeonidou[1]; [1]*High Performance Networks Group, Univ. of Bristol, UK;* [2]*State Key Lab of Information Photonics and Optical Photonics Communications, Beijing Univ. of Posts and Telecommunications, China.* We propose and deploy an ISIC platform based on polarization and neural-network analysis, and conduct a two-week field trial in a metro network, achieving real-time train traffic monitoring and localization while maintaining high-quality communication.

**M4J.5 • 17:30**
**Coexistence Demonstration of Reflective OFDR Sensing and Commercial Transceivers in a Submarine Testbed,** Roland Ryf[1], Nicolas Fontaine[1], Sarvesh S. Bidkar[1], Jesse E. Simsarian[1], Mohamad Hossein Idjadi[1], Lauren Dallachiesa[1], David Neilson[1], Mikael Mazur[1]; [1]*Nokia Bell Labs, USA.* We investigate the performance and coexistence of an optical frequency domain reflectometer (OFDR) based high-resolution reflective sensing prototype in conjunction with commercial transponders in a dryland submarine testbed link.

## Room 518

### M4K • Fiber Monitoring and Modeling—Continued

**M4K.4 • 17:15**
**Modeling and Experimental Validation of Unrepeated Optical Transmission System With Bi-Direction Raman Amplifier for 4D PS-QAM,** Jiwei Xu[1], Zhiwei Liang[1], Jianbo Lin[1], Yi Lei[1], Ming Chen[2], Bin Chen[1]; [1]*School of Computer Science and Information Engineering, Hefei Univ. of Technology, China;* [2]*Huawei Technologies Co Ltd, China.* 4D PS-QAM is numerically and experimentally analyzed in a 260km unrepeated transmission system with bi-direction Raman-amplifier. By considering power profile and various signal-dependent impairments, a gap between SSFM simulations and experiments within 0.2dB is demonstrated.

**M4K.5 • 17:30**
**High-Resolution Filtering Offset Detection and Localization Using Longitudinal Power Monitoring,** Jun Ho Chang[1], Choloong Hahn[1], Qingyi Guo[1], Zhiping Jiang[1]; [1]*Huawei Technologies Canada, Canada.* We have demonstrated the localization of faulty off-centered optical filters using correlation-based longitudinal power monitoring. Reference-waveform sweeping detects offsets below 3 GHz in multiple filters along the link, relying solely on the received waveform.

## Room 403A

### M4A • QoT and AI Based Digital Twins—Continued

**M4A.5 • 17:45** ★ Top-Scored
**OSNR/GSNR Prediction in Brownfield Links via a DLM-Anchored Hybrid Physics/ML Model,** Agastya Raj[2], Venkata Virajit Garbhapu[2], Hiroyuki Ishihara[1], Peyman Pahlevanzadeh[2], Hideki Nishizawa[1], Takeo Sasai[1], Daniel C. Kilper[2], Marco Ruffini[2]; [1]*Nihon Denshin Denwa Kabushiki Kaisha, Japan;* [2]*The Univ. of Dublin Trinity College, Ireland.* We present a DLM-anchored hybrid physics/ML framework for brownfield optical links that accurately predicts per-channel power, OSNR, and GSNR. Calibrating span/ILA boundaries via DLM yields ≤0.39/0.43 dB of OSNR/GSNR errors across single-channel and OSaaS provisioning.

**M4A.6 • 18:00**
**LLM-Enhanced Digital Twin Framework in Optical Networks,** SEN SHEN[1], Wanxin Zhao[1], Haiyuan Li[1], Yiran Teng[1], Vaigai Yokar[1], Ali Mehrpooya[1], Shuangyi Yan[1], Dimitra Simeonidou[1]; [1]*Univ. of Bristol, UK.* We propose an LLM-enhanced DT framework for optical networks, integrating intent parsing, real-time telemetry, auto-simulation and closed-loop optimisation. Two use cases deliver autonomous QoT-aware provisioning, fast decisions and self-improving reasoning, advancing AI-native, policy-compliant network operation.

**M4A.7 • 18:15**
**Digital Twin-Based Quality-of-Transmission Estimation for Inter-Satellite All-Optical Networks,** Shoichiro Oda[1], Hideaki Kotake[1], Satoshi Shinada[1], Yusuke Hirota[1], Hideaki Furukawa[1]; [1]*National Inst of Information & Comm Tech, Japan.* We present a digital twin-based quality-of-transmission (QoT) estimation leveraging optical probing, validated through proof-of-concept experiment with testbed emulating Starlink orbital dynamics, enabling accurate performance estimation and adaptive data rate assignment for inter-satellite all-optical networks.

## Room 403B

### M4B • Optical Engines—Continued

**M4B.5 • 17:45**
**Highly-Integrated 16-Channel Silicon-Photonics Optical Engine Enabling PAM6 Transmission With BER < 1E-9,** Son T. Le[1], Sara Kacmoli[1], Amitkumar Mahadevan[1], Guilhem de Valicourt[1], Peter Winzer[1]; [1]*Ciena Corporation, USA.* We demonstrate 53-GBaud PAM6 transmission with an aggregate data rate exceeding 2 Tb/s using a highly-integrated, high-density, low-power 16-channel SiPh optical engine, achieving a raw BER < 1E-9 for the first time, showing the feasibility of reliable optical PAM6 transmission.

**M4B.6 • 18:00** Invited
**Technology for AI Interconnect Scale-Up Solutions,** Andrew C. Alduino[1], Siamak Amiralizadeh[1], Afshin Shamshooli[1], Yiwei Peng[1], Viral Lowalekar[1], Rob Stone[1], Pengyue Wen[1], Wing Wang[1], Nan Ge[1], Wayne Zhang[1], Greg Wang[1], Rongchun Zhu[1], Nhan Hoang[1], Jonny Stever[1], Jiu Xu[1], Jason Pruitt[1], Anju John[1], Saurabh Agrawal[1], Freddy Mercado[1], Olaf Moeller[1], Darron Young[1]; [1]*Meta Platforms Inc, USA.* We present an evaluation of optical scale-up networking technologies building upon our CPO reliability testing. We consider implications of performance and reliability on cluster performance and the challenges of at scale deployment and management.

## Room 408A

### M4C • Optical Parametric and Raman Amplifiers—Continued

**M4C.3 • 18:00**
**Two-Pump Distributed Parametric Amplification of Two 50Gbps PAM4 Channels in SSMF in O-Band,** MUNIRA B. MOSTAFA[1], Mariia Bastamova[1], Dmitrii Stoliarov[1], Andrew Ellis[1], Vladimir Gordienko[1]; [1]*Aston Univ., UK.* We demonstrate for the first time a two-pump distributed parametric amplifier for multi-channel amplification in SSMF in O band with gain up to 16 dB, bandwidth up to 19 nm and only ~155mW per pump

**M4C.4 • 18:15**
**ILP-Based Joint Signal–Pump Power Optimization for Hybrid Raman/DFA Amplified Multi-Band Fiber Systems,** Mahdieh Mehrabi[3], Farhad Arpanaei[1], Hamzeh Beyranvand[3], Mohammad Javad Emadi[3], Mahdi Ranjbar Zefreh[2], Oscar G. De Dios[4], Juan Pedro Fernández-Palacios Giménez[4], Alfonso Sanchez-Macian[1], José Alberto Hernández Gutiérrez[1], David Larrabeiti[1]; [1]*Universidad Carlos III de Madrid, Spain;* [2]*CISCO, Italy;* [3]*Amirkabir Univ. of Technology, Iran (the Islamic Republic of);* [4]*Telefonica Global CTIO, Spain.* This paper proposes an ILP-based signal and pump power optimization method that achieves an optimal trade-off between total capacity, GSNR flatness, and computational efficiency, resulting in a 310 Tb/s capacity, a 2.4 dB flatter GSNR, and a 95% faster execution.

## Room 408B

### M4D • Heterogeneous Integrated Devices—Continued

**M4D.5 • 17:45**
**82-mm-Long Optical Link Using Micro-Transfer-Printed Directly Modulated Membrane Laser and Photodetector on SiN Waveguide: Toward Wafer-Scale Optical Interconnects,** Yoshiho Maeda[1,2], Takuma Aihara[1,2], Tatsurou Hiraki[1,2], Takuro Fujii[1,2], Tomonari Sato[1,2], Shinji Matsuo[1,2]; [1]*Device Technology Labs., NTT, Inc, Japan;* [2]*Device Innovation Center, NTT, Inc., Japan.* We demonstrate an optical link using micro-transfer-printed III-V directly modulated membrane laser and photodetector on an 82-mm-long SiN waveguide, achieving 48-Gbps NRZ operation with an energy cost of 0.24 pJ/bit at 50°C.

**M4D.6 • 18:00** Invited
**Wafer-Scale Transfer Printing: Ready for Production, Ready for Impact,** Sarah Uvin[1,2], Maximilien Billet[1,2], Bart Kuyken[1,2], Günther Roelkens[1,2]; [1]*Universiteit Gent, Belgium;* [2]*Interuniversitair Micro-Elektronica Centrum, Belgium.* Wafer-scale micro-transfer printing is evolving into a production-ready platform for heterogeneous photonic integration. High-yield placement, reproducible processes, and robust scalability enable III-V and LN integration on silicon, accelerating the transition from R&D demonstrations to manufacturable photonic technologies.

## Room 411

### M4E • Few-Mode and Multi-Mode Fiber—Continued

**M4E.5 • 17:45**
**Experimental Demonstration of Ultra-Long (100 km) Ring-Core Fiber Mode Transfer Matrix Characterization and Sensing,** Ziyi Tang[1], Yize Liang[1], Lei Shen[2], Lei Zhang[2], Jian Wang[1]; [1]*Huazhong Univ. of Science and Technology, China;* [2]*Yangtze Optical Fibre and Cable Joint Stock Ltd Co, China.* We demonstrate the mode transfer matrix characterization over 100-km ring-core fiber using a self-referenced common-path method, achieving the specific intensity pattern generation and remote rotational speed measurement.

**M4E.6 • 18:00** Invited
**Few-Mode and Multicore Fiber for Spatial Division Multiplexing: Recent Progress and Remaining Challenges,** Georg Rademacher[1], Ruben S. Luis[2], Benjamin J. Puttnam[3], Julian Schneck[1], Giammarco Di Sciullo[4], Divya A. Shaji[4], Lucas Zischler[4], Cristian Antonelli[4]; [1]*Universität Stuttgart, Germany;* [2]*Kokuritsu Kenkyu Kaihatsu Hojin Joho Tsushin Kenkyu Kiko, Japan;* [3]*Microsoft Azure, UK;* [4]*Universita degli Studi dell'Aquila, Italy.* We review recent developments in few-mode and multi-core fibers. We highlight novel transmission effects, such as Stimulated Raman Scattering in transmission and/or amplification and review recent transmission demonstrations.

## Room 501ABC

### M4F • Photonic Interconnects for Scalable AI—Continued

**M4F.6 • 17:45** Invited
**Scale-Out and Scale-Up Photonic Interconnects,** Anand Ramaswamy[1]; [1]*Broadcom Corporation, USA.* This presentation will discuss scale-out and scale-up photonic interconnects.

## Room 502A

### M4G • Panel: Probabilistic Amplitude Shaping after 10 Years: Where Are we Now and What is to Come?—Continued

## Room 502B

### M4H • Practical Demonstrations of THz Communications—Continued

**M4H.6 • 17:45**
**600-Gbps THz Wireless Communication Enabled by Low-Noise Integrated Kerr Optical Frequency Combs,** Jiankang Li[1], Cai Yuancheng[1,2], Kunpeng Jia[3], Wei Liang[4], Xiaoguang Yang[1,2], Chenye Qin[3], Zexin Zhao[3], Chong Sheng[3], Yongming Huang[1,2], Shi-ning Zhu[3], Xiaohu You[1,2], Zhenda Xie[3], Min Zhu[1,2]; *[1]National Mobile Communications Research Laboratory, Southeast Univ., China; [2]Purple Mountain Laboratories, China; [3]National Laboratory of Solid State Microstructures, Nanjing Univ., China; [4]Chinese Academy of Sciences Suzhou Inst. of Nano-tech and Nano-Bionics, China*. We develop the low-noise integrated Kerr optical frequency combs which can serve as photonics THz sources, and demonstrate a 600-Gbps THz wireless communication over 4 m at 300 GHz band for the first time.

**M4H.7 • 18:00** ★ Top-Scored
**Field Trials of Photonics 312 GHz Terahertz-Wave Signals Transmission Over 3 km Wireless Distance,** Weiping Li[1], Jianjun Yu[1,2], Xianming Zhao[3], Xin Lu[1], Ye Zhou[1], Jiali Chen[1], Kaihui Wang[1], Wen Zhou[1], Kaile Li[4], Min Zhu[2], Jiao Zhang[2], Jianguo Yu[5], Feng hao[6]; *[1]Fudan Univ., China; [2]Purple Mountain Laboratories, China; [3]Harbin Inst. of Technology, China; [4]Xidian Univ. Hangzhou Inst. of Technology, China; [5]Beijing Univ. of Posts and Telecommunications, China; [6]Xi'an Univ. of Posts and Telecommunications, China*. We demonstrate field trials of photonics 312 GHz terahertz-wave (THz-wave) signals transmission over a record-breaking 3km wireless distance. This represents the first demonstration of the longest wireless distance communication for THz-wave above 300 GHz.

**M4H.8 • 18:15**
**Polarization Effects and Crosstalk Mitigation in a 240 Gbps Dual-Polarization SISO Optical–THz Integrated System,** Zhigang Xin[3,1], Jiao Zhang[1], Min Zhu[2,1], Qing Zhong[2,1], Mingzheng Lei[1], Bingchang Hua[1], Cai Yuancheng[1], Junjie Ding[1], Xingyu Chen[1], Yunwu Wang[1], Long Zhang[1], yucong Zou[1], Bo Liu[4], Jianjun Yu[1,5]; *[1]Purple Mountain Laboratories, China; [2]Southeast Univ., China; [3]Southeast Univ., China; [4]Nanjing Univ. of Information Science and Technology, China; [5]Fudan Univ., China*. We experimentally demonstrate a 240 Gbps dual-polarization SISO fiber–THz system at 320 GHz, using an OMT for dual-polarization multiplexing and demultiplexing. A Correlation-Avoidance MIMO volterra nonlinear equalizer effectively suppresses polarization crosstalk, enabling high-speed, reliable signal transmission.

## Room 515A

### M4I • Symposium: Beyond the Atmosphere: Architectures and Technologies for Optical Space Communication II—Continued

A discussion will follow the presentations.

## Room 515B

### M4J • Fiber Sensing II—Continued

**M4J.6 • 17:45** ★ Top-Scored
**DAS Over a 585-km EDFA-Repeatered Link With Co-Propagating 15.8-Tb/s Transmission,** Robson A. Colares[2,1], Daniele Orsuti[2], Ruben S. Luis[2], Jun Sakaguchi[2], Shoichiro Oda[2], Satoshi Shimizu[2], Werner Klaus[2], Besma Kalla[4], Chigo M. Okonkwo[4], Thomas Bradley[4], Martina Cappelletti[3], Luca Schenato[3], Andrea Galtarossa[3], Luca Palmieri[3], Darli Mello[1], Hideaki Furukawa[2]; *[1]Department of Communications, Universidade Estadual de Campinas, Brazil; [2]National Inst. of Information and Communication Technology (NICT), Japan; [3]Universita degli Studi di Padova, Italy; [4]Technische Universiteit Eindhoven, Netherlands*. We demonstrate joint 15.8-Tb/s transmission and distributed acoustic sensing over 585 km with 20 m spatial resolution using bidirectional repeater units, achieving a strain noise <0.4 nε/√Hz. The link includes 90 km of field-deployed fiber.

**M4J.7 • 18:00** Invited
**Real-Time Coherent OFDR Over Live Networks: From Access to Subsea,** Mikael Mazur[1], Nicolas K. Fontaine[1], Roland Ryf[1], Lauren Dallachiesa[1], Patrick Iannone[1], Haoshuo Chen[1], David Neilson[1]; *[1]Nokia Bell Labs, USA*. We demonstrate how optical frequency domain reflectometry with continous power probe pulses enables real-time distributed fiber-optic sensing over various network configurations ranging from 1x32 PON to trans-oceanic submarine systes and networks using hollow-core fiber.

## Room 518

### M4K • Fiber Monitoring and Modeling—Continued

**M4K.6 • 17:45**
**First Experimental Investigation of Koopman-Based Fiber Parameter Identification,** Shahzeb Aamir[1], Olaf Schulz[2], Stephan Pachnicke[2], Sander Wahls[3]; *[1]Technische Universiteit Delft, Netherlands; [2]Chair of Communications, Christian-Albrechts-Universitat zu Kiel, Germany; [3]Inst. of Industrial Information Technology, Karlsruher Institut fur Technologie, Germany.* Koopman-based fiber parameter identification is experimentally validated for the first time, on SSMF and NZDSF single-span fiber links. We propose to apply the method backwards, which leads to significantly improved performance.

**M4K.7 • 18:00** Invited
**On the Potential of Optimized Perturbation Models for Fiber Nonlinearity Cancellation,** Astrid Barreiro[1], Gabriele Liga[1], Alex Alvarado[1]; *[1]Technische Universiteit Eindhoven, Netherlands*. We discuss nonlinear interference cancellation using optimized first-order regular perturbation. Genie-assisted simulations of single-span PM-16QAM transmission over 210–250km achieve effective SNR gains above 2dB.

## Room 403A

**14:00–15:30**
**Tu2A • Advanced Coherent Technologies and Event Localization**
*Presider: Qunbi Zhuge; Shanghai Jiao Tong Univ., China*

**Tu2A.1 • 14:00** Invited
**Advanced Technologies in Coherent Pluggables and Use Cases,** Maria Vasilica Ionescu[1], Aditya Kakkar[2], Han Sun[2]; [1]*Nokia, Sweden;* [2]*Nokia, Canada.* Coherent pluggables, leveraging advanced CMOS and PICs, are mapped to concrete applications — DCI, metro, longhaul — demonstrating how multiple form factors, data rates, and interoperability match diverse network demands for scalable optical performance.

## Room 403B

**14:00–16:00**
**Tu2B • Single-Core Fiber and Spatial Division Multiplexing**
*Presider: Andrey Kobyakov; Corning Inc., USA*

**Tu2B.1 • 14:00** Invited
**Suppression of Rayleigh Scattering Loss in Silica Glass Formed by the Compression of its Melted Phase,** Madoka Ono[1]; [1]*Tohoku Daigaku, Japan.* We show that hot-compressed silica glass exhibits extreme transparency via topological pruning. This optimization, experimentally confirmed at around 0.8 GPa, provides a path to next-generation optical materials.

## Room 408A

**14:00–16:00**
**Tu2C • Autonomous Optical Networks**
*Presider: Ricard Vilalta; Centre Tecnològic Telecom de Catalunya, Spain*

**Tu2C.1 • 14:00** Invited
**Vision 2030: Autonomous Network Control in an All-Optical World,** Lluis Gifre Renom[1], Ricard Vilalta[1], Raul Muñoz[1]; [1]*Centre Tecnològic Telecom de Catalunya, Spain.* We envision optical transport networks embedding Agentic-AI–based automation that provide local autonomy, low-latency control loops, agent-to-agent coordinated and distributed intelligence, and inherent disaster resilience, enabling scalable, autonomous multi-domain infrastructures.

## Room 408B

**14:00–15:45**
**Tu2D • Scaling Photonic Integrated Circuits**
*Presider: Janet Chen; NVIDIA Corporation, USA*

**Tu2D.1 • 14:00**
**Advancing Silicon Photonics With Photonic-Native Compact Modeling and Hardware Correlation,** Qidi Liu[2], Zhengxing Zhang[1]; [1]*Cadence Design Systems Inc, Canada;* [2]*GlobalFoundries Inc, USA.* We present a novel photonic-native compact modeling method for silicon photonics, enabling true bidirectionality and multi-mode/multi-channel simulation. This framework is applied to next-generation high-speed transceivers, offering a solution for high-density, energy-efficient optical interconnects for AI/HPC.

**Tu2D.2 • 14:15** Invited
**3D Hybrid Bonded EIC-PIC Integration and Packaging Technologies,** S. J. Ben Yoo[1,2]; [1]*Univ. of California Davis, USA;* [2]*E O Lawrence Berkeley National Laboratory, USA.* Hybrid-bonding technique offers the most advanced 3D co-integration of photonic and electronic integrated circuits for power-efficient and high-throughput data systems. We will discuss the world's first 3D hybrid-bonded EPIC and review co-design and co-integration strategies.

## Room 411

**14:00–16:00**
**Tu2E • Metro-Access Integration and Traffic Optimization**
*Presider: Anna Tzanakaki; Univ. of Athens, Greece*

**Tu2E.1 • 14:00**
**Optical Switching in PON: Improved Energy-Efficiency and Cost-Effective Protection,** Laurens Breyne[1], Jerome Arokkiam[2], Paul Spruyt[3], Ian Horsley[2], Yannick Sillis[3], Mal Hubert[2], Alistair Poustie[2], Hugh Singleton[2], jochen maes[1]; [1]*Nokia Bell Labs, Belgium;* [2]*BT Research & Network Strategy, UK;* [3]*Nokia, Belgium.* We leverage optical switching in PON to scale OLT power consumption with traffic and allow cost-efficient protection. Prototypes are used to outline a path towards traffic outage times equal to or faster than type-B protection.

**Tu2E.2 • 14:15** Invited
**Radio-Optical Confluence in Intelligent Edge Networks,** Akshita Gupta[1], Devika Dass[1], Agastya Raj[1], Marco Ruffini[1], Paolo Monti[2], Daniel C. Kilper[1]; [1]*Univ. of Dublin Trinity College, Ireland;* [2]*Chalmers tekniska hogskola AB, Sweden.* Challenges associated with densification of radio access networks are motivating exploration of more efficient and scalable architectures. We examine recent progress in one direction that involves moving beyond radio and optical convergence to full confluence.

## Room 501ABC

**14:00–16:00**
**Tu2F • Subsea Cable Sensing**
*Presider: Siddharth Varughese; Google LLC, USA*

**Tu2F.1 • 14:00** ★ Top-Scored
**Multi-Modal Fibre Sensing for Offshore Environmental and Infrastructure Monitoring,** Konstantinos Alexoudis[1,2], Florian Azendorf[1], Alvaro Doval[3], Steinar Bjørnstad[3], Jasper Müller[1], Vincent Sleiffer[1], Chigo Okonkwo[2], Thomas Bradley[2]; [1]*Adtran Networks SE, Germany;* [2]*Technische Universiteit Eindhoven Department of Electrical Engineering, Netherlands;* [3]*Tampnet AS, Norway.* Monitoring a 118 km subsea cable using Distributed acoustic, state-of-polarization, and Brillouin sensing captured storm-induced strain up to ≈0.003 με (dynamic) and ≈180 με (static), demonstrating consistent yet distinct modal responses to environmental loading.

**Tu2F.2 • 14:15** ★ Top-Scored
**First Observations of Subsea Cable Physical Contacts Combining State of Polarization (SoP) and Distributed Acoustic Sensing (DAS),** Steinar Bjørnstad[1], Alvaro Doval[1], Anders Tysdal[1]; [1]*Tampnet, Norway.* In a field trial, DAS and SoP monitoring are combined. Trawling across subsea cables is detected: DAS identifies approaches, while SoP distinguishes contacts from passes and quantifies impact strength and cable displacement.

## Room 502A

### 14:00–16:00
### Tu2G • Panel: Machine Learning is Taking Over Optical Communications - But Which Algorithms Should We Use?

**Organizers:**
Boris Karanov, *Karlsruher Inst. für Technologie, Germany*
Lakshmi Narasimhan, *Indian Inst. of Technology, India*
Deepa Venkitesh, *Indian Inst. of Technology, India*

**Speakers:**
Steve Hranilovic, *McMaster Univ., Canada*
Mathieu Chagnon, *Mitsubishi Electric Research Laboratories, USA*
Tim O'Shea, *DeepSig AI, USA*
Tingjun Chen, *Duke Univ., USA*
Toshiake Akino, *Arycs Technologies, USA*

This panel addresses the critical need for an effective selection framework for machine learning (ML) algorithms in optical communication networks. ML shows great potential in challenging tasks such as nonlinearity compensation, network performance monitoring, and fault management. The plethora of state-of-the-art ML algorithms makes choosing the best fit difficult. What data is used for training and evaluation is equally important. Bringing together researchers, industry experts, and network operators, the panel will review current ML applications, highlighting benefits and challenges.

The key points in this panel will be:

- The discussion will focus on suitability and limitations of different ML algorithms for key optical communication tasks, aiming to establish selection criteria for dataset quality, performance, interpretability, efficiency, and scalability.
- The scope will include ML-based signal processing, transmission data analysis, network optimization, and trends such as photonic neural networks and standardized ML models.
- The goal is to provide practical guidelines and foster collaboration, ultimately advancing intelligent, ML-driven optical networks towards real-world demands.

## Room 502B

### 14:00–16:00
### Tu2H • Photonic Integrated Circuits for Wireless Communications
*Presider: Todd Ulmer; MIT Lincoln Laboratory, USA*

**Tu2H.1 • 14:00** Invited
**Overview of the DARPA Space BACN Program,** Michael C. Butterfield[1]; [1]*GoLion Company, USA*. This presentation will include an overview of DARPA Space BACN Program.

## Room 515B

### 14:00–16:00
### Tu2J • Inverse Designed Integrated Photonic Components
*Presider: Sagi Mathai; HPE Labs, USA*

**Tu2J.1 • 14:00** Tutorial
**Inverse Design of High Performance Photonic Integrated Components,** Jelena Vuckovic[1]; [1]*Stanford Univ., USA*. We describe our photonic inverse design approach, and show how it can be employed to design high performance photonic integrated components, which can be fabricated in commercial foundries and which experimentally outperform photonics PDK.

Jelena Vuckovic is the Jensen Huang Professor of Electrical Engineering at Stanford. She is a member of the National Academy of Sciences, a Fellow APS, Optica, and IEEE, and a recipient of numerous honors, including most recently Zeiss Award. Vuckovic is a co-founder and lead scientific advisor of SPINS Photonics.

## Room 518

### 14:00–16:00
### Tu2K • Entanglement Sources, Distribution and Photonic Architectures
*Presider: Reza Nejabati; Cisco Systems Inc., USA*

**Tu2K.1 • 14:00**
**Reconfigurable Quantum Networking With a CMOS-Based, Multi-Channel Entangled Pair Source,** Peyman Parsa[1], Benjamin MacLellan[1], Robin Helsten[1], Khuong Tran[1], Youssef El Goundali[1], Etienne De Montigny[2], Yoann Jestin[1], Piotr Roztocki[1]; [1]*Ki3 Photonics Technologies, Canada;* [2]*Defence Research and Development Canada Valcartier, Canada*. A CMOS-based, multi-channel entangled pair source (C-Band, 200 GHz-spaced grid) is rack-mounted with a co-propagating synchronization signal. Operating regimes, channel definitions, routing, and projection measurements are all software-defined, facilitating agile, multi-user entanglement distribution networks.

**Tu2K.2 • 14:15**
**Synchronized Entanglement Distribution Across Deployed Fiber Coexisting With Fully-Loaded C-Band Optical Communications,** Gina Talcott[1], Ahnnika Hess[1], Jordan Thomas[1], Laura d'Avossa[2], Scott Kohlert[3], Fei Yeh[1], Jim Hao Chen[1], Joe Mambretti[1], Tim Rambo[4], Gregory S. Kanter[1,5], Prem Kumar[1]; [1]*Northwestern Univ., USA;* [2]*Univeristy of Naples Federico II, Italy;* [3]*Ciena Corporation, USA;* [4]*Quantum Opus, USA;* [5]*NuCrypt, USA*. We distribute entanglement over a 24-km deployed fiber alongside a synchronization channel and high-power (21 dBm), fully-loaded C-band classical optical communications. Through wavelength engineering, we maintain high visibilities with little difference due to coexisting light.

## Show Floor Programming

**SF3 • The Network and System Implications of CPO/NPO/xPO and the New Photonics Ecosystem for AI/ML Interconnects SF**
10:30–11:30, *Theater II*

**SF4 • OpenROADM MSA Updates**
10:30–11:30, *Theater III*

**MW1 • State of the Industry: Now and in 2031**
10:30–12:00, *Theater I*

**Technology Showcase:**
**Data Center Reliability in Crisis: Why Past Validation Breaks at 1.6T**
KEYSIGHT
11:45-12:15, *Theater III*

**DCSK • Keynote, Scaling with Optics: Building AI Ready Fabrics from IMDD Pluggables to Coherent DCI**
12:00–12:30, *Theater II*

**MW2 • Market Status and Enabling Technologies of 1.6Tbps and Beyond**
12:30–14:00, *Theater I*

**Technology Showcase:**
**Smart Infrastructure Monitoring with Advanced Fiber Optics**
Lightera
12:30-13:00, *Theater III*

**DCS1 • Data Center Interconnect Trends, Challenges and Opportunities in the AI Era**
12:30–14:00, *Theater II*

**Technology Showcase:**
**Silicon Micro Lens: The Optical Heart of AI-Driven CPO and OCS Architectures**
SUNA
13:15-13:45, *Theater III*

**Technology Showcase:**
**Semiconductor-Enhanced Passives: The Evolutionary Path Towards High Speed Transceiver**
SUNA
14:00-14:30, *Theater III*

**MW3 • Recent Advances in AI Cluster Interconnects**
14:15–15:45, *Theater I*

**DCS2 • Scaling AI Clusters: Challenges in Scale-Up and Scale-Out for Future Growth**
14:15–15:45, *Theater II*

## Room 403A

### Tu2A • Advanced Coherent Technologies and Event Localization—Continued

**Tu2A.2 • 14:30**
**Detecting Abnormal Noise Location in an Optical Fiber Link Using Eigenvalue Transmission,** Hideaki Shimpo[1], Takumi Motomura[2], Kaito Geshi[1], Akihiro Maruta[1], Ken Mishina[1]; [1]*The Univ. of Osaka, Japan;* [2]*National Inst. of Technology, Nara college, Japan*. In this study, we experimentally demonstrate the feasibility of the sensing method for detecting abnormal noise location in an optical fiber link by monitoring eigenvalues in the inverse scattering transform.

**Tu2A.3 • 14:45**
**Offset-Free Least-Squares Power Profile Estimation via DSP Frame Pilot Symbols,** Yingjie Jiang[2], Du Tang[1], Hao Zhou[2], Fan Yang[2], Yutao Zhou[2], Baoxuan Quan[2], Yaojun Qiao[2]; [1]*China Academy of Information and Communications Technology, China;* [2]*Beijing Univ. of Posts and Telecommunications School of Information and Communication Engineering, China*. A least-squares power profile estimation method via DSP frame pilot symbols is proposed, requiring no post-FEC symbols while remaining offset-free. Experiments on 80 GBaud DP-16QAM links closely match ideal-reference results, promising for practical deployment.

## Room 403B

### Tu2B • Single-Core Fiber and Spatial Division Multiplexing—Continued

**Tu2B.2 • 14:30**
**Evaluating Macrobend Loss Reduction in Trench-Assisted Fibers,** Andrey Kobyakov[1], Aramais Zakharian[1], Snigdharaj Mishra[1]; [1]*Corning Inc., USA*. We derive and validate, numerically and experimentally, an accurate closed-form analytical formula for bend loss suppression effectiveness in optical fibers with arbitrarily shaped down-doped trench, simplifying design of low bend loss index profiles.

**Tu2B.3 • 14:45**
**Cost Estimation of Multi-Core Few-Mode Fibers,** Pierre Sillard[1]; [1]*Prysmian, France*. We estimate the cost per core and per mode of multi-core few-mode fibers, finding it equivalent to, or lower than, standard single-mode fiber for 2-core designs and for ≤~4-core designs with ≥10 modes per core.

## Room 408A

### Tu2C • Autonomous Optical Networks—Continued

**Tu2C.2 • 14:30**
**Distributed and Dynamic AI Agent Collaboration Over Optical Transport for Network Orchestration and Monitoring,** Xiaonan Xu[1], Haoshuo Chen[1], Sarvesh S. Bidkar[1], Jesse E. Simsarian[1], Ells Burrows[1], Roland Ryf[1], Mikael Mazur[1], Nicolas Fontaine[1], David Neilson[1]; [1]*Nokia Bell Labs, USA*. We demonstrate a dynamic multi-agent system distributed over 811-km optical transport networks for cross-domain orchestration and monitoring. By selecting optimal agents based on instantaneous conditions, the system achieves greater stability and 2.9× lower latency.

**Tu2C.3 • 14:45**
**Machine Learning Assisted Digital Twin Framework for Improved EDFA Gain and QoT Estimation,** Vignesh Karunakaran[1,2], Sharon Yeh[1], Abdelrahmane Moawad[3], Robert Emmerich[3], Behnam Shariati[3], Ronald Romero Reyes[2], Johannes Fischer[3], Achim Autenrieth[1], Thomas Bauschert[2]; [1]*Adtran Networks SE, Germany;* [2]*Chair of Communication Networks, Technische Universitat Chemnitz, Germany;* [3]*Fraunhofer-Institut fur Nachrichtentechnik Heinrich-Hertz-Institut HHI, Germany*. We propose a hybrid digital twin using GNPy with ML-assisted EDFA models for accurate QoT estimation. The models achieve sub-0.1dB gain error, enhancing data efficiency and improving end-to-end lightpath signal-to-noise ratio estimation within GNPy.

## Room 408B

### Tu2D • Scaling Photonic Integrated Circuits—Continued

**Tu2D.3 • 14:45**
**Samsung Foundry 300-mm Silicon Photonics Platform for HPC/AI Applications,** Seok-Hee Hwang[1], Seong-Hwan Kim[1], Jongwoo Park[1], Bongkwon Son[1], Jung-Tack Yang[1], SeungHun Lee[1], Seungjun Han[1], Seung-Kuk Kang[1], Dong Cheon Kim[1], Dongheon Kim[1], Seyoon Kim[1], Sihan Kim[1], Young Chul Kim[1], Yunji Kim[1], Junyeong Kim[1], Taehong Min[1], Kyutae Park[1], Raeyoung Park[1], Yeonjae Park[1], Jin-Yeong Park[1], Chan-Wook Baik[1], Dongjun Seo[1], Seungkyun Song[1], Hyeonseok Sim[1], Doojun Eom[1], Byungeun Yun[1], Duhyun Lee[1], Woo-Bin Lee[1], Eunhyup Lee[1], Ji-hyung Lee[1], Chanyang Lee[1], Changbum Lee[1], Woongbae Jeon[1], Kwangho Jeong[1], Minsuk Jeong[1], Kyung-Sang Cho[1], Kwansik Cho[1], Hyoungrae Cho[1], Sein Choi[1], Jaewon Choi[1], Jaeho Choi[1], Junghoon Chey[1], Junik Choi[1], Soonchoel Her[1], Seungjun Kim[1], Hyochul Kim[1], Hyundai Park[1], Kangho Lee[1]; [1]*Foundry Business, Samsung Electronics Co Ltd, Korea (the Republic of)*. We present the recent development of Samsung Foundry's 300-mm silicon photonics platform for next-generation optical interconnect. This paper reviews the platform overview, the performance of photonic devices and the PDK.

## Room 411

### Tu2E • Metro-Access Integration and Traffic Optimization—Continued

**Tu2E.3 • 14:45**
**Generative Forecasting of Aggregated FTTR Traffic for Resource Allocation Enabling Immersive XR Collaborations,** SOURAV MONDAL[1], Ka-Lun Lee[1], Elaine Wong[1]; [1]*Univ. of Melbourne, Australia*. We leverage coarse-grained Transformer-generative forecasts of multi-modal traffic aggregated from FTTR endpoints to proactively allocate resources in FTTH networks, ensuring immersive Quality-of-Experience requirements of XR collaborations. Results show upto 70% more accurate long-horizon traffic forecasts.

## Room 501ABC

### Tu2F • Subsea Cable Sensing—Continued

**Tu2F.3 • 14:30**
**Multidimensional Fusion Sensing of Submarine Cables Based on Distributed Optical Fiber Sensing Technology,** Xia Gao[1], Qian Zhang[1], Xianda Lin[2], Zhebin Hong[3], Jian Xu[4], Guoxiang Li[4], Mingxiong Duan[4], Yuhan Hu[1], Jianjun Wu[4], Sen Jia[5], Yi Ding[1], Lipeng Feng[1], Xin Qin[1], Xiaowei Lou[1], Qian Hu[1], Xiaoli Huo[1], Junjie Li[1]; [1]*China Telecom Research Inst., China;* [2]*China Telecom Guangdong Branch, China;* [3]*China Telecom shantou international submarine cable station, China;* [4]*Accelink Technologies Co. Ltd, China;* [5]*China Telecom Corporation, China*. The DOFS integrating intensity-phase-frequency parameters deployed on submarine communication cables, achieving for the first time the multi-dimensional perception of fiber loss, temperature, ocean gravity waves, tides, earthquakes, typhoons and vessel activities simultaneously.

**Tu2F.4 • 14:45**
**Repeater Fault Detection and Localization Using Coherent OTDR for Multicore Fiber Submarine Cable Systems,** Kosuke Komatsu[1], Kodai Ishida[2], Shohei Beppu[1], Daiki Soma[1], Seiya Sumita[1], Taiki Fukushima[2], Hidenori Takahashi[1], Yuta Wakayama[1], Takehiro Tsuritani[1]; [1]*KDDI Research, Inc., Japan;* [2]*Anritsu Kabushiki Kaisha, Japan*. We experimentally evaluate the fault detection performance of coherent OTDR in two systems with and without high-loss loopbacks, focusing on gain reduction in optical submarine repeaters and achieving 1-dB measurement accuracy in both systems.

## Room 502A

### Tu2G • Panel: Machine Learning is Taking Over Optical Communications - But Which Algorithms Should We Use?—Continued

## Room 502B

### Tu2H • Photonic Integrated Circuits for Wireless Communications—Continued

**Tu2H.2 • 14:30** ★ Top-Scored

**K/Ka-Band MmWave Radio-Over-Fiber Transceiver With co-Designed SiGe EIC and SiPh PIC for Intra-Satellite Links,** Gaël Jongbloet[1], Torben Onselaere[1], Kieran De Bruyn[1], Marijn Werbrouck[1], Reinier Broucke[1], jasper jans[1], Cedric Bruynsteen[1], Guy Torfs[1], Nishant Singh[1], Johan Bauwelinck[1]; [1]*IDLab, Ghent Univ.-imec, Belgium*. We demonstrate an all-silicon fully-integrated mmWave radio-over-fiber transceiver for bands in the 18-36 GHz range containing a SiGe RFIC and SiPh PIC with Si MZM and Ge photodiode.

**Tu2H.3 • 14:45** ★ Top-Scored

**Packaged InP PIC for Photonic RF Receive Front-End of High-Capacity Telecom Satellites,** Metodi Belchovski[1,2], Alexander Grebenchukov[1], Benoit BENAZET[2], Idelfonso Tafur Monroy[1], Michel Sotom[2], Simon Rommel[1]; [1]*Technische Universiteit Eindhoven, Netherlands;* [2]*Research and Product Development, Thales Alenia Space, France*. We demonstrate a packaged InP photonic integrated circuit receiver for Ka- and Q/V-band satellite links, achieving up to 14 dB noise-figure reduction via phase modulation and balanced detection, matching electronic RF performance with reduced SWaP.

## Room 515B

### Tu2J • Inverse Designed Integrated Photonic Components—Continued

## Room 518

### Tu2K • Entanglement Sources, Distribution and Photonic Architectures—Continued

**Tu2K.3 • 14:30**

**Entanglement-Based Clock Offset Estimation Using Off-the-Shelf Hardware Components Over a Field-Deployed Fiber Link,** Ming Yin[1], Matheus Sena[1], Maximilian Schulz[1], Michaela Ritter[1], Ralf-Peter Braun[1], Ronny Döring[1], Marc Geitz[1], Oliver Holschke[1]; [1]*Deutsche Telekom AG, Germany*. We demonstrate quantum-entanglement-based clock offset estimation using a commercially available entangled-photon source over both laboratory and field-deployed fiber links, showing that spectral filtering enhances timing accuracy and enables precise offset estimation between independent time-stamping modules.

**Tu2K.4 • 14:45**

**Implementation of 8×8 Image Generation on a Quantum Photonic Chip Using Chip Multiplexing,** Haoran Ma[1], Huihui Zhu[1], Zichao Zhao[1], Qishen Liang[1], Baojie Hou[1], bin zhang[1], DONGHUI CHEN[1], DENGHUI WANG[1], Yuehai Wang[1], Jianyi Yang[1]; [1]*Zhejiang Univ., China*. We experimentally implement a quantum generative adversarial network (GAN) on a fabricated 5-qubit quantum photonic chip. By employing a chip multiplexing technique, the network successfully generates 8×8 images of digit 0.

## Show Floor Programming

**MW3 • Recent Advances in AI Cluster Interconnects**
14:15–15:45, *Theater I*

**DCS2 • Scaling AI Clusters: Challenges in Scale-Up and Scale-Out for Future Growth**
14:15–15:45, *Theater II*

**SF5 • F5G: Advances in International Optical Networks Towards 2030 and Beyond (ION-2030)**
14:45–15:45, *Theater III*

## Room 403A

### Tu2A • Advanced Coherent Technologies and Event Localization—Continued

**Tu2A.4 • 15:00**
**Advancing SOP Event Localization Through Commercial Transponder Characterization,** Fabien Boitier[1], Patricia Layec[1], Filippo Polo[2], Alessandro Nale[2], Matteo Lonardi[2], Carlo Costantini[2], Martin Belzner[3], Robert Posilovic[3], Andreas Benz[3], Dirk Eggers[3], Andreas Preiss[3], Stefan Weisser[3]; [1]*Nokia Bell Labs, France;* [2]*Nokia, Italy;* [3]*Nokia, Germany.* We characterize SOP event localization with a commercial transponder on a 150 km link. Fast events achieved below 20 m of standard deviation. We propose a localization improvement of low-speed events, achieving constant performance up to 10 krad/s.

**Tu2A.5 • 15:15** ★ Top-Scored
**Mode-Resolved Longitudinal Power and MDL Monitoring in Multi-Mode Fiber Transmission,** Minami Takahashi[1], Takeo Sasai[1], Megumi Hoshi[1], Masanori Nakamura[1], Akira Kawai[1], Kohki Shibahara[1], Takayuki Kobayashi[1], Yutaka Miyamoto[1], Etsushi Yamazaki[1]; [1]*Network Innovation Laboratories, NTT, Inc., Japan.* We experimentally demonstrate the first mode-resolved fiber-longitudinal power monitoring (LPM) in a three-mode fiber link by extending the receiver-side-DSP-based LPM algorithm to multi-mode transmission, enabling location-resolved mode-dependent loss (MDL) monitoring down to 1 dB.

## Room 403B

### Tu2B • Single-Core Fiber and Spatial Division Multiplexing—Continued

**Tu2B.4 • 15:00** Tutorial
**Past, Present and Future Fiber Technology for Optical Transmission Systems,** Ming-Jun Li[1]; [1]*Corning Inc., USA.* This tutorial reviews fiber technology evolution and presents recent advancements for enhancing fiber transmission capacity and optical interconnect density. It explores opportunities of these new optical fibers as well as challenges for practical applications.

Dr. Ming-Jun Li is a Corporate Fellow with Corning Incorporated, where he conducts research on optical fibers. He is a member of the US NAE, a Fellow of Optica, IEEE and SPIE. He received the 2023 John Tyndall Award. He holds 308 US patents and has published over 380 papers.

## Room 408A

### Tu2C • Autonomous Optical Networks—Continued

**Tu2C.4 • 15:00**
**Experimental Validation of Lightpath Operation Based on Continuous Digital-Twin Model Tuning,** Pol Gonzalez[1], Abdel-Rahmane Moawad[2], Sadegh Ghasrizadeh[1], Ramon Casellas[3], Marc Ruiz[1], Hussein Zaid[2], Luis Velasco[1]; [1]*Universitat Politecnica de Catalunya, Spain;* [2]*Fraunhofer Heinrich-Hertz-Inst., Germany;* [3]*Centre Tecnològic de Telecomunicacions de Catalunya (CTTC/CERCA), Spain.* A complete digital twin-assisted lightpath operation workflow for multiband optical networks is proposed for assured performance and reliable surveillance. Accurate performance estimation and prompt degradation detection through continuous model tuning using telemetry are experimentally shown.

**Tu2C.5 • 15:15**
**Differentiated Alarm Feature Modeling Toward Intelligent Fault Recognition in Scale-Aware Optical Networks,** Xinyang Li[1], Hui Li[1], Xin Qin[2], Rentao Gu[1], Zheqing Lv[2], Yi Ding[2], Yadong Gong[2], Yuefeng Ji[1]; [1]*Beijing Univ. of Posts and Telecommunications, China;* [2]*China Telecom Research Inst. Beijing, China.* A multi-algorithm collaborative framework for optical network fault analysis is proposed. Based on the heterogeneous network feature matching analysis model, it achieves recognition accuracy exceeding 98%.

## Room 408B

### Tu2D • Scaling Photonic Integrated Circuits—Continued

**Tu2D.4 • 15:00** ★ Top-Scored
**An Innovative 300mm Back Side Integrated Silicon Photonics Platform for 200Gbits/s/Lane Applications,** Sébastien Crémer[1], Eva Kempf[1], Laurent Milord[1], Stéphane Monfray[1], Audrey Michard[1], Fouad Bentata[1], Laurent Garchery[1], Antonio Fincato[1], Imene Reghioua[1], Florian Delachat[1], Frederic Le Roux[1], Agnese Tortelli[1], Marion Croisy[1], Edy Azrak[1], Hugo Nuez[1], Gregory Imbert[1], Guillaume Landie[1], Baptiste Guyard[1], Andres Lopez Garcia[1], Tommaso Giammaria[2], Marvin Frauenrath[1], Sylvie Delmedico[1], Aurore Durel[1], Delia Ristoiu[1], Melissa Brihoum[1], Sebastien Berard-Bergery[1], Ophelie Foissey[1], Sebastien Jan[1], Veronique Caubet-Hilloutou[1], Leopold Virot[1], Philippe Grosse[2], Daivid Fowler[2], André Myko[2], Daniele Sette[2], Karim Hassan[2], Nicolas Planes[1], Sylvie Gellida[1], Frederic Boeuf[1]; [1]*STMicroelectronics, France;* [2]*CEA LETI, France.* We present PIC100G, an innovative Silicon Photonics platform compatible with edge coupling and targeting 200Gbits/s/lane product. This paper presents the process flow as well as the performances of main photonic devices.

**Tu2D.5 • 15:15** Invited
**Fully Automated Wafer-Level Edge and Grating Coupling Measurement System for Silicon Photonic Integrated Circuits,** Quan Yuan[1], Joe Frankel[1], Divya Pratap[1]; [1]*FormFactor Inc, USA.* This presentation will discuss automated wafer-level edge and grating coupling measurement systems for silicon photonic integrated circuits.

## Room 411

### Tu2E • Metro-Access Integration and Traffic Optimization—Continued

**Tu2E.4 • 15:00** Invited
**Photonic Integrated Wavelength Distribution Nodes for Optical Metro-Access Networks,** Nicola Calabretta[1], Shiyi Xia[1], Henrique Freire Santana[1], Marijn Rombouts[1], Yu Wang[1], Aref Rasoulzadeh Zali[1]; [1]*Technische Universiteit Eindhoven, Netherlands.* Optical metro-access networks must support rapidly increasing capacity demands generated by 6G applications. We present photonic integrated wavelength-switching nodes that dynamically distribute high-capacity 800Gbps WDM channels to diverse access nodes enabling multi-Tbps WDM metro-access networks.

## Room 501ABC

### Tu2F • Subsea Cable Sensing—Continued

**Tu2F.5 • 15:00**
**Risk Assessment Method for Submarine Optical Cable Inspection Utilizing Φ-OTDR DAS,** Keisuke Murakami[1], Masahiko Abe[1], Kevin Tan[1], Chihiro Kito[1]; [1]*Nihon Denshin Denwa Kabushiki Kaisha, Japan.* Innovative inspection methods on submarine cables are required for effective maintenance. We propose a remote risk assessment method for submarine cable inspection utilizing Φ-OTDR that can, in experiments, detect changes in cable conditions.

**Tu2F.6 • 15:15** Invited
**Safeguarding Subsea Infrastructure Through Multimodal Fiber Sensing,** Zack Spica[1,2]; [1]*Univ. of Michigan, USA;* [2]*Lumetec Inc, USA.* Submarine cable outages are dominated by accidental seabed contact. We present a real-time sensing platform combining polarization monitoring, distributed acoustics, and AIS analytics to deliver instant alerts, precise localization, and proactive protection of cable routes.

## Room 502A

### Tu2G • Panel: Machine Learning is Taking Over Optical Communications - But Which Algorithms Should We Use?—Continued

## Room 502B

### Tu2H • Photonic Integrated Circuits for Wireless Communications—Continued

**Tu2H.4 • 15:00**
**A Single High-Power SiC-Based UTC-PD Enabling a 40-Gbit/s Two-Channel FDM-THz Link,** Yoshiki Kamiura[1], Shinji Iwamoto[1], Masato Kawano[1], Tomohiro Tetsumoto[2], Yuya Mikami[1], Norihiko Sekine[2], Tadao Nagatsuma[3], Tadao Ishibashi[4], Kazutoshi Kato[1]; *[1]Kyushu Univ., Japan; [2]National Inst. of Information and Communications Technology, Japan; [3]The Univ. of Tokyo, Japan; [4]Wavepackets LLC, Japan.* We demonstrate 40-Gbit/s two-channel FDM-THz transmission using a single SiC-UTC-PD, where 5 Gbaud 16-QAM carriers at 257 and 277 GHz achieved 16.3 m links below the HD-FEC limit, verifying distance and channel scalability.

**Tu2H.5 • 15:15**
**Imaging APD Receiver for Multi-Gbit/s Optical Wireless Communication With Angular Diversity.,** Atiyeh Pouralizadeh[1], Max Julius Bode[1], Giulio Boniello[1], Malte Hinrichs[1], Christoph Kottke[1], Sarah Cwalina[1], Ronald Freund[1], Volker Jungnickel[1]; *[1]Fraunhofer HHI, Germany.* Using 9 VCSEL arrays and a 12×12 imaging APD array receiver, we demonstrate angular diversity reception by pixel selection at a net data rate of 4.395 Gbit/s over 20 cm for the first time.

## Room 515B

### Tu2J • Inverse Designed Integrated Photonic Components—Continued

**Tu2J.2 • 15:00** ★ Top-Scored
**Adjoint-Optimized Dual-Layer Grating Couplers for Low-Loss, High-Bandwidth Optical Interconnects,** Norman Shi[1], Kuo-Fang Chung[1], James Tsai[1], Yannick Augenstein[2], Bohan Zhang[2], Tyler Hughes[2], Orphus Kuo[1], En-Chan Chen[1], Chia-Chun Chu[1], Tzu-Heng Wu[1], Shih-Chi Liu[1], Jackie Tung[1], Shu-Wei Chang[1], Anderson Lin[1], Sheng-Kai Yeh[1], Andy Wang[1], Yu-Wei Liu[1], John Wen[1], Hsiang-Chu Wang[1], Ta-Ching Tzu[1], Po-Chen Yeh[1], Shao-Da Wang[1], Fan Hu[1], Fu-Chun Huang[1], Shi-Min Wu[1], Ricky Kuo[1], Fred Chen[1], Alex Fann[1], Cheng-Tse Tang[1], Wei-Kang Liu[1], Chun-Hung Chen[1], Kelvin Tai[1], Calvin Hung[1], Yin-Chen Lu[1], Hau-Yan Lu[1], Chih-Tsung Shih[1], Jyun-Ying Lin[1], Feng Yuan[1], Chia-hua Chu[1], Felix Tsui[1], Victor Shih[1], Shih-Fen Huang[1]; *[1]Taiwan Semiconductor Manufacturing Co Ltd, Taiwan; [2]FlexCompute Inc., USA.* We present a dual-layer grating coupler platform, optimized through inverse design, that integrates silicon and silicon nitride layers to achieve low insertion loss and broad optical bandwidth for both single-polarization and polarization-splitting grating couplers.

**Tu2J.3 • 15:15**
**Inverse-Designed Etch-Stable Ring Modulators,** Peng Sun[1], Brett Klehn[1], Calvin Ma[1], Vesselin Velev[1], Itamar Priel[2], Liron Gantz[2]; *[1]NVIDIA Corp, USA; [2]NVIDIA Corp, Israel.* Wafer-level measurements of inverse designed ring modulators show a 2.5-fold reduction in sensitivity to etch depth variation compared with simple circular rings. Simulations predict a fivefold reduction, with residual wafer stress limiting further improvement.

## Room 518

### Tu2K • Entanglement Sources, Distribution and Photonic Architectures—Continued

**Tu2K.5 • 15:00**
**Optical Phased Array Chip-Based Free-Space QKD Experiment Using Compact Quantum Photonics Modules,** Minchul Kim[2,1], Junsang Oh[2], Byung-Seok Choi[2], Joong-Seon Choe[2], Ju Hee Baek[2], Chun Ju Youn[2], Hyo-Hoon Park[1], Hamza Kurt[1], Hoon Kim[1]; *[1]The School of Electrical Engineering, Korea Advanced Inst. of Science and Technology College of Engineering, Korea (the Republic of); [2]Quantum Technology Research Division, Electronics and Telecommunications Research Inst., Korea (the Republic of).* We demonstrate the first free-space QKD experiment using an optical phased array chip for compact, fully integrated, and mobile free-space QKD systems. We achieve 1% QBER for a couple of beam steering conditions.

**Tu2K.6 • 15:15**
**Demonstration of Entanglement Based and DWDM Compatible Quantum Alert Mechanism for Optical Communication Systems,** Amir Minoofar[1], Jiapeng Zhao[1], Mahdi Bornadel[1], Michael Kilzer[1], Stephane vinet[1], Eneet Kaur[1], Luca Della Chiesa[1], Christian Schmutzer[1], Joshua Castro[2], Galan Moody[2], Ramana Kompella[1], Reza Nejabati[1]; *[1]Cisco, USA; [2]Univ. of California Santa Barbara, USA.* We demonstrate a quantum alert mechanism that uses quantum entanglement and random frequency hopping for eavesdropper monitoring in a classical optical network.

## Show Floor Programming

**MW3 • Recent Advances in AI Cluster Interconnects**
14:15–15:45, *Theater I*

**DCS2 • Scaling AI Clusters: Challenges in Scale-Up and Scale-Out for Future Growth**
14:15–15:45, *Theater II*

**SF5 • F5G: Advances in International Optical Networks Towards 2030 and Beyond (ION-2030)**
14:45–15:45, *Theater III*

| Room 403A | Room 403B | Room 408A | Room 408B | Room 411 | Room 501ABC |
|---|---|---|---|---|---|
| **Tu2A • Advanced Coherent Technologies and Event Localization—Continued** | **Tu2B • Single-Core Fiber and Spatial Division Multiplexing—Continued** | **Tu2C • Autonomous Optical Networks—Continued** | **Tu2D • Scaling Photonic Integrated Circuits—Continued** | **Tu2E • Metro-Access Integration and Traffic Optimization—Continued** | **Tu2F • Subsea Cable Sensing—Continued** |

**Tu2C.6 • 15:30**
**Demonstration of a Collision Control Mechanism for Inter-AIDC Traffic in a Spine-Leaf Multi-Granularity All-Optical Switching Network,** Haoyang Chen[1], Huitao Zhou[1], Yuanhang Shi[1], Xingyi Zhang[1], Zhiqun Gu[1], Yuefeng Ji[1], Jiawei Zhang[1]; [1]*Beijing Univ. of Posts & Telecom, China.* We present a collision control mechanism for a spine-leaf multi-granularity all-optical switching network handling time-sensitive inter-AIDC traffic. An FPGA-based testbed demonstrate that the proposed mechanism effectively resolves optical time-slot conflicts and enhances overall network throughput.

**Tu2C.7 • 15:45**
**Reinforcement Learning Assisted Control Framework for Self-Configuring SOA-Based Optical Metro-Access Networks,** Shiyi Xia[1], Henrique Freire Santana[1], Marijn Rombouts[1], Elham Khani[1], Sandeep Singh[1], oded Raz[1], Nicola Calabretta[1]; [1]*Technische Universiteit Eindhoven, Netherlands.* Reinforcement learning (RL)–Deep Deterministic Policy Gradient (DDPG) assisted self-configuration closed-loop control framework for SOA-based filterless metro-access networks is demonstrated. Improved OSNR and BER reduction, and 30% power savings were demonstrated.

**Tu2E.5 • 15:30**
**Traffic Measurements and Models Based on Real User Data From Different German Operators,** Mirco Börner[1], Kristof Obermann[1], Carmen Mas Machuca[2]; [1]*Technische Hochschule Mittelhessen, Germany;* [2]*Universität der Bundeswehr München, Germany.* We present compact Fourier models of aggregated real user traffic, derived from 3129 German access connections, providing, to our knowledge, the most current representation of PON user behavior for energy-efficient resource and capacity planning.

**Tu2E.6 • 15:45**
**Bandwidth Allocation Optimization for Single-Subcarrier Reception in TFDM Simplified CPON,** Jifan Yin[1], Peiji Song[2], Yuan Liu[1], Calvin C. K. Chan[1]; [1]*Chinese Univ. of Hong Kong, Hong Kong;* [2]*Univ. of Cambridge, UK.* We propose a mathematical model and an algorithm to optimize bandwidth resource allocation in a TFDM simplified CPON with single-subcarrier reception constraint. 100G downstream transmission with single-subcarrier reception shows good rate-diversity gain over all-subcarrier reception.

## Room 502A

### Tu2G • Panel: Machine Learning is Taking Over Optical Communications - But Which Algorithms Should We Use?—Continued

## Room 502B

### Tu2H • Photonic Integrated Circuits for Wireless Communications—Continued

**Tu2H.6 • 15:30**
**Semi-Transparent CdTe Solar Panels for Optical Wireless Communications,** Matthew Anderson[1], Isaac N. Osahon[1], Martyn Rush[2], Harald Haas[1], Iman Tavakkolnia[1]; [1]*Univ. of Cambridge, UK;* [2]*Polysolar Ltd, UK*. Presented is the first demonstration of semi-transparent (20%, 50%) solar panels (30x30cm, CdTe), as optical wireless communication receivers. The results show that the system is robust against angular and lateral misalignment, critical for real-world implementation.

**Tu2H.7 • 15:45**
**J-Band Waveguide-Coupled UTC-PD Module Enabling 200 Gbit/s Photonic Terahertz Communications,** Liga Bai[4], Tianyu Long[1], Lu Zhang[4], Zhidong Lyu[4], Oskars Ozolins[2,3], Xiaodan Pang[4,2], Baile Chen[1], Xianbin Yu[4,2]; [1]*ShanghaiTech Univ., China;* [2]*Rigas Tehniska Universitate, Latvia;* [3]*RISE Research Inst.s of Sweden AB, Sweden;* [4]*Zhejiang Univ., China*. We present a J-band waveguide-coupled UTC-PD module that simultaneously achieves high responsivity and output power, enabling a stable 286 GHz photonic wireless link over 10 m with 200 Gbit/s polarization-multiplexed QPSK high-capacity transmission.

## Room 515B

### Tu2J • Inverse Designed Integrated Photonic Components—Continued

**Tu2J.4 • 15:30**
**Ultrasmall SCL-Band Wavelength Multiplexers Using Mosaic-Based Digital Metamaterial,** Takeshi Fujisawa[1], Takuya Mitarai[2,3], Yusuke Sawada[2,3], Takuya Okimoto[2,3], Takuo Hiratani[2,3], Kento Komatsu[2,3], Hideki Yagi[2,3], Naoki Fujiwara[2,3]; [1]*Hosei Daigaku Rikogakubu Daigakuin Rikogaku Kenkyuka, Japan;* [2]*Sumitomo Denki Kogyo Kabushiki Kaisha, Japan;* [3]*Photonics Electronics Technology Research Association, Japan*. An ultrasmall SCL-band wavelength multiplexer based on digital metamaterial is proposed and experimentally demonstrated for the first time. A low insertion loss (~3-dB) SCL-band filtering with only 3.6×12 $\mu m^2$ footprint is successfully demonstrated.

**Tu2J.5 • 15:45**
**Inverse-Designed Edge Couplers for Multimode Silicon Nitride Photonics,** Julian L. Pita Ruiz[1], Samuel Gougeon[2], Mostafa Youssef[1], Bora Ung[1], Sophie LaRochelle[2], Michaël Ménard[1]; [1]*Ecole de Technologie Superieure, Canada;* [2]*Universite Laval, Canada*. We demonstrate inverse-designed five- and ten-mode edge couplers in silicon nitride for efficient coupling to elliptical-core fibers. They achieve coupling efficiencies of up to –2.4 dB and 3-dB bandwidths spanning the C and L bands.

## Room 518

### Tu2K • Entanglement Sources, Distribution and Photonic Architectures—Continued

**Tu2K.7 • 15:30** Invited
**Generation, Manipulation and Detection of Single Photons,** Val Zwiller[1]; [1]*Single Quantum BV, Delft, The Netherlands*. We discuss the production of quantum devices with single and entangled photons generated by quantum dots and detected by superconducting nanowire detectors and their applications in quantum communication, integrated circuits, lidar and microscopy.

## Show Floor Programming

**MW3 • Recent Advances in AI Cluster Interconnects**
14:15–15:45, *Theater I*

**DCS2 • Scaling AI Clusters: Challenges in Scale-Up and Scale-Out for Future Growth**
14:15–15:45, *Theater II*

**SF5 • F5G: Advances in International Optical Networks Towards 2030 and Beyond (ION-2030)**
14:45–15:45, *Theater III*

## Room 403A

**16:30–18:15**
**Tu3A • Transmission System Modeling and Its Validation**
*Presider: Domaniç Lavery; Nokia Corporation, UK*

**Tu3A.1 • 16:30** Invited
**Fiber Transmission Dynamics in Wideband Systems,** Andre Richter[1], Vladislav Neskorniuk[1], Dmitry Khomchenko[1], Elias Giacoumidis[1], Igor Koltchanov[1]; [1]*VPIphotonics, Germany.* We present an effective method for formulating general propagation equations that describe the various linear, nonlinear, and polarization-sensitive fiber characteristics in wideband transmission systems and illustrate its application in scenarios across several wavelength bands.

**Tu3A.2 • 17:00**
**O-Band Closed-Form Formula of the ISRS GN Model,** Henrique Buglia[2], Zelin Gan[1], Mindaugas Jarmolovicius[1], Jiaqian Yang[1], Romulo Aparecido de Paula Junior[1], Ronit Sohanpal[1], Eric Sillekens[1], Robert Killey[1], Polina Bayvel[1]; [1]*Univ. College London, USA;* [2]*Nokia, USA.* A closed-form formula for nonlinear interference (NLI) estimation in ultra-wideband optical systems is presented. By including four-wave mixing (FWM), it improves the O-band accuracy by up to 1.9 dB over our previous model.

## Room 403B

**16:30–18:30**
**Tu3B • ThZ and Microwave Generation**
*Presider: Prince Anandarajah; Dublin City Univ., Ireland*

**Tu3B.1 • 16:30** Invited
**Low Noise Microwave Generation With Stable Lasers,** William Loh[1]; [1]*MIT Lincoln Laboratory, USA.* We showcase the potential for optical frequency division of ultrastable lasers down to 10 GHz microwave frequency to reach ultralow levels of phase noise with inherent resilience to the environment.

**Tu3B.2 • 17:00**
**Dual Optical Frequency Comb Down-conversion of D-Band mm-Wave Signals,** Callum Deakin[1], Zichuan Zhou[2], Ronit Sohanpal[2], Zhixin Liu[2]; [1]*Nokia Bell Labs, USA;* [2]*Univ. College London, UK.* We demonstrate a dual optical frequency comb concept that down-converts arbitrary narrowband D-band (110-170 GHz) signals to baseband without any filter or optical/RF frequency tuning, using low frequency RF components.

## Room 408A

**16:30–18:30**
**Tu3C • Tunable Microrings, MZIs, Isolators, and Athermal PICs**
*Presider: Mario Dagenais; Univ. of Maryland at College Park, USA*

**Tu3C.1 • 16:30** ★ Top-Scored
**Crosstalk-Resilient Wavelength Locking for Si Micro-Ring-Resonator-Based Ultra-Dense WDM Receivers,** Seung-Jae Yang[1], Yongjin Ji[1], Daewon Rho[1], Jae-Ho Lee[1], Woo-Young Choi[1]; [1]*Yonsei Univ., Korea (the Republic of).* We present a crosstalk-resilient wavelength locking technique for ultra-dense MRR-based WDM receivers. Crosstalk between adjacent rings is mitigated by custom circuits, and the proposed locking robustly tracks target wavelengths under interference. A 4 × 28 Gb/s Si photonic receiver with 250 pm (31.2 GHz) spacing verifies the method.

**Tu3C.2 • 16:45** ★ Top-Scored
**Ring Resonator-Based Dynamic Controller for Precise Wavelength Separation of a DWDM Laser Source,** Jahnavi Sharma[1], Cooper Levy[1], James Jaussi[1], Zhe Xuan[1], Duanni Huang[2], Haisheng Rong[2], Dan Lake[1], Prathapa Puttaswamy[1], Ranjeet Kumar[1]; [1]*Intel Corporation, USA;* [2]*Intel Corporation, USA.* We demonstrate a ring-resonator based controller that provides simultaneous and continuous control of the wavelength spacing of a distributed feedback laser array maintaining it within 201±4 GHz in the presence of ambient variations.

**Tu3C.3 • 17:00** Invited
**Chip-Scale Non-Magnetic Wideband Reconfigurable Optical Isolators,** Peter T. Rakich[1], Haotian Cheng[1], Yishu Zhou[1], Margaret Pavlovich[1], Freek Ruesink[1], Shai Gerter[1], Andrew Starbuck[2], Andrew Leenheer[2], Andrew Pomerene[2], Douglas C. Trotter[2], Christina Dallo[2], Matthew Boady[2], Katherine Musick[2], Michael Gehl[2], Ashok Kodigala[2], Matthew Eichenfield[2], Nils Otterstrom[2], Anthony Lentine[2]; [1]*Yale Univ., USA;* [2]*Sandia National Laboratories, USA.* Using acousto-optic scattering and dispersion engineering, we demonstrate new on-chip nonmagnetic optical isolator designs that support high bandwidth (> 1 THz), low-loss isolation, and rapid electrical reconfigurability for advanced integrated photonics applications.

## Room 408B

**16:30–18:30**
**Tu3D • Optical Doped Fiber Amplifiers**
*Presider: Robert Tench; Cybel, LLC, USA*

**Tu3D.1 • 16:30** Invited
**What's Next for Optical Amplification? New Materials, Spectral Bands, and Applications,** Aleksandr I. Donodin[1], Vitaly Mikhailov[2], Egor Manuylovich[1], Jiawei Luo[2], Dmitrii Stoliarov[1], David DiGiovanni[2], Sergei K. Turitsyn[1]; [1]*Aston Univ., UK;* [2]*Lightera Laboratories, USA.* Emerging doped-fiber amplifiers are redefining optical amplification beyond the conventional C+L-bands. This paper discusses new materials, broader spectral coverage, and high-power solutions for data transmission in standard and hollow-core fibers, as well as for photonic-integrated-circuit applications.

**Tu3D.2 • 17:00**
**High Gain, low-Noise Broadband Hybrid Fiber Amplifier for L+U Band Amplification,** Shiqi Zhou[1], Hui Zhang[1], Xin Huang[1], Junjie Qi[1], Zhaolong Liao[1], Yifei Xu[1], Yuanpeng Ding[1,2], Li Zhang[1], Chan Li[1], Guofeng Yan[2,3], Bing Han[2,3], Lei Shen[1], Lei Zhang[1], Jie Luo[1], Jian Wang[2,3]; [1]*State Key Laboratory of Optical Fiber and Cable Manufacture Technology, YOFC, China;* [2]*Wuhan National Laboratory for Optoelectronics and School of Optical and Electronic Information, Huazhong Univ. of Science and Technology, China;* [3]*Optics Valley Laboratory, China.* We first report a compact broadband hybrid amplifier based on PCF and BDF, capable of efficient amplification across the L+U bands, providing a 34.4-dB net gain and 3.34-dB NF.

## Room 411

**16:30–18:30**
**Tu3E • Submarine & Hollow-Core Fiber Systems**
*Presider: Jean-christophe Antona; Alcatel Submarine Networks Inc., France*

**Tu3E.1 • 16:30** Invited
**Toward Multi-Petabit Submarine Cables: Opportunities and Challenges of Multi-Band, Multi-Core Fibers and Hollow-Core Fibers,** Alexis Carbo Meseguer[1]; [1]*Alcatel Submarine Networks Inc., France.* Submarine cable evolution is driven by AI traffic growth. This study shows that managing power and space constraints, not technology itself, defines scalability. C+L and multi-core fibers may reach 1 Pbps, but overcoming the powering limitations is necessary first to unlock multi-Pbps systems.

**Tu3E.2 • 17:00**
**Extending a Single-Span Characterization to the Full Submarine Link: a Digital Twin Approach for Accurate G/OSNR Prediction Over 150 Spans,** Alexis Carbo Meseguer[1], Raul Fonseca Poca[1], Chiara Lasagni[3], Juliana Tiburcio de Araujo[1], Jean Christophe Antona[1], Maxence Zhuang[1], Sebastien Dupont[1], Dominique Mongardien[1], Pascal Pecci[2], Philippe Perrier[2], Vincent Letellier[1]; [1]*Alcatel Submarine Networks Inc., France;* [2]*Meta Platforms Inc, USA;* [3]*Universita degli Studi di Parma, Italy.* We show that a single measured span, properly adapted, is representative of a 10,200-km submarine link with over 150 amplifiers. Indeed, after one end-to-end calibration, 0.23 dB of RMSE in G/OSNR prediction can be obtained when tested with hundreds of random input pre-emphases.

## Room 501ABC

**16:30–18:30**
**Tu3F • Satellite Optical Networks**
*Presider: Nicola Sambo; Scuola Superiore Sant'Anna, Italy*

**Tu3F.1 • 16:30**
**Pre-Load-Balancing Against SGL Attenuation in Optical Satellite Networks,** Zijun Li[1], wei wang[1], Yi An[1], Yongli Zhao[1], Jie Zhang[1]; [1]*Beijing Univ. of Posts & Telecom, China.* We propose a pre-load-balancing (PLB) algorithm against satellite-ground link(SGL) attenuation to proactively mitigate potential service interruption. The simulation result shows that PLB can reduce 53.4% service interruption and 39.81% latency jitter.

**Tu3F.2 • 16:45**
**Leveraging Network Diversity for Capacity Maximization in European Optical GEO Feeder Systems Under Realistic Optical Turbulence,** Ollie Farley[2], Perrine Lognoné[2], Rajiv Boddeda[1], James Osborn[2]; [1]*Nokia Bell Labs France, France;* [2]*Durham Univ., UK.* Using year-long turbulence data from 25 different European sites, we optimize the GEO feeder-link optical network with adaptive optics at ground stations, achieving turbulence mitigation without extended interleaving and enhancing reliability in high-throughput optical systems.

**Tu3F.3 • 17:00**
**Mobile Orbital Domain-Based Hierarchical Routing in Satellite Networks,** Zilong Ye[1,2], Philip N. Ji[1], Deniz Bajin[3], Connor Wang[3], Yunxuan Wang[3], Ting Wang[1]; [1]*NEC Laboratories America Inc, USA;* [2]*Cal State LA, USA;* [3]*Pomona College, USA.* We propose a mobile orbital domain-based hierarchical routing scheme which addresses the challenges posed by constant satellite movement and the resulting dynamic network topology, thus significantly improving the routing scalability and efficiency in satellite networks.

## Room 502A

### 16:30–18:30
### Tu3G • Panel: Artificial Intelligence in Optical Network Control and Management

**Organizers:**
Ashwin Gumaste, *Microsoft, USA*
Ricard Vilalta, *CTTC, Spain*

**Speakers:**
Shamim Akhtar, *Apple, USA*
Juan Pedro Fernández-Palacios Giménez, *Telefónica Innovación Digital S.L.U., Spain*
Priya Kesavan, *Microsoft, USA*
Paparao Palacharla, *Fujitsu, USA*
Walid Wakim, *Nokia, USA*

Optical networks are under pressure from soaring traffic, disaggregation, and the demand for automation, yet manual management remains brittle in the face of complex telemetry and rising cyber-risks. AI offers a path forward: from auto-provisioning and predictive maintenance to real-time resource tuning, anomaly detection, and security analytics, deployments already show gains in performance, resilience, and cost efficiency. Building on our OFC 2024 workshop and 2025 special session, the upcoming panel will explore how large language models and generative AI can take this further—embedding intent-based interfaces, generating configuration code, and orchestrating multi-vendor, multi-layer domains toward self-optimizing, self-securing optical networks. To ensure an engaging and insightful session, the panel will focus on:

The key discussions to address in this panel are:

- Evolving challenges in optical network control and management under growing bandwidth demands and complexity, and how AI can address them.
- Current and emerging AI/ML applications, highlighting concrete use cases, demonstrated benefits, and enabling technologies.
- Intent-based networking, exploring how high-level business objectives can translate into automated configurations and management actions.
- Predictive maintenance and anomaly detection, with the latest advances in anticipating failures and detecting security threats.

## Room 502B

### 16:30–18:30
### Tu3H • Beamsteering for Optical Wireless
*Presider: Katherine Newell, Johns Hopkins Univ., USA*

**Tu3H.1 • 16:30**
**Design of FSOC Terminal With Simplified Optical Axis Self-Calibration,** Haoran Fang[1], Jin T. Mei[1], Qirun Fan[1], Yifei Zhu[1], Yi Liu[1], Wenjing Xuan[1], Chen Liu[1]; [1]*Huazhong Univ. of Science and Technology, China.* We introduce an optical axis self-calibration method that utilizes ambient light, which reduces the coarse optical axis deviation from 11.70 mrad to 1.05 mrad and is verified in a 2 km across-lake experiment.

**Tu3H.2 • 16:45**
**120° Wide-FoV, 40-Gbps High-Date-Rate, Short-Range Laser Communication Using Avalanche PD Array and Spatial Diversity Signal Processing,** Toshimasa Umezawa[1], Zu-Kai Weng[1], Yuki Yoshida[1], Atsushi Matsumoto[1], Kouichi Akahane[1], Naokatsu Yamamoto[1]; [1]*National Inst of Information & Comm Tech, Japan.* Wide-field-of-view laser communication demonstrations of up to 40 Gbps were performed using an avalanche photodetector array and spatial diversity in digital signal processing. A wide FoV of 60° on one side was achieved.

**Tu3H.3 • 17:00** Invited
**Photonic Integrated Circuit for Optical Beam Steering,** Yong Liu[1], Hao Hu[1]; [1]*DTU Electro, Danmarks Tekniske Universitet, Denmark.* I will present our recent advances in integrated optical phased arrays (OPAs) for solid-state optical beam steering, which achieve simultaneously wide field of view, high resolution, and low side-lobe levels.

## Room 515A

### 16:30–18:30
### Tu3I • Symposium: Next Generation Interconnects for AI Scale-up Systems
*Presider: Fotini Karinou, Microsoft, USA*

**Tu3I.1 • 16:30** Invited
**Next Generation Interconnects for AI Scale Up - End User Perspective,** Rob Stone[1]; [1]*Meta Platforms Inc, USA.* Future AI scale-up infrastructure will transition from electrical to optical interconnects to enable larger domains, rack disaggregation, and higher bandwidth. This talk will share end user perspectives on deployment challenges and evolving requirements.

**Tu3I.2 • 16:45** Invited
**Practical Challenges in Scaling to Multi-Rack Pods,** Ram Huggahalli[1]; [1]*Microsoft, USA.* Optical technologies and high radix switches motivate multi-rack scale-up domains. However, there are system considerations involving link performance, physical integration, RAS, and fiber management. Further, system design must target high operational efficiency with real workloads.

**Tu3I.3 • 17:00** Invited
**Next Generation Interconnects for AI Scale Up Systems,** Manish Mehta[1]; [1]*Broadcom Corporation, USA.* Abstract not available.

## Room 515B

### 16:30–18:30
### Tu3J • High-Speed EAMs and EMLs
*Presider: Hideyuki Nasu; Furukawa Elect Ichihara Phototonics Lab, Japan*

**Tu3J.1 • 16:30** Invited
**High-Speed EMLs for AI/ML Applications,** Nobuo Ohata[1], Mizuki Shirao[1], Shinya Okuda[1], Kei Masuyama[1], Asami Uchiyama[1], Kenichi Abe[1], Kiyotomo Hasegawa[1]; [1]*Mitsubishi Electric Corporation, Japan.* We reported a high-speed EML and its assembly technology for AI/ML applications. By employing the narrow high-mesa waveguide structure and flip chip bonding technology, the EML subassembly achieved a wide 3-dB bandwidth of 110 GHz.

**Tu3J.2 • 17:00**
**Low Loss Electro-Absorption Modulator With Extrapolated Bandwidth of 180 GHz Enabled by Ultra-Thin Ge Process,** Zixuan Cai[1,2], Xu Wang[1,2], Fengxin Yu[2], Jinwen Song[2], Wei Chu[2], Haiwen Cai[2], Xiao Hu[2]; [1]*Fudan Univ., China;* [2]*Zhangjiang Laboratory, China.* Employing ultra-thin Ge process, the electro-absorption modulator with 1.5 dB insertion loss and extrapolated bandwidth of 180 GHz is demonstrated. It supports 120 Gbit/s NRZ and 300 Gbit/s PAM-4 modulation with clear eye diagram openings.

## Room 518

### 16:30–18:30
### Tu3K • Quantum Networking Protocols, Control, and Multi-Node Architectures
*Presider: Rui Lin; Chalmers Tekniska Högskola, Sweden*

**Tu3K.1 • 16:30**
**Programmable Quantum Key Distribution Network for Dynamic and Multi-Granular Key Allocation,** Florian Honz[1], Vana Pezelj[1], Valeria Saggio[1], Winfried Boxleitner[1], Michael Hentschel[1], Philip Walther[2], Hannes Hübel[1], Bernhard Schrenk[1]; [1]*Austrian Inst. of Technology GmbH, Austria;* [2]*Vienna Center for Quantum Science and Technology (VCQ), Universitat Wien Fakultat fur Physik, Austria.* We demonstrate a QKD scheme enhanced with flexible key-rate allocation. A dynamic secure-key rate range of 18.7dB (76×) is obtained through programmable spectrum and detector choice, enabling a fine-grained and efficient use of network resources.

**Tu3K.2 • 16:45**
**High-Rate Quantum Digital Signatures Using Coherent States With one-Time Universal Hash,** Mingze Wu[2], Ting Ye[1], Yan Pan[1], Heng Wang[1], Junhui Li[2], Yun Shao[1], Yang Li[1], Wei Huang[1], Song Yu[2], Bingjie Xu[1], Yichen Zhang[2]; [1]*Inst. of Southwestern Communication, China;* [2]*Beijing Univ. of Posts and Telecommunications, China.* We report an efficient quantum digital signature system using coherent states that achieves a signature rate of 1144 times per second for a 1 Mbit message over 50 km fiber with information-theoretic security.

**Tu3K.3 • 17:00**
**Hybrid Quantum Neural Network for Symbol Recovery in Photonic-Assisted Terahertz Communication System,** Qihang Wang[1], Wen Zhou[1], Sicong Xu[1], Jie Zhang[1], Siqi Wang[1], Chengzhen Bian[1], Mingxu Wang[1], Jingtao Ge[1], Jingwen Lin[1], Zhihang Ou[1], Tong Wang[1], Tengsheng Zhang[1], Weiping Li[1], Kaihui Wang[1], Jianjun Yu[1]; [1]*Fudan Univ., China.* We propose a hybrid quantum neural network for symbol recovery, experimentally demonstrated over a 200-m wireless link, achieving 11.48 Gbit/s real-time data rate with lower computational complexity and improved performance over conventional methods.

## Show Floor Programming

**SF1 • Future Photonics for AI: From PICs to Pods to Factories**
16:00–17:00, *Theater I*

**SF2 • Global Forum's Vision for Future Open AI Networking: What Industry Collaboration Is Needed for Scalable AI Cluster Networks?**
16:00–17:00, *Theater II*

**SF6 • OIF: CEI-448Gbps – Fast and Furious Signaling Spec Development**
16:00–17:00, *Theater III*

## Room 403A

### Tu3A • Transmission System Modeling and Its Validation—Continued

**Tu3A.3 • 17:15**
**Investigation of Wide-Band Nonlinear Effects Leveraging a Semi-Analytical EGN Model,** Chiara Lasagni[1], Lucas Zischler[2], Paolo Serena[1], Alberto Bononi[1], Giammarco Di Sciullo[2], Antonio Mecozzi[2], Cristian Antonelli[2]; [1]*Universita degli Studi di Parma, Italy;* [2]*Universita degli Studi dell'Aquila, Italy.* We investigate the impact of sparse SRS equalization and symbol rate on fiber nonlinearities. We exploit a semi-analytical EGN model, based on novel power-evolution expressions, validated over C+L and S+C+L transmissions.

**Tu3A.4 • 17:30**
**On Fiber and System Alternatives for 2-Pb/s Submarine Cables,** John D. Downie[1], Lidia Galdino[1], Pascal Pecci[2]; [1]*Corning Inc., UK;* [2]*Meta, France.* We consider four fiber and system options to achieve 2-Pb/s submarine cable capacity. We evaluate cost/bit for each by finding the maximum span lengths supporting 2-Pb/s capacity with the target fiber pair count.

**Tu3A.5 • 17:45**
**Closed-Form Expression for Spatial Correlation Function of Nonlinear Fiber Propagation and Its Applications to Longitudinal Power Monitoring,** Takeo Sasai[1], Etsushi Yamazaki[1]; [1]*NTT, Japan.* A closed-form expression for spatial correlation function of nonlinear fiber propagation for Nyquist-limit signals is presented. Its applications to LPM, including a low-memory formulation (99.9990% reduction) and analytical bound for spatial resolution, are demonstrated.

## Room 403B

### Tu3B • ThZ and Microwave Generation—Continued

**Tu3B.3 • 17:15**
**On-Chip Active Mode-Locked Optoelectronic Oscillator for Fully Tunable Microwave Pulses Generation,** Xu Hong[1], Yuxi Wang[1], Bin Wang[1], Weifeng Zhang[1]; [1]*Beijing Inst. of Technology, China.* We propose an on-chip active mode-locked optoelectronic oscillator for fully tunable microwave pulses generation. By controlling the free-carrier concentration for high-speed loop-gain modulation, microwave pulses with tunable center frequency and duty cycle are experimentally generated.

**Tu3B.4 • 17:30** Tutorial
**Integrated THz Platforms: From Generation to Transmission and Detection,** Tadao Nagatsuma[1]; [1]*Tokyo Daigaku, Japan.* This talk reviews recent progress in integrating III-V photonic and electronic THz devices onto SiC and Si substrate platforms by using epi-layer transfer technology. We also showcase applications in both wireless and wired THz communication systems.

Tadao Nagatsuma received his Ph.D. degree in electronic engineering from Kyushu University in 1986. From 1986 to 2007, he was with NTT. From 2007 to 2024, he served as a Professor at the Graduate School of Engineering Science, The University of Osaka. He is currently with the Graduate School of Science, The University of Tokyo.

## Room 408A

### Tu3C • Tunable Microrings, MZIs, Isolators, and Athermal PICs—Continued

**Tu3C.4 • 17:30**
**Silicon Ring-Based WDM Filter With a Low Tuning Power of 3.80 mW/π per Channel,** Qingzhong Deng[1], Hakim Kobbi[1], Jeroen De Coster[1], Rafal Magdziak[1], Shalini Jakanadan[1], Sadhishkumar Balakrishnan[1], Neha Singh[1], Marko Ersek Filipcic[1], Maumita Chakrabarti[1], Dimitrios Velenis[1], Vincent De Heyn[1], Peter Verheyen[1], Huseyin Sar[1], Philippe Absil[1], Filippo Ferraro[1], Yoojin Ban[1], Joris Van Campenhout[1]; [1]*InterUniv. Microelectronics Center, China.* We demonstrate a silicon ring-based 8-channel WDM filter that achieves a record-low thermal tuning power of 3.80 mW/π (= 420 GHz/mW) per channel and an ultra-compact footprint of 10×160 μm$^2$.

**Tu3C.5 • 17:45**
**Piezoelectrically Tunable Athermal Mach-Zehnder Interferometer Based on a Tantalum Pentoxide Platform,** Mingjian You[1], Zhenyu Liu[1], Xingyu Tang[1], Jiaxin Hou[1], Ziming Zhang[1], Junke Zhou[1], Quan Pan[1], Min Wang[1], Qiancheng Zhao[1]; [1]*State Key Laboratory of Quantum Functional Materials, School of Microelectronics, Southern Univ. of Science and Technology, China.* We demonstrate a piezoelectrically tunable tantalum pentoxide asymmetric Mach-Zehnder interferometer (AMZI) with a low temperature-dependent wavelength shift (TDWS) of 1.98 pm/K and a DC tuning efficiency of -36.9 pm/V around 1550 nm.

## Room 408B

### Tu3D • Optical Doped Fiber Amplifiers—Continued

**Tu3D.3 • 17:15**
**Hybrid BiEr Fiber Amplifier for WDM Seamless Amplification of S- and C-Transmission Bands,** Vitaly Mikhailov[1], Jiawei Luo[1], Aleksandr I. Donodin[2], Yuriy Dulashko[1], Gabriel Puc[1], Brian Mangan[1], Robert Windeler[1], Paul Westbrook[1], Jeffrey Nicholson[1], Sergei K. Turitsyn[2], David DiGiovanni[1]; [1]*Lightera laboratories, USA;* [2]*Aston Inst. of Photonic Technologies, UK.* We report BiEr-DFA for seamless amplification of the S+C-bands with >20 dB small signal gain and <6 dB corresponding NF over 9 THz bandwidth (1490-1560 nm). Amplifier has 23 dBm output power and 20% PCE.

**Tu3D.4 • 17:30**
**Shortest Fiber Length (<26 m) BDF/EDF Hybrid Amplifier Achieving >20 dB Gain with High Output Power Over 166 nm-Wide E+S+C Band,** Chenchen Wang[2], Hengyun Jiang[2], Maha Bouhadida[1], Yann Frignac[1], Luo Han[2], Zhiyong Feng[2], Gabriel Charlet; [1]*Huawei Technologies France, France;* [2]*Huawei Technologies Co Ltd, China.* We demonstrate an E+S+C-band hybrid amplifier using only 26 m of fiber, achieving 20 dB gain and 27 dBm output from 1400–1566 nm. With a 40 m low-concentration fiber front stage, the average noise figure is 5 dB.

**Tu3D.5 • 17:45**
**Relative Intensity Noise Transfer in O-Band Bismuth Doped Fibre Amplifiers,** Daniel J. Elson[1], Aleksandr I. Donodin[2], Vitaly Mikhailov[3], Jiawei Luo[3], Shigehiro Takasaka[4], Noboru Yoshikane[1], Takehiro Tsuritani[1], Yuta Wakayama[1]; [1]*KDDI Research Inc., Japan;* [2]*Aston Univ. Inst. of Photonics Technology, UK;* [3]*Lightera, USA;* [4]*Furukawa Denki Kogyo Kabushiki Kaisha, Japan.* Pump-to-signal RIN transfer is observed in forward-pumped bismuth-doped f ibre amplifiers using ytterbium lasers. Although forward pumping shows a lower apparent noise figure, RIN transfer degrades SNR, while backward pumping suppresses this effect, ensuring low-noise performance.

## Room 411

### Tu3E • Submarine & Hollow-Core Fiber Systems—Continued

**Tu3E.3 • 17:15** Top-Scored
**Accelerating Hollow-Core Fiber Deployment: an Efficient One-Shot Field Measurement Technique to Characterize $CO_2$ Absorption-Induced OSNR Penalty,** Yan He[3,2], Sai Chen[2], Liang Dou[1], Zhiqun Zhai[2], Huan Zhang[2], Yuanchao Su[2], Alan Pak Tao Lau[3]; [1]*Alibaba Cloud Computing, Alibaba Group, China;* [2]*Alibaba Cloud Computing, Alibaba Group, China;* [3]*The Hong Kong Polytechnic Univ., Hong Kong.* We analyze and model $CO_2$ absorption-induced OSNR penalties of 100km hollow core fiber (HCF), and demonstrate that the model can be re-calibrated to characterize the OSNR penalties for other 80km/130km HCFs using one-shot in-field measurement.

**Tu3E.4 • 17:30**
**Diagnostic Limitations of Unidirectional and Bidirectional OTDR in Hollow-Core Fiber Splicing,** Xiaokai Wang[1], Shuhai Li[1], Peng Li[1], Jun Chu[1], Chengyan Zhang[1], Liyan Zhang[1], Lei Zhang[1], Zhuang Xiong[1], Jie Luo[1]; [1]*Yangtze Optical Fibre and Cable Joint Stock Ltd Co, China.* We propose a practical OTDR-based diagnostic strategy for HCF splicing, combining pre/post-discharge comparison, unidirectional rapid detection, and bidirectional acceptance testing to improve splice quality, reduce rework, and ensure reliable deployment.

**Tu3E.5 • 17:45**
**First Real-Time Field Demonstration of Space-Division Multiplexing Transmission Enabled by 1.2Tb/s/λ OTN and Multi-Core Amplifier,** Xishuo Wang[1], Anxu Zhang[1], Lipeng Feng[1], Lei Shen[2], Wenzhe Chang[1], Zhengyu Liu[1], Xiankun Zhu[1], Yuan Gao[2], Junjie Qi[2], Lei Zhang[2], Jie Luo[2], Kai Lv[1], Xia Sheng[1], Yuyang Liu[1], Xiaoli Huo[1], Chengliang Zhang[1]; [1]*China Telecom Beijing Research Inst., China;* [2]*State Key Laboratory of Optical Fiber and Cable Manufacture Technology, Yangtze Optical Fibre and Cable Joint Stock Ltd Co, China.* We demonstrate real-time space-division multiplexing transmission enabled by multi-core amplifier over field-deployed cable for the first time. Single-span 153.6 Tb/s transmission over 48 km 4-core cable is achieved using 1.2Tb/s/λ transponders and C-Band core-pumped EDFA.

## Room 501ABC

### Tu3F • Satellite Optical Networks—Continued

**Tu3F.4 • 17:15**
**Orbit-Aware Routing Framework for Inter-Satellite All-Optical Networks,** Yusuke Hirota[1], Shoichiro Oda[1], Hideaki Kotake[1], Toshimasa Umezawa[1], Satoshi Shinada[1], Hideaki Furukawa[1]; [1]*National Inst of Information & Comm Tech, Japan.* We propose an orbit aware routing framework for inter satellite all optical networks that exploits LEO geometry, prioritizing intra orbit links and selecting satellites with the longest ground station visibility. Simulations on Starlink constellations verify improvement of path failure rates.

**Tu3F.5 • 17:30**
**Proactive Handover for Latency-Sensitive Applications in Optical Satellite Networks,** Yi An[1], wei wang[1], Zijun Li[1], Chongzhu Huang[1], Yongli Zhao[1], Jie Zhang[1]; [1]*Beijing Univ. of Posts and Telecommunications, China.* We propose a proactive handover strategy for dynamic satellite topology to reduce latency and meet latency/reliability-sensitive service requirements, demonstrating a 39.06% reduction in propagation latency while minimizing reliability degradation.

**Tu3F.6 • 17:45**
**Forecasting-Based Path Precomputation to Reduce APT Delays in Optical Satellite Networks,** Wang Hua[1], wei wang[2], Massimo Tornatore[3], Yongli Zhao[2], jie zhang[2]; [1]*Nanjing Tech Univ., China;* [2]*Beijing Univ. of Posts and Telecommunications, China;* [3]*Politecnico di Milano, Italy.* A path-precomputation scheme is proposed to alleviate ATP delays in optical satellite networks. By forecasting requests on active links, it achieves up to 33.16% delay reduction, for 7.05× increase in runtime over conventional real-time computation.

## Room 502A

### Tu3G • Panel: Artificial Intelligence in Optical Network Control and Management—Continued

## Room 502B

### Tu3H • Beamsteering for Optical Wireless—Continued

**Tu3H.4 • 17:30**
**300-GHz Independent Multi-Beam Steering From a Single Antenna Using Fiber Chromatic Dispersion and a Photomixer Array,** Masato Kawano[1], Yoshiki Kamiura[1], Yuya Mikami[1], Kazutoshi Kato[1]; [1]*Kyushu Univ., Japan*. We demonstrate 300-GHz independent two-beam steering from a single antenna array using fiber chromatic dispersion and a UTC-PD array, verifying signal quality through 4K video transmission.

**Tu3H.5 • 17:45**
**Continuously Tunable, Low Phase Noise Photonic Frequency Synthesizer Over 3–170 GHz for High Performance mm-Wave Communications,** Amany Kassem[1], Zichuan Zhou[1], Izzat Darwazeh[1], Zhixin Liu[1]; [1]*Univ. College London, UK*. We demonstrate tunable 3–170GHz frequency synthesis using phase-locked, low-linewidth lasers and frequency-divider-assisted architecture, achieving non-scaling jitter of 39fs sub-24GHz and 12fs at 170GHz, outperforming an all-electronic synthesizer and enabling D-band 1-GBd QPSK/16-QAM transmission.

## Room 515A

### Tu3I • Symposium: Next Generation Interconnects for AI Scale-up Systems—Continued

**Tu3I.4 • 17:15** Invited
**Sensing VCSEL Interconnects for Scaleup Applications,** Matthew Sysak[1]; [1]*Lumentum Operations LLC, USA*. This presentation will discuss low power, low-cost, high reliability, and ultra-high density sensing VCSEL interconnects for scaleup applications. Sensing VCSEL technology leverages well established supply chain, including manufacturing, test, a history of high-volume deployments.

**Tu3I.5 • 17:30** Invited
**Enabling Beyond CPO – Challenges and Opportunities,** Phil Winterbottom[1]; [1]*Celestial.AI, USA*. Silicon Photonics is set to permeate the connectivity infrastructure of data centers over the next few years. With a little thought now into the architecture of CPO now we can position the technology for deep integration into switches, CPUs and AI accelerators in the future.

**Tu3I.6 • 17:45** Invited
**Advanced Interconnects for Silicon Photonics Packaging,** Kevin Dezfulian[1]; [1]*GlobalFoundries, USA*. We outline advanced interconnect solutions, built on silicon photonics, for datacenter switch and compute applications with an emphasis on detachable optical links and their interaction with the assembly and test of 2.5D and 3D packages.

## Room 515B

### Tu3J • High-Speed EAMs and EMLs—Continued

**Tu3J.3 • 17:15**
**High-Bandwidth-Density Uncooled EML Array for up to 770 Gb/s/mm and 11 km Fiber Reach,** Michael A. Theurer[2], Gayatri Vasudevan Rajeswari[2], Jonathan Andree[2], Christoph Kottke[2], Ronald Freund[2,1], Patrick Runge[2], Martin Moehrle[2], Ariane Sigmund[2], Martin Schell[2,1]; [1]*Technische Universitat Berlin, Germany*; [2]*Fraunhofer-Institut fur Nachrichtentechnik Heinrich-Hertz-Institut HHI, Germany*. We demonstrate a compact EML array, featuring integrated RF routing and reduced channel spacing for high bandwidth density. The device delivers 770 Gb/s/mm, supports fiber reach of 11 km, and uncooled operation.

**Tu3J.4 • 17:30**
**Differential Drive EML With Tandem Modulator Structure for 200G/Lane and Beyond Applications,** Hideki Oe[1], Kyohei Maekawa[1], Kenta Sugawara[1], Masahiro Honda[1], Kosuke Saito[1], Fumihiro Nakajima[1], Takamitsu Kitamura[1], Tohma Watanabe[1], Kazuki Torii[1], Hirohiko Kobayashi[1], Kan Takada[1], Daisei Shoji[1]; [1]*Sumitomo Electric Device Innovations, Inc,, Japan*. Differential drive EML with tandem modulator structure is reported. 3 dB bandwidth is 80 GHz and the device achieved 5.2 dB extinction ratio and 1.28 dB TDECQ at 113 Gbd PAM4 with 2.0 Vpp differential drive.

**Tu3J.5 • 17:45** ★ Top-Scored
**360 Gbps PAM4 Differentially Driven EML With 100 GHz 3-dB Bandwidth Dual Series-Connected EAMs for Next-Generation 3.2 Tbps Data Center Transceivers,** Shinya Okuda[1], Yohei Hokama[1], Kenichi Terao[1], Shunto Katsumi[1], Takaya Morikawa[1], Toshiya Tsuji[1], Chikara Watatani[1], Yoshimichi Morita[1], Masaaki Shimada[1], Takuma Fujita[1], Asami Uchiyama[1], Mizuki Shirao[1], Kyosuke Kuramoto[1], Eitaro Ishimura[1], Akihito Ono[1]; [1]*Mitsubishi Electric Corporation, Japan*. Developed a high-speed differentially driven EML with dual EAMs, achieving >100 GHz 3-dB bandwidth. Demonstrated 360 Gbps (180 Gbaud PAM4) operation with a 3.3 dB TDECQ (BtB) for next-generation 3.2 Tbps data center transceivers.

## Room 518

### Tu3K • Quantum Networking Protocols, Control, and Multi-Node Architectures—Continued

**Tu3K.4 • 17:15**
**Emulation of Optically Interconnected Quantum Data Centers Topologies for Cost–Fidelity Benchmarking,** Seyed Navid Elyasi[1], Seyed Morteza Ahmadian[1], Rui Lin[1], Paolo Monti[1]; [1]*Chalmers Univ. of Technology, Sweden*. We emulate optically interconnected quantum processors in ring, star, and line topologies using a quantum computer. GHZ benchmarks show that the star provides the best trade-off between cost and fidelity under transduction and fiber noise.

**Tu3K.5 • 17:30**
**SimDisQ-Layout: Simulating Circuit Layout for Distributed Quantum Computing,** Sen Zhang[1], Yipei Liu[1], Brian Mark[1], Weiwen Jiang[1], Zebo Yang[2], Lei Yang[1]; [1]*George Mason Univ., USA*; [2]*Florida Atlantic Univ., USA*. SimDisQ-Layout is the very first tool to automatically compile a quantum circuit across photonic-connected distributed quantum processors. Its design follows a divide-and-conquer paradigm for circuit partitioning, transpilation, and assembly, producing simulatable and implementable circuit layouts.

**Tu3K.6 • 17:45**
**Noise-Rejecting Photonic Integrated Circuit for Robust Quantum Random Number Generation,** Peter R. Smith[1], Davide G. Marangon[1], Taofiq Paraiso[1], James F. Dynes[1], Andrew J. Shields[1]; [1]*Toshiba Europe Ltd- Cambridge Research, USA*. We present a monolithic photonic integrated circuit for quantum random number generation, incorporating optical amplification and differential detection for noise rejection. The device was packaged, assembled, and demonstrated stable entropy generation at gigabit-per-second rates.

## Room 403A

### Tu3A • Transmission System Modeling and Its Validation—Continued

**Tu3A.6 • 18:00**
**Fast and Stable Method for Simulation of Third-Order Backward Raman Amplifiers,** Hartmut Hafermann[1], Mingpu Qiu[1], Abel Lorences-Riesgo[1], Salma ESCOBAR LANDERO[1], Zhihang Wu[1], Lin Gan[2], Yann Frignac[1], Gabriel Charlet[1]; [1]*Huawei Technologies France SAS, France;* [2]*Huawei Technologies Co Ltd, China.* We introduce a novel method to solve the boundary value problem posed by the coupled SRS differential equations in presence of ASE and Rayleigh scattering. We apply it to simulate a high-power third-order Raman amplifier and compare results to experiment.

## Room 403B

### Tu3B • ThZ and Microwave Generation—Continued

## Room 408A

### Tu3C • Tunable Microrings, MZIs, Isolators, and Athermal PICs—Continued

**Tu3C.6 • 18:00** Invited
**Low Loss Athermal TFLN PICs for Next Gen PON,** Daoxin Dai[1]; [1]*Zhejiang Univ., China.* This presentation will discuss low loss athermal TFLN PICS for next generation PON.

## Room 408B

### Tu3D • Optical Doped Fiber Amplifiers—Continued

**Tu3D.6 • 18:00**
**CMOS-BEOL Compatible, High Output Power & Efficiency, Erbium Doped Waveguide Amplifiers for Next-Generation Integrated Photonics,** Jiale Sun[1], Sören Lerner[2], Zheru Qiu[1], Xuan Yang[1], Xinru Ji[1], Yichi Zhang[1], Grigorii Likhachev[1], Tobias J. Kippenberg[1], Carsten Ronning[2]; [1]*Ecole polytechnique federale de Lausanne, Switzerland;* [2]*Friedrich-Schiller-Universitat Jena, Germany.* We demonstrate CMOS-BEOL compatible erbium doped waveguide amplifiers with 30 dB off-chip gain, pump-signal power conversion efficiency of 40% on-chip (22.4% off-chip), with output power of 227 mW on-chip (170 mW off-chip).

**Tu3D.7 • 18:15**
**BiDi-EDF Enabled Co-Frequency Co-Time Full-Duplex Transmission Over Single-Span 150-km ST-HCF for ZR+ Applications,** Yuqi Li[2], Yue Meng[2], Xuchen Hua[2], Zichen qian[2], Siyu Chen[2], Zihe Hu[2], Mingming Zhang[2], Yuan Gao[1], Jun Wu[1], Ming Tang[2]; [1]*Yangtze Optical Fibre and Cable Joint Stock Ltd Co, China;* [2]*Huazhong Univ. of Science and Technology, China.* Leveraging ST-HCF and Bi-Di-EDF amplifier, a co-frequency co-time full-duplex ZR+ transmission over 150 km is achieved. With ultra-low back Rayleigh scattering, the amplifier offers a bidirectional gain of 18 dB and a 7-dB power budget.

## Room 411

### Tu3E • Submarine & Hollow-Core Fiber Systems—Continued

**Tu3E.6 • 18:00** Invited
**Real-Time High Speed Transmission Over Deployed AR-HCFs: Challenges, Enabling Technologies, and Future Perspectives,** Dawei Ge[1], Dong Wang[1], Mingqing Zuo[1], Han Li[1], Dechao Zhang[1]; [1]*China Mobile Research Inst., China.* This paper explores HCF communication systems, focusing on deployment, architecture evolution for its properties, novel channel impairments, waveband selection and system challenges, outlining key application directions.

## Room 501ABC

### Tu3F • Satellite Optical Networks—Continued

**Tu3F.7 • 18:00** Invited
**Non-Terrestrial Networks: Time-Variant Impairments and Recovery Strategies Upon Outages,** Giulio Cossu[1], Sujit Basu[1], Andrea Sgambelluri[1], Luca Oliviero[1]; [1]*TeCIP Inst., Scuola Superiore Sant'Anna, Italy.* Free-Space optical links are crucial for next 6G networks. We characterize the equipment commonly used in fiber systems against time-variant impairments, typical of such links, and proposed a reliability strategy to mitigate the impact.

## Room 502A

### Tu3G • Panel: Artificial Intelligence in Optical Network Control and Management—Continued

## Room 502B

### Tu3H • Beamsteering for Optical Wireless—Continued

**Tu3H.6 • 18:00**
**Enhanced Field-of-View Using Integrated Waveguide-Confined Receiving Antenna for Indoor Optical Wireless Communication Systems,** Yin-he Jian[2,1], Mikolaj Wolny[2], Chia-Yu Lee[1], Chi-Wai Chow[1], Eduward Tangdiongga[2]; [1]*National Yang Ming Chiao Tung Univ. College of Electrical and Computer Engineering, Taiwan;* [2]*Technische Universiteit Eindhoven Department of Electrical Engineering, Netherlands.* We present a large field-of-view (FoV) waveguide-confined optical receiving antenna featuring 5.3-dB power variation and > 28.12-Gbps within 12° range in narrow-beam-steered system; and 6.4° 6-dB FoV in ultra-narrow-beam-steered system, enabling to support > 70-Gbps.

## Room 515A

### Tu3I • Symposium: Next Generation Interconnects for AI Scale-up Systems—Continued

**Tu3I.7 • 18:00** Invited
**Innovative Electrical and Optical Interconnects in Advanced Packaging,** Chih-Pin Hung[1]; [1]*ASE Group, Taiwan.* The rapid evolution of AI has ushered new era computational demands, necessitating paradigm shift in data center architecture. This presentation will explore the opportunities and challenges of advanced packages with both electrical and optical interconnects.

**Tu3I.8 • 18:15** Invited
**Manufacturing and Packaging of Optical Interconnects for AI Scale-up Systems,** Jason Wildt[1]; [1]*Jabil, Inc., USA.* This presentation will discuss manufacturing and packing of optical interconnects for AI scale-up systems.

## Room 515B

### Tu3J • High-Speed EAMs and EMLs—Continued

**Tu3J.6 • 18:00**
**400G per Lane Differential Drive Electroabsorption Modulated Lasers (EML) With 99GHz 6-dB EO BW for Next Generation 3.2T IM-DD Applications,** Prashanth Bhasker[1], Sumeeta Arora[1], Hui Fu[1], Chris Fuchs[1], Ayman Kanan[1], John E Johnson[1]; [1]*Broadcom Corporation, USA.* We report an O-band differential-drive EML achieving 99GHz 6-dB bandwidth and 3.8dB ER at 55 °C. Device delivers 6.5dBm modulated power and open 320 Gbits/s PAM-4 and 413 Gbits/s PAM-6 eyes suitable for 3.2T applications.

**Tu3J.7 • 18:15**
**4λ x 226 Gbps PAM4 Transmission Over 2-km SSMF With Differential Drive EA-DFB Lasers Under 1.5-Vppd Low Swing Voltage,** Ryosuke Hatai[1], Takanori Suzuki[1], Hideaki Matsuzaki[1], Masato Ito[1], Hiroshi Hamada[1], Syunya Yamauchi[1], Atsushi Mimura[1], Yuma Endo[1], Ryo Nakao[1], Hisashi Yoshida[1], Hyota Fujishima[1], Atsushi Tada[1], Noriko Sasada[1], Kazuhiko Naoe[1]; [1]*Lumentum Japan, Inc, Japan.* 226 Gbps PAM4 transmission over 2-km SSMF using 4-wavelength differential drive EA-DFB lasers is demonstrated. Low TDECQ of less than 2.4 dB and ER of over 4.1 dB have been achieved by 1.5-Vppd low swing voltage.

## Room 518

### Tu3K • Quantum Networking Protocols, Control, and Multi-Node Architectures—Continued

**Tu3K.7 • 18:00** Invited
**Entanglement Networks for Datacentre-Scale Quantum Computing,** John Jarman[1]; [1]*Nu Quantum, UK.* Valuable applications for quantum computers need large, error-corrected machines that scale far beyond current single-core designs. Nu Quantum is developing the hardware to interconnect quantum cores using entanglement networks, enabling quantum computing at datacentre scale.

## Room 502A

**19:30–21:00**

### Rump Session: From Short Hops to Long Hauls: What Parts of the Fiber Spectrum Shall we Use, and Why?

**Organizers:**
Roy Rubenstein, *LightCounting LLC, USA*
Antonio Tartaglia, *Ericsson, Italy*
Dirk Van Den Borne, *Juniper Networks, Inc., Germany*

Fiber optics communications became practical when we found, for the first time, a match between the characteristics of the medium, the transmitters, and the receivers that we were able to build with repeatable characteristics.

Over the decades, we have developed several successful combinations covering various application scenarios, from short-reach optical interconnects all the way to submarine links, using specific portions of the fiber spectrum.

- Will the bands we have predominantly used - O-band for short reach interconnects and C+L band for long reach- still be the winners in their respective application domains?
- Is there territory being contended?
- Are there new "challenger" bands emerging somewhere?
- Which present or future bands will new types of media - multicore fiber, few modes fiber, hollow core fiber- use to attack the dominant position of G.652 fiber?

## Room 403B

**08:00–10:00**
**W1A • Thin-Film LN/LT and Silicon Mach-Zehnder Modulators**
*Presider: Patrick Runge; Fraunhofer HHI, Germany*

**W1A.1 • 08:00** Invited
**Integrated Electro-Optic Frequency-Domain Equalizer for Ultra-Broadband Optical Modulators,** Yuya Yamaguchi[1], Paikun Zhu[1], Pham Tien Dat[1], Shingo Takano[2], Shotaro Hirata[2], Yu Kataoka[2], Junichiro Ichikawa[2], Ryo Shimizu[2], Kouichi Akahane[1], Naokatsu Yamamoto[1], Atsushi Kanno[3,1], Tetsuya Kawanishi[4,1]; [1]*National Inst. of Information and Communications Technology, Japan;* [2]*Sumitomo Osaka Cement Co Ltd, Japan;* [3]*Nagoya Inst. of Technology, Japan;* [4]*Waseda Univ., Japan.* We review research on high-speed optical modulator utilizing an integrated electro-optic frequency-domain equalizer, which enables bandwidth expansion of modulator in traveling-wave configuration. The device performance of thin-film lithium niobate modulator with the integrated equalizer is discussed.

## Room 408A

**08:00–09:45**
**W1B • Laser Prototypes and Packaging**
*Presider: Akhiro Noriki, National Inst of Advanced Industiral Science and Technology, Japan*

**W1B.1 • 08:00** Invited
**Rf and Thermal Challenges for Advanced Optical Subsystem Packaging,** John Osenbach[1]; [1]*Nokia Solutions and Networks Oy, Finland.* Internet traffic exponential growth driving speed and capacity capability of coherent pluggable modules imposes challenges on rf- and thermal-performance. This paper addresses these challenges with particular attention on environmental impacts on their stability/reliability.

## Room 408B

**08:00–09:15**
**W1C • High-speed Transmission Systems**
*Presider: Haik Mardoyan; Nokia Bell Labs, France*

**W1C.1 • 08:00** Invited
**Coded Modulation Targeting Higher Spectral Efficiency in High-Speed Transmission Systems,** Hussam G. Batshon[1]; [1]*Nokia Bell Labs, USA.* We present SPC-coded probabilistic shaping for long-haul optical transmission that enables iterative decoding and improves spectral efficiency without changing the FEC or shaping structure. Experiments at ≥ 100 GBd confirm coding gains at fixed spectral efficiency and improved robustness under practical SNR constraints.

## Room 411

**08:00–10:00**
**W1D • Transceiver Design, Characterization and Optimization**
*Presider: Shota Ishimura; KDDI Research Inc., Japan*

**W1D.1 • 08:00**
**Non-Intrusive Separation and Characterization of Transmitter and Receiver Frequency Responses for Coherent Optical Communication System,** Linsheng Fan[3], Qun Zhang[3], Shunfeng Wang[3], Xiongbin Yu[3], Xiuquan Cui[3], Zhongliang Sun[3], Zhaopeng Xu[3], Junpeng Liang[3], Qian Xiang[1], Tianjian Zuo[1], Tonghui Ji[3], Yanfu Yang[3,2], Zhixue He[3], Jinlong Wei[3]; [1]*Huawei Technologies Co Ltd, China;* [2]*Harbin Inst. of Technology Shenzhen, China;* [3]*Peng Cheng Laboratory (PCL), Shenzhen, China.* We present a non-intrusive method to characterize coherent transceiver frequency responses without any hardware modification. Compensation using the characterization results improves 2 dB OSNR sensitivity at 7% FEC threshold in a 69-GBaud experimental system.

**W1D.2 • 08:15**
**Modulation Crosstalk Cancellation for Ultra-Dense WDM Silicon Photonic MRM Transmitters,** Yongjin Ji[1], Daewon Rho[1], Seung-Jae Yang[1], Woo-Young Choi[1]; [1]*Yonsei Univ., Korea (the Republic of).* An electrical-domain assisted modulation crosstalk cancellation technique for cascaded MRM-based WDM transmitters achieves 4 x 25 Gb/s PAM-4 operation at 340 pm (42.4 GHz) spacing, maintaining clear eyes without modifying the photonic IC.

## Room 501ABC

**08:00–09:30**
**W1E • Next-generation Fiber Links**
*Presider: Molly Piels; OpenLight Photonics, USA*

**W1E.1 • 08:00** Invited
**AI in Performance Optimization of Short Reach Optical Interconnects,** Luca Poti[1,2], Asfand Nizamani[1], Li Zhang[1], Dario Cellini[4], Mareli Rodigheri[3], Stella Civelli[5], Ramin Solaimani[1], Pantea Nadimi Goki[4], Muhammad A. Naz[1], Marco Secondini[4], Enrico Forestieri[4], Fabio Cavaliere[6]; [1]*CNIT, Italy;* [2]*Universitas Mercatorum, Italy;* [3]*Universidade Estadual de Campinas, Brazil;* [4]*Scuola Superiore Sant'Anna, Italy;* [5]*Consiglio Nazionale delle Ricerche, Italy;* [6]*Ericsson research Italy, Italy.* We review recent AI techniques for short-reach optical links and demonstrate DSP design for a bipolar PAM system with a direct-detection receiver using physically assisted AI, achieving measurable performance gains over conventional adaptive equalization–based receivers.

## Room 502A

**08:00–10:00**
**W1F • Multicore Fiber**
*Presider: Chiara Lasagni; Universita degli Studi di Parma, Italy*

**W1F.1 • 08:00**
**Ultra-Low Birefringence in High-Density Trench-Assisted Multi-Core Fibers via Fluorine-Doped Stress Rods,** Gustavo Ocampo[1], Kunimasa Saitoh[1]; [1]*Hokkaido Univ., Japan.* We propose fluorine-doped stress rods to suppress thermally induced birefringence in dense trench-assisted MCFs, achieving single-mode-fiber-like birefringence with worst-case beat length ≥10 m in standard-cladding eight-core, 30 µm-pitch design, extendable to other dense layouts.

**W1F.2 • 08:15**
**Accuracy Limits of Crosstalk Measurement Techniques for Weakly Coupled Multi-Core Fibers,** Jonaq N. Sarma[1], Anjana K[1], Chandan S. Yadav[1], Deepa Venkitesh[1]; [1]*Indian Inst. of Technology Madras, India.* We report a comparison between power meter, OTDR and wavelength resolved methods for measuring crosstalk in a weakly coupled multicore fiber revealing trade offs in accuracy, dynamic range, and practicality for network deployment.

## Room 502B

### 08:00–09:45
### W1G • Co-existence of Sensing and Communication
*Presider: Takeo Sasai; NTT, Japan*

**W1G.1 • 08:00**
**High-Precision Positioning Based on Millimeter-Wave Photonic Chaotic Distributed Sensing System for RAN,** yaxuan Li[1,2], Boyu Dong[1,2], Junlian Jia[1,2], Yinjun Liu[1,2], An Yan[1,2], Xuyu DENG[1,2], Junhao Zhao[1,2], Yuqin Yuan[1,2], Qingyu Han[1,2], Jianyang Shi[1,2], Nan Chi[1,2], Junwen Zhang[1,2]; [1]*Key Laboratory for Information Science of EMW (MoE), College of Future Information Technology, Fudan Univ., China;* [2]*Shanghai Engineering Research Center of Low-Earth-Orbit Satellite Communication and Applications, Shanghai Collaborative Innovation Center of Low-Earth-Orbit Satellite Communication Technology, Fudan Univ., China.* We proposed and experimentally demonstrated a W-band photonic MMW chaotic distributed unambiguous sensing system for RAN, achieving a ranging resolution of 1.12 cm and <1.2-cm 2D positioning error with an angular coverage of 24.5 degrees.

**W1G.2 • 08:15**
**Interference Suppression With Software Programmable Microwave Photonic Filter in RF Communications,** Can Wang[1], Yuxin Liang[2], Hanmeng Li[2], Kangpeng Ye[1], Liga Bai[1], Zhidong Lyu[1], Qun Zhang[3], Borja Vidal[5], Oskars Ozolins[7,6], Xiaodan Pang[1,7], Dezhi Zhang[4], Naidi Cui[2], Lu Zhang[1], Xianbin Yu[1,7]; [1]*Zhejiang Univ., China;* [2]*Chongqing United Microelectronics Center, China;* [3]*Shandong Zhike Intelligence Computing Co Ltd, China;* [4]*State Key Laboratory of Optical Fiber and Cable Manufacture Technology, China;* [5]*Universidad Politecnica de Valencia, Spain;* [6]*RISE Research Inst.s of Sweden, Sweden;* [7]*Rigas Tehniska universitate, Latvia.* A software-programmable integrated microwave photonic filter enabled by photonic circuits is demonstrated for suppressing strong RF interference in a 2 Gb/s QPSK RF communication system, achieving more than 40% EVM improvement.

## Room 515A

### 08:00–10:00
### W1H • Multi-Band/Core and Hollow Core Fiber Optical Networks
*Presider: Yvan Pointurier; Huawei Technologies, France*

**W1H.1 • 08:00** Invited
**Emerging Network-Wide Use Cases for Hollow Core Fibers,** Memedhe Ibrahimi[1], Giovanni S. Sticca[1], Francesco Musumeci[1], Massimo Tornatore[1]; [1]*Politecnico di Milano, Italy.* We overview network-wide use cases of the selective deployment of Hollow-Core Fiber (HCF) in optical networks, including latency-constrained Data Center consolidation and high-power amplification, while assessing key deployment challenges and opportunities.

## Room 515B

### 08:00–10:00
### W1I • Optical Access Network Evolution
*Presider: Gaël Simon; Orange, France*

**W1I.1 • 08:00**
**Best Migration Strategies Comparison Towards 100G Coherent PON,** Ritanshi Agarwal[1], Carmen Mas Machuca[1]; [1]*Chair of Communication Networks, Universitat der Bundeswehr Munchen, Germany.* This work has implemented and evaluated different migration strategies towards aggregated 100G PON solutions. Results in an area of 610.27km² with 73500 ONUs identify 100G-Coherent PON R-OLT as the best cost-efficient solution towards 100G PON.

**W1I.2 • 08:15**
**New Chromatic Dispersion Digital Pre-Compensation Method Using FIR Coefficients Optimized From Upstream Burst-Mode Signals in IMDD/Coherent Hybrid PON,** Jin Uchiyama[2], Ryo Koma[2], Kazutaka Hara[1], Ryo Igarashi[2], Jun-ichi Kani[2], Tatsuya Shimada[2]; [1]*NTT Inc, Japan;* [2]*Kabushiki Kaisha NTT Yokosuka Kenkyu Kaihatsu Center, Japan.* We propose a new CD-DPC method that uses upstream burst-mode signals to optimize FIR filter coefficients. Successful 50-Gbps transmission over 80 km SMF was demonstrated for both upstream and downstream with an optical budget exceeding 33 dB.

## Room 518

### 08:00–10:00
### W1J • Foundations of Quantum Systems: Hardware, Protocols, and Emerging Architectures
*Presider: Natalia Herrera Valencia; Heriot-Watt Univ., UK*

**W1J.1 • 08:00**
**A Reconfigurable Silicon Photonic Chip for Dual-Degree-of-Freedom Quantum Key Distribution,** Xu Yan[1], Xin Hua[1], Yanxin Han[1], Zongyang Li[1], Jie Yan[1], Shengxiang Zhang[1], Min Liu[1], Ying Zhu[1], Hongguang Zhang[1], Daigao Chen[1], Xi Xiao[1]; [1]*Nat Optoelectronics Innovation Center, China.* We proposed a novel silicon photonic encoder for QKD that enables on-demand selection of the encoding degree of freedom—either polarization or time-bin phase—for quantum state generation, and demonstrated QKD systems achieving secure key rates of 1 kbps over 128 km (polarization) and 2.4 kbps over 75 km (time-bin phase) through single-mode fiber.

**W1J.2 • 08:15**
**10 GHz Phase-Randomized Light Source for Quantum Photonic Applications,** Yuen San Lo[1], Adam Brzosko[1,2], Peter R. Smith[1], Robert I. Woodward[1], Davide G. Marangon[1], James F. Dynes[1], Sergio Juárez[1], Taofiq Paraiso[1], Mark Stevenson[1], Andrew J. Shields[1]; [1]*Toshiba Europe Limited Cambridge Research Laboratory, UK;* [2]*Engineering Department, Cambridge Univ., UK.* We demonstrate a method to overcome undesired phase correlations in gain-switched lasers at high repetition rates. Using an external spontaneous-emission source, we restore phase randomization up to 10 GHz, enabling high-rate quantum key distribution and quantum random number generation.

## Room 403B

### W1A • Thin-Film LN/LT and Silicon Mach-Zehnder Modulators—Continued

**W1A.2 • 08:30**
**A 60 GHz EO Bandwidth Mach-Zehnder Modulator for 200G/λ O-Band Datacom in 300-mm Monolithic CMOS Silicon Photonics Foundry,** Ming Gong[1]; [1]*Globalfoundries Inc Malta, USA*. We report a push-pull Mach-Zehnder modulator in a 300-mm CMOS silicon photonics foundry with 60 GHz EO bandwidth. We demonstrate 2.9 dB TDECQ and 3.7 dB ER in 200 Gbps PAM-4 transmissions with 7-tap FFE.

**W1A.3 • 08:45**
**Thin-Film Lithium Niobate Modulators With 110 GHz Bandwidth and 1.9 V•cm Efficiency on 200-mm Silicon Substrate,** Yiwen Zhang[1], Chen Iau[1], Bo Li[1], Suan Neng Foo[1], Jae Ok Yoo[1], Biwei Pan[1], Wen Qi Tan[1], Navab Singh[1], Leh Woon Lim[1], Landobasa Tobing[1], Xianshu Luo[1], Yee-Chia Yeo[1]; [1]*National Semiconductor Translation and Innovation Centre, Singapore*. We demonstrate thin-film lithium niobate modulators on 200-mm wafers in a back-end-of-line CMOS foundry. We achieve O-band propagation loss of <0.5 dB/cm and TFLN modulators with 110 GHz bandwidth and 1.9 V•cm modulation efficiency.

**W1A.4 • 09:00**
**Sub-V-driven 110-GHz O-band Electro-Optic Modulator on Thin-Film Lithium Tantalate,** Mengyue Xu[1], Yang Lan[1], Jinze Shi[1], Di Liang[1]; [1]*Univ. of Michigan, USA*. We demonstrate O-band Mach–Zehnder modulators on thin film lithium tantalate with $V_\pi$ of 1 V from 10 Hz to 10 kHz and electro-optic bandwidth beyond 110 GHz, enabled by localized silicon substrate removal.

## Room 408A

### W1B • Laser Prototypes and Packaging—Continued

**W1B.3 • 08:30**
**>+25-dBm × 8-Channel SOA-Integrated DFB-LD-Based TOSA for CPO External Laser Sources,** Kohei Umeta[1], Taketsugu Sawamura[1], Takuma Yoshida[1], Akihiro Imamura[1], Hiroyuki Ishii[1], Hideyuki Nasu[1]; [1]*Photonics Laboratories, Furukawa Electric Co., Ltd., Japan*. We demonstrate >+25-dBm × 8-channel SOA-integrated DFB-LD-based TOSA which can be built in CPO ELS modules. All 8 channels exhibit fiber-coupled optical power of 25 dBm at a case temperature of 25 °C.

**W1B.4 • 08:45**
**A 53-Gbaud NRZ/PAM4 × 8-Channel 1060-nm Single-Mode VCSEL-Based Ultra-Compact and High-Energy-Efficient CPO Transceiver for Full-Reach Datacenter Links,** Wataru Yoshida[4], Yuto Iwane[1], Kazuya Nagashima[3], Kazutaka Takeda[1], Hideyuki Nasu[3], Fumio Koyama[2]; [1]*Fuji Film Business Innovation Kabushiki Kaisha, Japan;* [2]*Tokyo Kagaku Daigaku, Japan;* [3]*Furukawa Denki Kogyo Kabushiki Kaisha, Japan;* [4]*Furukawa Denki Kogyo Kabushiki Kaisha, Japan*. We demonstrate an ultra-compact (1.22 $cm^2$ footprint), high-energy-efficient (4.5 pJ/bit), 53-Gbaud × 8-channel 1060-nm SM VCSEL-based CPO transceiver enabling 2-km SMF parallel links. A newly designed two-microlens-array coupling system achieves <2 dB loss.

**W1B.5 • 09:00** ★ Top-Scored
**106-Gbps 940-nm Flip-Chip Back-Emitting VCSEL With Metalens for NPO/CPO Applications,** HUAWEN HU[1], Qinpei Liu[1], Yipeng Ji[1], Binbin Zhao[1], Tingyu Cheng[1], Yao Cui[1,2], ChihChiang Shen[1], Jiaxing Wang[1], Connie J. Chang-Hasnain[1,2]; [1]*Berxel Photonics, China;* [2]*Tsinghua-Berkeley Shenzhen Inst., Tsinghua Univ., China*. We demonstrate a 940-nm flip-chip back-emitting VCSEL with integrated metalens exhibiting ultra-large fiber coupling tolerances and a substantially reduced junction temperature. We report 106-Gbps PAM4 operation at 100°C and transmission over 30-m standard OM2 MMF.

## Room 408B

### W1C • High-speed Transmission Systems—Continued

**W1C.2 • 08:30** ★ Top-Scored
**High-Symbol-Rate 192-GBaud Signal Transmission in S+C+L Band Over 2000 km With Net Bitrate of 102.8 Tb/s,** Fukutaro Hamaoka[1], Masanori Nakamura[1], Kosuke Kimura[1], Hiroto Kawakami[1], Shimpei Shimizu[1], Takayuki Kobayashi[1], Yutaka Miyamoto[1], Etsushi Yamazaki[1]; [1]*Network Innovation Laboratories, NTT, Inc., Japan*. We demonstrated 92-channel 192-GBaud WDM transmission in 18.4-THz triple-band with our proposed low-noise forward Raman pumping technique, achieving the highest average channel rate of 1.117 Tb/s/λ over 2000 km with a total net-bitrate 102.8 Tb/s.

**W1C.3 • 08:45**
**Low-Complexity Subcarrier-Merged Digital Back-Propagation for High-Baud-Rate Subcarrier-Multiplexing Optical Transmission Systems,** Zhiyuan Yang[1], Yongxin Sun[1], Yicheng Xu[1], Mengfan Fu[1], Lilin Yi[1], Weisheng Hu[1], Qunbi Zhuge[1]; [1]*Shanghai Jiao Tong Univ., China*. We propose a low-complexity subcarrier-merged DBP (SM-DBP) scheme for SCM systems. Experiments demonstrate that compared with SCM-DBP, SM-DBP reduces complex multiplications by ~74% while delivering similar performance.

**W1C.4 • 09:00**
**Mitigating EEPN-Induced Timing Jitter in High Baud Rate Optical Systems: Experimental Validation and DSP Optimization,** Fred Buchali[1], Vahid Aref[1], Giancarlo Gavioli[1], Gabriele Balducci[1]; [1]*NI, Nokia, Italy*. We experimentally assess EEPN-induced timing jitter in 130-GBaud systems, validating analytical models from [6]. Variable bandwidth timing estimation reduces RMS jitter ~40–45% and improves worst-block SNR ~1 dB over 950–2850 km transmission.

## Room 411

### W1D • Transceiver Design, Characterization and Optimization—Continued

**W1D.3 • 08:30**
**Online Joint and Precise Estimation of Transmitter and Receiver IQ-Skew for Ultra-High Baud-Rate Digital Subcarrier Multiplexing Transmissions,** Le H. Yu[1], Meng Xiang[1], Xiang Junjiang[1], Gai Zhou[1], Hexun Jiang[2], Wang Yongben[2], Shuai Wei[2], Hengqi Liu[2], Xiang Li[2], Yong Chen[2], Songnian Fu[1], Yuwen Qin[1]; [1]*Guangdong Univ. of Technology, China;* [2]*ZTE Corporation, China*. We propose an online joint estimation of transmitter and receiver IQ-skew leveraging a time-orthogonal frequency-domain-zero-autocorrelation sequence. The 100-GBaud DP-16QAM digital subcarrier multiplexing experimental transmission verify the <0.1 ps accuracy, enabling precise correction without performance penalty.

**W1D.4 • 08:45**
**Experimental Validation of Deep Unfolding for Parameter Optimization in MIMO Adaptive Equalization,** Koji Igarashi[1], Takumi Takahashi[1]; [1]*The Univ. of Osaka, Japan*. We experimentally demonstrate a deep unfolding approach for parameter optimization in MIMO adaptive equalization with separated carrier phase estimation and frequency offset compensation, achieving a significant reduction in optimization cost while attaining optimal equalization performance.

**W1D.5 • 09:00**
**Chirp-Parameter-Independent Zero-Dispersion Wavelength Estimation Method for Penalty-Free and Equalizer-Free 60-km Transmission of Over 100 Gbps IM-DD Signals,** Yasunari Tanaka[1], Kazutaka Hara[1], Jun-ichi Kani[1], Tatsuya Shimada[1]; [1]*NTT Yokosuka R&D Center, Japan*. We propose a chirp-parameter-independent zero-dispersion wavelength estimation method and demonstrate penalty-free and equalizer-free 60-km transmission of 100 Gbps PAM4 signals, enabling the use of any type of modulator without chirp measurement, thereby eliminating management costs.

## Room 501ABC

### W1E • Next-generation Fiber Links—Continued

**W1E.2 • 08:30**
**Record 3 ms Switching Time Wavelength Selective Switch,** Yuyang Liu[1], Shiqiang Li[2], Fanmiao Kong[2], Wenjie Yao[2], Junyu Hua[2], Xiaojia Si[2], Lizhen Lu[2], Wei Jia[2], Zhijun Zhu[2], Hao Wang[2], Xinhua Xiao[2], Xiaolu Song[2], Zhiwu Chang[2], Anxu Zhang[1], Hao Liu[1], Xia Sheng[1], Xishuo Wang[1], Kai Lv[1], Wenqiang Zhang[3], Xiaoli Huo[1], Junjie Li[1]; [1]*China Telecom Research Inst., China;* [2]*Huawei Technologies Co., Ltd., China;* [3]*China Telecommunications Corporation, China*. We have demonstrated a record 3 ms switching time wavelength-selective switch using the proposed Fabry-Pérot-enhanced liquid crystal on silicon (LCoS) pixels and thin-cell liquid crystal design, achieving over two-order magnitude speed improvement versus conventional WSS, enabling telecom-grade sub-50-ms restoration in long-haul optical networks.

**W1E.3 • 08:45** ★ Top-Scored
**Real-Time 1.2 Tb/s S- Band Silicon Photonics Transceiver Operating at 6-THz Tunable Bandwidth,** Baoluo Yan[1], Dongchen Zhang[1], Xingzhou Xu[2], Zhenqian Yang[1], Hong Liu[1], Huan Chen[1], Yan Zhao[1], Wenbo Yu[1], Nishan Wu[1], Zhiyong Zhao[1], Kezhi Qiao[1], Yong Chen[1], Hu Shi[1]; [1]*ZTE Corporation, China;* [2]*ZTE Photonics Technology Japan Co. Ltd, Japan*. To our knowledge, we demonstrate the largest S-band real-time rate of 1.2 Tb/s transceiver achieving 6-THz tuning via external cavity ITLA with >17.5 dBm, and a B2B OSNR tolerance comparable to that of C/L-band.

**W1E.4 • 09:00** Invited
**CPO Technology for AI Applications,** Henning Lysdal[1], Barak Freedman[1]; [1]*NVIDIA Corporation, Denmark*. Monolithic integration, fiber optics and advanced packaging have brought dramatic improvements to IT infrastructure over the past several decades. Now they come together as co-packaged optics to meet the demands of AI.

## Room 502A

### W1F • Multicore Fiber—Continued

**W1F.3 • 08:30**
**Synchronous Propagation Delay Measurement for Few-Mode Multi-Core Fibers Based on $S^2$ Method,** Xiaoeze Tang[1], Lei Shen[2], Shecheng Gao[1], Jiajing Tu[1]; [1]*Jinan Univ., China;* [2]*Yangtze Optical Fibre and Cable Joint Stock Ltd Co, China*. This paper proposes a $S^2$-based method to synchronously measure DMGD and ICS for few-mode multi-core fiber. A 2-km 3-mode 7-core fiber has been tested with accuracy ≤ 0.1ps/m and high efficiency without core-separation devices.

**W1F.4 • 08:45** Invited
**Distributed Measurement of Polarization and Coupling Characteristics of SDM Fibers,** Martina Cappelletti[3], Loreto V. Romero Ponce[3], Luca Schenato[3,2], Andrea Galtarossa[3,2], Antonio Mecozzi[1], Cristian Antonelli[1,2], Luca Palmieri[3,2]; [1]*Universita degli Studi dell'Aquila, Italy;* [2]*Consorzio Nazionale Interuniversitario per le Telecomunicazioni, Italy;* [3]*Universita degli Studi di Padova, Italy*. Distributed measurements of polarization in uncoupled-core multicore fiber and mode coupling in SDM fibers is reviewed. The concept of Rayleigh seeds is introduced to interpret experimental results in multimode SDM fibers.

## Room 502B

### W1G • Co-existence of Sensing and Communication—Continued

**W1G.3 • 08:30**
**FPGA-Based Experimental Analysis of Fixed-Point Precision Impact on SOP Estimation in Coherent Communications Receivers,** Geraldo Gomes[1], Rafael Vieira[1], Hani Kbashi[1], Aleksandr I. Donodin[1], Shekhar Saxena[1], Stylianos Sygletos[1], Ian Phillips[1], Jaroslaw Prilepsky[1], Mikael Mazur[2], Sergei K. Turitsyn[1], Pedro Freire[1]; [1]*Aston Univ., UK;* [2]*Nokia Bell Labs, USA.* We experimentally evaluated the sensing-communication trade-off from the fixed-point precision MIMO equalizer using FPGA. At 7-bit, noise floor drops ~100× and angular error 63%, but the communication performance saturates while the hardware complexity rises.

**W1G.4 • 08:45**
**Single-Ended Forward Sensing System Over an All-Passive Fiber Link Enabled by LFM,** Yi Zou[1], Chenbo Zhang[1], Jiachuan Yang[1], Zhangyuan Chen[1], Xiaopeng Xie[1]; [1]*Peking Univ., China.* We demonstrate a simplified single-ended forward sensing system using an LFM signal to realize an all-passive sensing link, achieving 10-m localization accuracy and a notably 45-dB dynamic range over a 15-km SMF link.

**W1G.5 • 09:00**
**Joint Self-Coherent Communication and Sensing Using a 7.6 MHz Linewidth DFB Laser Enabled by Pilot-Tone Aided Balanced Delay Interferometry,** Yaguang Hao[1,2], Bang Yang[2], Quanxin Na[1], Jianwei Tang[1,2], Linsheng Fan[1], Chen Cheng[2], Qun Zhang[1], Dongwei Zhuang[1], Bing Yue[1], Yifan Xu[2], Yanfu Yang[2], Xueyang Li[1], Zhixue He[1], Lei Wang[1]; [1]*Peng Cheng Laboratory, China;* [2]*Harbin Inst. of Technology Shenzhen, China.* Enabled by pilot-tone assisted balanced delay laser interferometry, we demonstrate joint sensing and self-coherent communication using a 7.6 MHz-linewidth DFB laser. Both functions share a common wavelength, system hardware and core DSP algorithms.

## Room 515A

### W1H • Multi-Band/Core and Hollow Core Fiber Optical Networks—Continued

**W1H.2 • 08:30** ★ Top-Scored
**Optimal Placement of Hollow-Core Fiber Spans in Optical Transport Networks With CAPEX Constraints,** Joao Pedro[1,2], Bruno Correia[1], Diogo Morão[1]; [1]*Nokia Corporation, Portugal;* [2]*Instituto de Telecomunicacoes Lisboa, Portugal.* This paper presents a method to optimally place a limited number of hollow-core fiber (HCF) spans and high-power booster/in-line-amplifiers in optical mesh networks. Results show it effectively increases network capacity/reach while enforcing the CAPEX-related constraint.

**W1H.3 • 08:45**
**Optimal Output Power for C-Band Optical Amplifiers in Transparent WDM Networks Based on Hollow Core Fiber,** Thierry Zami[2,1], Nicola rossi[2,1], bruno lavigne[2,1]; [1]*Nokia Corporation, France;* [2]*Alcatel Submarine Network, France.* Despite negligible WDM non-linear effects in HCF versus SSMF, this study illustrates why in-line EDFAs outputting more than 30 dBm are not the most optimal for wide networks fitted with HCF over the C band.

**W1H.4 • 09:00**
**A Network-Wide Power Analysis of Cladding-Pumped Amplification in Multi-Core Optical Networks,** Memedhe Ibrahimi[1], Giovanni S. Sticca[1], Manuel Tibaldini[1], Martina Milione[1], Francesco Musumeci[1], Giammarco Di Sciullo[2], Andrea Marotta[2], Cristian Antonelli[2], Massimo Tornatore[1]; [1]*Politecnico di Milano, Italy;* [2]*Universita degli Studi dell'Aquila, Italy.* We investigate the power efficiency of cladding-pumped amplification in multi-core networks and demonstrate up to 37% power-per-bit savings compared to multi-fiber and core-pumped multi-core networks.

## Room 515B

### W1I • Optical Access Network Evolution—Continued

**W1I.3 • 08:30** Invited
**Optical Access Networks Roadmap,** Denis Khotimsky[1,2]; [1]*Verizon Communications Inc, USA;* [2]*Honorary Chair, FSAN, USA.* The talk provides a historical review, discusses current developments and forward-looking perspectives on the optical access networks evolution, while comparing the originally chartered 2007 and 2016 FSAN roadmaps with the progress subsequently achieved in practice.

**W1I.4 • 09:00**
**Toward Very High-Speed PON: C-Band Unified OLT Supporting Coherent and IM/DD ONU Interoperability via DSP Mode Compatibility and Zero-Flip Encoding,** Xuyu DENG[1], An Yan[1], Penghao Luo[1], Junhao Zhao[1], Renle Zheng[1], Yongzhu Hu[1], yaxuan Li[1], Nan Chi[1], Junwen Zhang[1]; [1]*Fudan Univ., China.* We experimentally demonstrate C-band unified PON with the OLT supporting coherent and IM/DD ONU interoperability via DSP-mode switching and zero-flip encoding, achieving 100/200/400-Gb/s transmission over 50-km SSMF with high optical power budgets.

## Room 518

### W1J • Foundations of Quantum Systems: Hardware, Protocols, and Emerging Architectures—Continued

**W1J.3 • 08:30** Tutorial
**Building Blocks of QKD: a Tutorial on Hardware, Protocols, and Post-Processing,** Robert I. Woodward[1]; [1]*Toshiba Europe Ltd- Cambridge Research, UK.* This tutorial introduces the various concepts that are required for high-performance quantum key distribution (QKD) technology. Both hardware and software aspects will be discussed, with a focus on the requirements for practical, deployable QKD systems.

Robert Woodward is a Principal Engineer and Team Leader at Toshiba Europe Ltd (Cambridge). He holds degrees from University of Cambridge and Imperial College London, and his current research focusses on fibre-based quantum communication technologies, alongside working on the development of Toshiba's QKD products.

## Room 403B

### W1A • Thin-Film LN/LT and Silicon Mach-Zehnder Modulators—Continued

**W1A.5 • 09:15**
**Lithium-Tantalate-on-Fused Silica Mach-Zehnder Modulators,** Zihan Li[1], Alexander Kotz[2], Christian Koos[2], Tobias J. Kippenberg[1]; *[1]École Polytechnique Fédérale de Lausanne, Switzerland; [2]Inst. of Photon. and Quant. Electron. (IPQ), Karlsruher Institut fur Technologie, Germany.* We demonstrate the lithium-tantalate-on-fused silica (LT-on-FS) Mach-Zehnder modulator manufactured in 4-inch wafer-scale. The 3-dB electro-optic bandwidth is measured up to 67 GHz with a 1.6 V modulation efficiency. We achieve net data rates of 437 Gbit/s with PAM8 signaling.

**W1A.6 • 09:30**
**High-Efficiency Ring-Assisted Mach-Zehnder Modulator on a Lithium Tantalate-on-Silicon Nitride Platform,** Forrest Valdez[1], Boris Zabelich[1], Viphretuo Mere[1], Pragati Aashna[1], Radha Krishnan[1], Camiel Op de Beeck[1], Arif Rahman[2], Shayan Mookherjea[2], Pieter Wuytens[1]; *[1]LIGENTEC SA, Switzerland; [2]Department of Electrical and Computer Engineering, Univ. of California San Diego, USA.* We present a heterogeneously integrated SiN/LTO ring-assisted Mach–Zehnder modulator with a modulation efficiency of 1.36 Vcm, insertion loss of 1.75 dB in the C-band, and 3-dB electro-optic bandwidth over 50 GHz on a wafer-scale platform.

**W1A.7 • 09:45**
**A 1.6 Tbit/s WDM Integrated Photonic IMDD Transmitter on Thin-Film Lithium Tantalate,** Shivaprasad Umesh Hulyal[1], Dengyang Fang[2], Jiachen Cai[1], Alexander Kotz[2], Xin Ou[3], Christian Koos[2], Tobias J. Kippenberg[1]; *[1]Swiss Federal Inst. of Technology, Switzerland; [2]Inst. of Photonics and Quantum Electronics (IPQ), Karlsruher Institut fur Technologie, Germany; [3]State Key Laboratory of Materials for Integrated Circuits, Shanghai Inst. of Microsystem and Information Technology, China.* We demonstrate a fully integrated photonic transmitter on a monolithic thin-film lithium tantalate platform, achieving an aggregate net data rate of 1.6 Tbit/s using wavelength-division multiplexing (WDM) with PAM-4 and PAM-8 modulation formats.

## Room 408A

### W1B • Laser Prototypes and Packaging—Continued

**W1B.6 • 09:15** Invited
**Mass Production of VCSELs for Datacom and Sensing Applications,** Hung-Pin Xiao[1]; *[1]WIN Semiconductors, Taiwan.* This paper reports the demonstration of our ability to realize precise process control and advanced process development. These abilities are pivotal for the VCSEL foundry to provide a reliable process and help achieving mass production.

## Room 408B

### W1C • High-speed Transmission Systems—Continued

## Room 411

### W1D • Transceiver Design, Characterization and Optimization—Continued

**W1D.6 • 09:15** ★ Top-Scored
**Quaternion Retrieval for Full-Field System Identification of Optic Fiber Systems via Direct Detection,** Yuki Yoshida[2], Setsuo Yoshida[1], Takeshi Hoshida[1], Kouichi Akahane[2], Naokatsu Yamamoto[2]; *[1]1Finity Inc., Japan; [2]Network Research Inst., NICT, Japan.* A novel pilot-aided quaternion retrieval technique for full-field optical system identification without coherent receivers is proposed and demonstrated experimentally in a 63.25-Gbaud dual-polarization 16-QAM system.

**W1D.7 • 09:30** Invited
**Co-Design of Electronic and Photonic Systems for Future LPO, NPO, and CPO,** Guilhem de Valicourt[1], Daniel Assumpcao[1], Siamak Abbaslou[1], Lukas Elsinger[1], Arash Adibi[1], Son T. Le[1], Peter Winzer[1]; *[1]Ciena Corporation, USA.* Linear-pluggable optics, near-packaged optics, and co-packaged optics provide low-power I/O solutions for AI/ML clusters. In this paper, we review the co-design of the electronic and photonic subsystems, discussing their principal benefits and the technical challenges.

## Room 501ABC

## Room 502A

### W1F • Multicore Fiber—Continued

**W1F.5 • 09:15** ★ Top-Scored
**Applicability of Homogeneous/Heterogeneous Multi-Core Fibers for Submarine Cables,** Ryota Imada[1], Takayoshi Mori[1], Masashi Kikuchi[1], Kazutaka Noto[1], Hiroyuki Iida[1], Kiyoshi Kamimura[1], Taro Iwaya[1], Takashi Matsui[1], Tomoya Shimizu[1]; *[1]Access Network Service Systems Laboratories, NTT, Inc., Japan.* We fabricate and characterize submarine cables accommodating G.654-compatible four-core fibers with homogeneous and heterogeneous cores, confirming 10,000 km transmission potential under XT variations from cabling processes and temperature fluctuations.

**W1F.6 • 09:30**
**Mass Production of Two-Core Fiber and Applicability for Pb/s Submarine Cable,** Yuki Kawaguchi[1], Hirotaka Sakuma[1], Tetsuya Haruna[1], Tetsuya Hayashi[1], Hideki Yamaguchi[1], Masaaki Hirano[1], Takemi Hasegawa[1]; *[1]Sumitomo Electric Industries Ltd., Japan.* We report mass production of 2-core-fiber(2CF) with Aeff of 112μm² and demonstrate ultra-low-loss of 0.155dB/km, negligibly low XT, and low PMD. Using mass production results, we clarify feasibility of 2CF to construct 1Pb/s transoceanic system.

**W1F.7 • 09:45**
**Lisbon Underground Multicore Fiber Ring,** Adolfo V. Cartaxo[1], Tiago F. Alves[1], João L. Rebola[1], Luis Cancela[1], Tobias Tiess[2], Kay Schuster[2], Martin Bottcher[2], Paulo Leal[3], Mirko Gori[4], Eduardo de Mingo[5], Leonardo burchini[4], António Morais Santos[6]; *[1]ISCTE-Instituto Universitario de Lisboa, Portugal; [2]Heraeus Holding GmbH, Germany; [3]Telcabo, Portugal; [4]Tratos Cavi S.p.A., Italy; [5]Telnet, Spain; [6]Lisbon Metropolitan, Portugal.* The Lisbon underground multicore fiber ring testbed is presented. It comprises a 144-fiber cable with 74 strands of 5 MCF types and over 1900 km of installed MCF in the stressful environment of Lisbon subway.

## Room 502B

### W1G • Co-existence of Sensing and Communication—Continued

**W1G.6 • 09:15**
**Experimental Investigation on Pulsed DAS Coexistence With DWDM High-Speed Coherent Transmission in C and L Bands,** Giuseppe Rizzelli[1], Marco Fasano[2], Saverio Pellegrini[1], Andrea Madaschi[2], Stefano Straullu[3], Antonino Nespola[3], Pierpaolo Boffi[2], Roberto Gaudino[1]; *[1]Politecnico di Torino, Italy; [2]Politecnico di Milano, Italy; [3]Fondazione LINKS, Italy.* We experimentally investigate on compatibility between pulsed DAS and DWDM coherent transmission in C and L bands, showing that counterpropagating setup is feasible up to high DAS peak power, while copropagation is significantly more critical.

**W1G.7 • 09:30**
**Long-Distance Integrated Forward Vibration Sensing and Terabit Optical Communication With 12.5-MHz DFB Laser via Phase Noise Separation,** Yixiao Zhu[1], Chenbo Zhang[2], Yi Zou[2], Xiang Cai[2], Yimin Hu[1], Xiansong Fang[2], Jingjing Lin[2], Jingchi Li[1], Xian Zhou[3], Xiaopeng Xie[2], 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 demonstrate integrated sensing and communication over 480-km single-mode fiber with low-cost 12.5-MHz linewidth DFB laser, achieving single-wavelength 1.07-Tb/s transmission with residual carrier-based phase tracking, and long-distance 277-pε/sqrt(Hz)@20-kHz forward vibration sensing with phase noise removal.

## Room 515A

### W1H • Multi-Band/Core and Hollow Core Fiber Optical Networks—Continued

**W1H.5 • 09:15**
**GSNR-Aware Spectral Slot and Inter-Band Wavelength Converter Assignment in Multi-Band Optical Networks,** Inwoong Kim[1], Motohiko Eto[2], Kyousuke Sone[2], Tomoyuki Kato[2], Takeshi Hoshida[2], Yu Tanaka[2], Paparao Palacharla[1]; *[1]1Finity America Inc., USA; [2]1Finity Inc., Japan.* We propose a novel GSNR-aware spectral slot and inter-band wavelength converter (IWC) assignment algorithm that improves SCL-band network utilization, achieving 38% higher network capacity with IWCs versus CL-band network, and only 8% improvement without IWCs.

**W1H.6 • 09:30**
**Adaptive-Transformer-Driven Transfer Learning for Online GSNR Optimization in Heterogeneous C+L-Band Networks,** Xiaoxuan Gao[1], Rentao Gu[1], Yuefeng Ji[1]; *[1]Beijing Univ. of Posts and Telecommunications, China.* We propose a pre-trained Transformer with trainable adapter leveraging transfer learning to overcome limited generalization in GSNR optimization across heterogeneous links, achieving 80% accuracy improvement and 0.34 dB average error using only 2% new data.

**W1H.7 • 09:45**
**User-Mobility-Aware Optimization of Fiber Placement in Hybrid Fiber-IAB Networks,** Piotr Lechowicz[1], Charitha Madapatha[1], Carlos Natalino[1], Tommy Svensson[1], Paolo Monti[1]; *[1]Chalmers tekniska hogskola AB, Sweden.* Metaheuristic optimization of hybrid fiber-IAB networks demonstrates that integrating user dynamics into topology design enables more adaptive and cost-efficient backhaul architectures, contributing to the development of scalable and flexible 6G network infrastructures.

## Room 515B

### W1I • Optical Access Network Evolution—Continued

**W1I.5 • 09:15**
**Demonstration of Dual-Polarization Intensity Modulation and Coherent-Detection Based Hybrid 200G PON Burst Reception With Fast- Converging Digital Signal Processing,** Yang Zou[1], Jing Li[1], Zhen Luo[1], Sunningchang Zhang[1], Xiatao Huang[2], Guoqiang Li[2], Xingang Huang[2], Shenmao Zhang[1], Xiaoxiao Dai[1], Mengfan Cheng[1], Lei Deng[1], Qi Yang[1], Deming Liu[1]; *[1]Huazhong Univ of Science and Technology, China; [2]State Key Laboratory of Mobile Network and Mobile Multimedia Technology, China.* A 51.6-ns preamble and the corresponding FF-CDR and fast-converging MIMO algorithms designed for DP-IM and coherent burst reception are experimentally demonstrated. 200Gb/s DP-PAM4 signal achieves a power budget of 29.5-dB after 22-km fiber transmission.

**W1I.6 • 09:30** Invited
**An Industrial Perspective on the Selection Between Coherent and IMDD Technologies for Next-Generation Access Networks,** Cláudio E. Rodrigues[1]; *[1]Altice Labs, Portugal.* This presentation provides an industrial perspective on the strategic selection between coherent and IMDD technologies, examining cost, power, scalability, ecosystem maturity, and investment risk to inform sustainable technology decisions for next-generation optical access networks.

## Room 518

### W1J • Foundations of Quantum Systems: Hardware, Protocols, and Emerging Architectures—Continued

**W1J.4 • 09:30** Invited
**Advances in Integrated Photonics for Quantum Networking,** Galan Moody[1]; *[1]Univ. of California Santa Barbara, USA.* I will present advances in integrated photonics for quantum networking, including heterogeneous III-V-on-SiN platforms enabling efficient and high-rate quantum light generation, frequency conversion, switching, and detection, providing opportunities for modular chip-based quantum interconnects and networked quantum systems.

## 10:30–12:00
## W2A • Joint Poster Session I

**W2A.1**
**Broadband MUTC-PD Based Photonic THz Transmitter for Multiband Wireless Communications,** Mingwei Sun[1], Yinjun Liu[2], Qingyu Han[2], Boyu Dong[2], Yaxuan Li[2], Bing Xiong[1], Junwen Zhang[2], Changzheng Sun[1], Zhibiao Hao[1], Jian Wang[1], Lai Wang[1], Yanjun Han[1], Hongtao Li[1], Lin Gan[1], Nan Chi[2], Yi Luo[1]; [1]*Tsinghua Univ., China;* [2]*Fudan Univ., China.* A compact THz transmitter integrating an ultrafast MUTC-PD and an end-fire antenna achieves high efficiency and an ultrawide bandwidth covering from 75 to 170 GHz, enabling 156 Gbps error-free wireless signal transmission.

**W2A.2**
**On-Chip Wavelength Monitoring in a Widely Tunable Hybrid InP/Polymer Photonic THz Source,** Kalliopi Spanidou[2], Luis González Guerrero[2], Tianwen Qian[1], Peer Liebermann[1], Sergio Rivera Lavado[2], David de Felipe[1], Norbert Keil[1], Guillermo Carpintero[2]; [1]*Fraunhofer Inst. for Telecommunications, Heinrich Hertz Inst., HHI, Germany;* [2]*Grupo de Optoelectronica y Tecnologia Laser (GOTL), Universidad Carlos III de Madrid Escuela Politecnica Superior, Spain.* We demonstrate an on-chip wavelength monitoring system comprising micro-optical thin-film filters and photodiodes integrated with a hybrid InP/polymer tunable laser, enabling continuous wavelength tuning and measurement over a 0.5-THz range.

**W2A.3**
**A Universal Loss Characterization Method for Integrated Photonic Circuits,** Haoran Chen[1], Ruxuan Liu[1], Gedalia Yakov Koehler[1], Shuman Sun[1], Zijiao Yang[1], Beichen Wang[1], Xu Yi[1]; [1]*Univ. of Virginia, USA.* We report a universal method to characterize loss/gain for integrated photonic circuits. The loss of each component in a circuit, including fiber-chip coupling facets, can be identified in non-demolition manner without compromising circuit functionality.

**W2A.4**
**Wafer-Scale, Ultra-Low-Loss and Polarization-Insensitive Si3N4 Photonic Integrated Circuits,** Zhonghan Wu[1], Haiyan Jia[1], Xin Xu[1], Jiarui Zhang[1], Zhangjun Huang[1], Zhichao Ye[1]; [1]*Hangzhou Qoretek Co., Ltd., China.* We demonstrated an in-house manufactured wafer-scale, polarization-insensitive Si3N4 PIC platform with <15 dB/m single-mode loss and <3.04 ps/m PMD. A library of high-performance, polarization-insensitive building blocks, including splitters and crossings, is also presented.

**W2A.5**
**Ultracompact High-Speed Surface-Reflective Modulator With Organic Electro-Optic Thin Film,** Seidai Karakida[1], Koto Ariu[1], Yusuke Tsubai[1], Go Soma[1], Takuo Tanemura[1]; [1]*Tokyo Daigaku, Japan.* Ultracompact polarization-independent surface-reflective modulator with an organic electro-optic thin film is demonstrated. A 30-μm-diameter vertically coupled Fabry-Perot resonator is employed to experimentally demonstrate high modulation efficiency of 0.30 nm/V and 3-dB bandwidth of 40 GHz.

**W2A.6**
**Encoder-Decoder Codesign of Lightweight 3D Surface Profiler via Integrated Photonic Sampler,** yizhi wang[2], Ziyao Zhang[2], Chunhui Yao[2,1], Huiyu Huang[2], Wanlu Zhang[2], Ting Yan[1], Liang Ming[1], Yuxiao Ye[1], Richard Penty[2], Qixiang Cheng[2,1]; [1]*GlitterinTech Limited, China;* [2]*Engineering, Univ. of Cambridge, UK.* Deep learning enables geometric sensing for efficient profiling applications. We present a surface profiler based on a codesigned encoder-decoder pair consisting of reconfigurable integrated sampler and 1D-CNN, achieving ~17μm vertical and ~30μm lateral accuracy, respectively.

**W2A.7**
**Quasi-Wavelength-Agnostic Photonic Coupler Using 3D-Nanoprinting,** Huiyu Huang[1], Zhitian Shi[1], Chunhui Yao[1,2], Richard Penty[1], Qixiang Cheng[1,2]; [1]*Univ. of Cambridge, UK;* [2]*GlitterinTech Ltd, China.* We report a 3D-nanoprinted coupler with elliptical reflectors, achieving a 1 dB bandwidth across 800 nm. Aberration suppression and mode-size conversion enable quasi-wavelength-agnostic, ultra-broadband coupling, validated with 980HP and UHNA1 fibers for scalable photonic integration.

**W2A.8**
**Silicon Optical 90° Hybrid Utilizing Widened Waveguides for Mitigating Phase Errors,** Takanori Sato[1], Taichi Muratsubaki[1], Shunsuke Miki[1], Kunimasa Saitoh[1]; [1]*Hokkaido Daigaku Daigakuin Joho Kagaku Kenkyuka, Japan.* We propose and experimentally demonstrate a novel silicon optical 90° hybrid utilizing 1200-nm-wide waveguides under pseudo-single-mode operation, achieving less than 5-degree phase error and 0.5-dB loss across 1515–1555 nm with a simple, crossing-free layout.

**W2A.9**
**Silicon Photonic S-Bent Directional Coupler With Low Wavelength-Dependent Coupling Variation,** Alaa Elshazly[1,2], Ahmed Bayoumi[1,2], Mehmet Oktay[1,2], Hakim Kobbi[1], Natarajan Rajasekaran[1], Rafal Magdziak[1], Mulham Khoder[1], Maumita Chakrabarti[1], Dimitrios Velenis[1], Huseyin Sar[1], Peter Verheyen[1], Philippe Absil[1], Filippo Ferraro[1], Yoojin Ban[1], Joris Van Campenhout[1], Wim Bogaerts[1,2], Qingzhong Deng[1]; [1]*InterUniv. Microelectronics Center, Belgium;* [2]*Information Technology, Universiteit Gent, Belgium.* We experimentally demonstrate a silicon photonic S-bent directional coupler achieving a coupling variation of only 0.065 over an 80 nm wavelength range, showing superior broadband performance with a fabrication-friendly minimum feature size of 200 nm.

**W2A.10**
**Reliability and Output Power Improvement of GaAs Nano-Ridge Lasers Integrated on 300 mm Silicon,** Ping-Yi Hsieh[1], Peter Swekis[1], Huseyin Sar[1], Davide Colucci[1,2], David Coenen[1], Debi P. Panda[1], Alexey Milenin[1], Andualem A. Yimam[2], Geert Morthier[2], Dries Van Thourhout[2], Maumita Chakrabarti[1], Yoojin Ban[1], Filippo Ferraro[1], Didit Yudistira[1], Bernardette Kunert[1], Joris Van Campenhout[1]; [1]*Interuniversitair Micro-Elektronica Centrum, Belgium;* [2]*Photonics Research Group, Universiteit Gent, Belgium.* Reliability-improved GaAs nano-ridge lasers are fabricated on 300 mm silicon. A novel contact-FIN-based design, including an anisotropic InGaP passivation, ensures carrier injection while pulling down the optical modes. Single-facet power exceeding 10 mW is achieved at 25 °C.

**W2A.11**
**High Thermal Efficiency Tunable Laser With Wide Wavelength Range and Frequency-Sweep Bandwidth,** Ziming Wang[1], Weipeng Wang[1], Jie Li[1], heming hu[1], wenqiang yue[1], Quanxin Na[2], Huan Qu[1], Baisong Chen[1], Yingzhi Li[1], Zihao Zhi[1], xianqi pang[1], Haolun Du[1], Guiyang Zhang[1], Qijie Xie[2], Xiaomin Nie[2], Xiaolong Hu[1], Junfeng Song[1,2]; [1]*Jilin Univ., China;* [2]*Pengcheng Laboratory, China.* A MCI tunable laser with cascaded phase shifters for enhanced thermal efficiency achieves a 93 nm tuning range, 48.5 kHz minimum linewidth, >5 GHz sweep, average SMSR >49 dB, and average output > 9 dBm for optical communication and LiDAR.

**W2A.12**
**A 4 Tbps 16-Channel DWDM Transmitter Using Extended-Depletion Silicon Photonic Microdisk Modulator Array,** Shenlei Bao[2,1], Chao Cheng[2,1], xianglin bu[2,1], Yihao Yang[2,1], Houyou Lai[2,1], Jintao Xue[2,1], Wenfu Zhang[2,1], Binhao Wang[2,1]; [1]*Univ. of Chinese Academy of Science, China;* [2]*Xi'an Inst. of Optics and Precision Mechanics, China.* We demonstrate a 16-channel silicon microdisk modulator array with a 3 dB electro-optic bandwidth exceeding 62 GHz. The transmitter supports 16 × 256 Gbps PAM4 transmission, delivering an aggregate data rate of 4 Tbps/fiber.

**W2A.13**
**12-Inch Wafer-Level Total Ionizing Dose Effect Analysis of Silicon Photonics Active Devices,** Wangxun Kang[2,1], Quan Li[1], Xiao Hu[1], Yi Yan[1], Fenghe Yang[1], Haibin Zhao[2], Wei Chu[1], Fang Wei[1], Haiwen Cai[1]; [1]*Zhangjiang Laboratory, China;* [2]*College of future information technology, Fudan Univ., China.* We report the first 12-inch wafer-level total ionizing dose (TID) effect analysis of active high speed silicon photonics devices. Statistical results show the rich behaviors and pave the way to enhance yield of mass production.

**W2A.14**
**High-Bandwidth Serpentine Segmented Silicon Photonic Mach-Zehnder Modulator for 192 Gbaud Transmission,** Qian Liu[1], Chao Cheng[1], Yangming Ren[1], Xinyu Li[1], Wenfu Zhang[1], Binhao Wang[1]; [1]*Chinese Academy of Sciences Xi'an Inst. of Optics and Precision Mechanics, China.* We demonstrate a serpentine segmented silicon Mach-Zehnder modulator with a 1 dB bandwidth >67 GHz at 0 V bias and a modulation efficiency of 1.14 Vcm, supporting 192 Gbaud transmission.

**W2A.15**
**Greater Than 100mW Coupled Power From O-Band Quantum Dot Laser to Silicon Nitride Waveguides Through Micro-Transfer Print Integration,** Diya Hu[1], Fatih Bilge Atar[2], Yuan Liu[1], Brian Corbett[2], Jonathan Klamkin[1]; [1]*Univ. of California Santa Barbara, USA;* [2]*Tyndall National Inst., Ireland.* Etched-facet O-band quantum dot Fabry-Perot lasers were integrated with low-loss silicon nitride waveguides on silicon through micro-transfer printing. Greater than 100mW power is coupled from both laser facets with approximately 4dB coupling loss per facet.

**W2A.16**
**Photonic Extreme Learning Machine Based on Coupled-Core Multicore Fibers,** Lu Zhang[1], Lin Sun[1], Lin Jiang[2], Jiaqi Cai[1], Zhipeng Bai[1], Lianshan Yan[2], Gordon Ning Liu[1], Yi Cai[1], Gangxiang Shen[1]; [1]*Soochow Univ., China;* [2]*Southwest Jiaotong Univ., China.* Elevated spatial mode dispersion of coupled-core multicore fibers enables notable layer expansion of photonic extreme learning machine (PELM). Numerical and experimental investigations of PELM based on coupled-core 4-core fibers are discussed.

**W2A.17**
**A Four-Group two-Core Fiber With low Inter-Group XT and low Intra-Group SMD in a Standard 125-μm Cladding,** shurong zhai[2], Yaping Liu[2], Zhiqun Yang[2], Zhanhua Huang[2], Lin Zhang[2,1]; [1]*Pengcheng Laboratory, China;* [2]*Tianjin Univ., China.* We propose a 4-group 2-core fiber with low inter-group XT of <-40 dB/100km and low intra-group SMD of 3.67 ps/√km under a 125-μm cladding, which can enhance capacity and effectively reduce MIMO complexity.

**W2A.18**
**Single-Shot Crosstalk Measurement in Multicore Fibers Using Broadband Sources With Enhanced Dynamic Range,** Ryota Kaji[1], Takuya Oda[1], Katsuhiro Takenaga[1], Kentaro Ichii[1]; [1]*Fujikura Ltd, Japan.* Fast and accurate single-shot crosstalk measurement using a broadband source was demonstrated without any averaging process, and theoretical analysis shows sufficient dynamic range over transmission distances exceeding 100 km.

**W2A.19**
**Pumping Power Reduction in Three-Stage Tandem Multiband EDFA for Multicore Bidirectional Transmission,** Yusuke Shimomura[1], Hitoshi Takeshita[1], Wakako Maeda[1]; [1]*NEC Corporation, Japan.* We demonstrate a low-power, three-stage tandem multiband and multicore EDFA (MB-MC-EDFA) for multicore bidirectional transmission in submarine cables. By applying ASE recirculation to the tandem MB-MC-EDFA, we achieve an 11% reduction in pumping power.

**W2A.20**
**20-dB Gain of Broadband Cr-Doped Crystalline Core Fiber for Mode Matching to Standard Single-Mode Fiber by Novel Edge and Brightness Recognition Growth,** CHIN-WEN TSENG[2], Kai-Chieh Chang[3], CHIH-HUNG HSU[1], Chun-Nien Liu[2], Wood-Hi Cheng[1]; [1]*Graduate Inst. of Optoelectronic Engineering, National Chung Hsing Univ., Taiwan;* [2]*Department of Electronic Engineering, National Chung Hsing Univ., Taiwan;* [3]*Graduate Inst. of Photonics and Optoelectronics, National Taiwan Univ., Taiwan.* We demonstrate 20-dB gain of broadband 9-mm Cr-doped crystalline core fiber (CDCCF) for mode matching to standard single-mode fiber employing novel edge and brightness recognition growth. This is the smallest core reported yet for CDCCF.

## W2A • Joint Poster Session I—Continued

**W2A.21**
**Ghost Imaging Through Multimode Fiber With Deep Learning Denoising,** Zinan Xiao[1], Redha Ibrahim[1], Alaaeddine Rjeb[1], Vladimir Shumigai[1], Wenqing Niu[1], Wahyu Gunawan[1], Juan Mosquera[1], Islam Ashry[1], Boon S. Ooi[1,2]; [1]*King Abdullah Univ. of Science and Technology Computer Electrical and Mathematical Science and Engineering Division, Saudi Arabia;* [2]*Rensselaer Polytechnic Inst., USA*. We demonstrate ghost imaging (GI) through multimode fiber (MMF), enhanced by convolutional neural networks for image denoising. The approach improves reconstruction quality and enables efficient imaging under limited measurements and complex propagation conditions.

**W2A.22**
**Experimental Demonstration of L-Band Discrete Raman Amplifier Using Germanium Doped Photonic Crystal Fiber With High Raman Gain Coefficient and low Loss,** hui zhang[1], Shiqi Zhou[1], Li Zhang[1], Liubo Yang[1], Yifei Xu[1], junjie qi[1], Zhaolong Liao[1], Qiqiang Yang[1], Yaping Liu[1], Liyan Zhang[1], Lei Shen[1], Lei Zhang[1], Jie Luo[1]; [1]*Yangtze Optical Fibre & Cable Co, China*. We characterized an L-band (1575-1610nm) discrete Raman amplifier utilizing germanium-doped PCF. Achieving an average gain of 25.88 dB with gain variation of 1.563 dB and NF< 4.778 dB under input signal power of -20dBm.

**W2A.23**
**Highly Sensitive and Wide-Angle Fibre-Optic Ultrasonic Detection Array With 3D-Printed Curved Cavities,** Zhi Zhang[1], Zongjing Li[2], Liangye Li[3], Dongchen Xu[1], Xuhao Fan[2], Geng Chen[1], Shaoling Zhang[1], Hao Li[1], Wei Xiong[2], Qizhen Sun[1]; [1]*School of Optical and Electronic Information, Huazhong Univ. of Science and Technology, China;* [2]*National Laboratory for Optoelectronics, Huazhong Univ. of Science and Technology, China;* [3]*School of Information Mechanics and Sensing Engineering, Xidian Univ., China*. We proposed a fiber-optic ultrasonic detection array with high sensitivity and wide angular response based on 3D-printed curved cavities. The sensor exhibits an ultra-low NEP of 24.6 Pa and a wide response angle of 120°.

**W2A.24**
**Network-Wide, Field-Deployable OSNR and Spectral Analytics Leveraging Transceivers as Diagnostic and Monitoring Tools,** Abhishek Anchal[1], Avi Levi[1]; [1]*Ribbon Communications, Israel*. We demonstrate a field-deployable, zero-cost, hardware-free method using commercial transceivers in CW mode for in-situ OSNR and bandwidth monitoring, achieving ~1 GHz bandwidth and <1 dB OSNR accuracy without additional equipment.

**W2A.25**
**Experimental Demonstration of a Highly-Secure Optical Network With Joint Quantum Key Distribution and Fiber Optic Sensing,** Alessandro Gagliano[1], Marco Fasano[1], Andrea Madaschi[1], Alberto Gatto[1], Pierpaolo Boffi[1], Paolo Martelli[1], Paola Parolari[1]; [1]*Politecnico di Milano, Italy.* We demonstrate the integration of quantum and sensing services within the same optical access infrastructure, enabling simultaneous real-time monitoring of deliberate physical attacks and secure quantum key generation with a QBER below 5%.

**W2A.26**
**Wavelength-Encoded Forward-Forward Algorithm for Backpropagation-Free Optical Neural Networks,** Yu Tao[1], Xuzhe Zhang[1], Yangyang Wan[1], Zuyuan He[1]; [1]*Shanghai Jiao Tong Univ., China*. We demonstrate backpropagation-free optical neural network training using wavelength encoding in multimode fibers. The method autonomously generates contrastive sample data in the optical domain, achieving >94% accuracy on benchmark datasets without global error propagation.

**W2A.27**
**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.

**W2A.28**
**Performance Thresholds for Optical Circuit Switching in LLM Inference,** Junsun Choi[1], Sunjin Choi[1], Sam Son[1], Vladimir Stojanovic[1,2], Yakun Sophia Shao[1], Borivoje Nikolic[1]; [1]*Univ. of California Berkeley, USA;* [2]*Ayar Labs, USA*. We analyze OCS-based networks for LLM inference, showing sub-700 ns reconfiguration is critical to outperform EPS without high link fan-out. High link fan-out can provide competitive performance even with slower reconfiguration across collective communication patterns.

**W2A.29**
**On-Chip Reconfigurable Wavefront Shaper for Precise Spatial and Polarization Control,** Zengqi Chen[1], Wu Zhou[1], Hao Chen[1], Kaihang Lu[1], Wenzhang Tian[1], Yiou Cui[1], Yuxiang Yin[1], Mingyuan Zhang[1], Xiaofu Pan[2], Jianqi Hu[2], Yeyu Tong[1]; [1]*Hong Kong Univ of Sci & Tech (Guangzhou), China;* [2]*The Univ. of Hong Kong, Hong Kong*. We demonstrated a reconfigurable silicon photonic processor capable of handling disordered speckle input. The spatial and polarization distribution of the output wavefront can be accurately manipulated using a simple self-configuration process.

**W2A.30**
**A Multi-Dimensional Multiplexing Photonic Architecture Enabling Large-Scale Reconfigurable Convolution Operations,** Qingrui Yao[1,2], Yuxin Sun[1,2], Yingying Peng[1], Yiwei Xie[1], Weike Zhao[1], Xiangxing Bai[2], Huan Li[1], Pan Wang[1], Yaocheng Shi[1], Daoxin Dai[1]; [1]*Zhejiang Univ., China;* [2]*Qianyuan national laboratory, China*. This architecture employs wavelength, mode, and polarization multiplexing to enable 96-dimensional highly parallel and reconfigurable optical computing, in which flexible convolution kernel configuration through dynamic channel selection is experimentally demonstrated.

**W2A.31**
**OCS-Based Double Resource Pooling for Flexible Intra- and Inter-Rail Connectivity in AIDC Networks,** Yingxin Guo[1], Tong Ye[1]; [1]*Shanghai Jiao Tong Univ., China*. We propose ocs-DRP, an OCS-based flat and scalable AIDC network, supporting flexible intra- and inter-rail connectivity through double resource pooling. Compared to rail-optimized fat-tree, ocs-DRP delivers comparable delay performance while reducing power consumption by 40%.

**W2A.32**
**QoT-to-Configuration: Conditional VAE–CGAN for Few-Shot Inverse Design of Optical Networks,** liu yuhao[1,2]; [1]*Shanghai JiaoTong Univ., China;* [2]*School of Information Science and Electronic Engineering, China*. We propose a conditional VAE–cGAN with a meta-augmentation controller for few-shot QoT-driven inverse design. Our framework generates network configurations from QoT metrics, aligns latent spaces adversarially, and reduces labeled-data requirements in optical network adaptation.

**W2A.33**
**Model for Designing Cost-Effective DSCM-Based Point-to-Multipoint Horseshoe Networks,** Carlos Castro[1], Scott Kotrla[2], Albert Rafel[3], Hideki Nakajima[4], Annachiara Pagano[5], Emilio Riccardi[5], Maria Vasilica Ionescu[6], Steven Hand[7], David Hillerkuss[1], Antonio Napoli[1]; [1]*Nokia Corporation, Germany;* [2]*Verizon Communications Inc, USA;* [3]*BT Applied Research, UK;* [4]*Colt Technology Services, Japan;* [5]*FiberCop, Italy;* [6]*Nokia Corporation, Sweden;* [7]*Nokia Corporation, USA*. We derive an analytical expression that compares the deployment costs of DSCM P2MP transceivers and single-carrier coherent P2P, enabling the identification of optical aggregation requirements for cost-effective P2MP metro-regional networks.

**W2A.34**
**Enabling Deterministic Inter-Data Center Communication Through a Multi-Layer SDN Architecture,** Yukihiro Togari[1], Shingo Okada[1], Tomonori Takeda[1], Shiro Mizuno[1]; [1]*NTT Musashino R&D Center, Japan*. We propose a multi-layer SDN architecture, SCX, enabling deterministic inter–data center communication. Experimental results demonstrate deterministic performance using FlexE-based time-division multiplexing and SRv6 control, achieving jitter-free and flexible optical transmission across distributed data centers.

**W2A.35**
**Regeneration-Aware Provisioning for Multi-Band Networks With Band Conversion: a Connectivity Graph Approach,** Saki Sakurai[1], Katsuaki Higashimori[1], Takuya Ohara[1]; [1]*NTT Network Innovation Laboratories, Nihon Denshin Denwa Kabushiki Kaisha, Japan*. A regeneration-aware provisioning algorithm is proposed for multi-band networks considering band/spectrum conversion. The effective regenerator assignment and modulation-format/band selection scheme increases the network throughput at the same blocking ratio by up to 42.9%.

**W2A.36**
**400G 4λ WDM-PON Over C–Band 20km~50km SSMF Enabled by Optically Filtered Comb Sideband Modulation and Linear Equalizer With 44dB Power Budget,** Yunhong Liu[1], Chao Li[1], Songyuan Hu[1], Yuru Tang[1], Xumeng Liu[1], Peng Sun[1], Shupeng Li[1], Ji Wang[1], Zhongshuai Feng[1], Shunfeng Wang[1], Zichen Liu[1], Xu Zhang[1], Zhixue He[1], Shaohua Yu[1]; [1]*Peng Cheng Laboratory, China*. We experimentally demonstrate a 400G 4λ WDM-PON system over C-band 20km~50km SSMF with below 12.5% SD-FEC limit of $1.0\times10^{-2}$ enabled by optically filtered comb sideband modulation and linear equalizer only, achieving 44dB optical power budget.

**W2A.37**
**Ultra-Stable Radio Access Network Synchronization by Cesium-Locked Comb Delivery and Clock Phase Caching,** Kari Clark[1], Zun Htay[1], Amany Kassem[1], Andrea Pertoldi[2], Zichuan Zhou[1], Benjamin Rudin[2], Florian Emaury[2], Izzat Darwazeh[1], Zhixin Liu[1]; [1]*Univ. College London, UK;* [2]*Menhir Photonics AG, Switzerland*. We achieve 6.5-ps 3.5-day-measured RMS radio unit relative synchronization, ns-order 27-hour-measured absolute synchronization, and <60-fs jitter RF carriers for radio access networks, by clock phase caching, cesium atomic clock locking and optical frequency comb distribution.

## Show Floor Programming

**NOSK • Keynote: Evolving Transmission Networks: Towards Disaggregation and Automation**
10:15–10:45, *Theater I*

**SF7 • Ethernet's Accelerating Evolution - Enabling the Expansion of AI**
10:30–11:30, *Theater II*

**Technology Showcase: Leading the Way – Future-ready Test Strategies for PIC and CPO Manufacturing**
QUANTIFI PHOTONICS
10:45-11:15, *Theater III*

**SF8 • 800ZR/LR and 1600ZR/ZR+/CL - Changing the Game...Again**
10:45–11:45, *Theater II*

**NOS1 • Realizing IP over DWDM: Benefits, Challenges and Customer Deployments**
10:45–12:15, *Theater I*

**SP3 TFLN Photonics at the Inflection Point: Product Readiness,, Manufacturing Scaling, Packaging, and Deployment**
HYPERLIGHT
11:30-12:30, *Theater III*

**NOS2 • What's Next in Long-Haul and Carrier Networks?**
12:30–14:00, *Theater I*

**SF20 Bridging Silicon and Light: Innovations at the Intersection of Semiconductors and Photonics**
12:45–13:45, *Theater III*

## W2A • Joint Poster Session I—Continued

**W2A.38**
**Novel Optical Connection Switching by APN Transceiver and Passive APN Splitter for 6G Mobile Fronthaul,** Yuya Saito[1], Yasuhiro Takizawa[1], Manabu Kotani[1], Shinya Ito[1], Yasuhiro Tanaka[1], Naoki Umezawa[1], Daisuke Umeda[1]; [1]*Sumitomo Electric Industries, Ltd, Japan*. To apply APN in mobile fronthaul economically, we propose an optical connection switching method utilizing our tunable APN transceiver and passive APN splitter with power splitters, enabling dynamic optical connection switching from an APN controller.

**W2A.39**
**IQ Skew Estimation and Calibration With Time-Interleaved Preamble for 256-Gb/s Coherent TFDM PON Downstream,** Guangying Yang[1], Yixiao Zhu[1], Xiaokai Guan[1], Mengyue Shi[1], Lilin Yi[1], Weisheng Hu[1]; [1]*Shanghai Jiao Tong Univ., China*. We propose time-interleaved preamble for IQ skew estimation in 256-Gb/s coherent TFDM-PON downstream, which reduces estimation error within ±0.6 ps and demonstrates robustness for edge subcarriers, coexistence of transmitter and receiver IQ-skew, and low-ROP conditions.

**W2A.40**
**Density-Aware Clustering-Based Non-Uniform Quantization for Efficient Equalization in a 135-Gb/s IM/DD System Using Commercial DML,** Cancan Chen[1,2], Zhaopeng Xu[1], Qi Wu[4], Yue Liu[3], Tonghui Ji[1], Honglin Ji[1], Yingying Zhou[1], Hui chen[1], Xingfeng Li[1], Jianwei Tang[1], Junpeng Liang[1], Zhongliang Sun[1], Linsheng Fan[1], Jinlong Wei[1], Yuan Jiang[2], Zhixue He[1], Weisheng Hu[1]; [1]*Pengcheng Laboratory, China;* [2]*Sun Yat-Sen Univ., China;* [3]*National Univ. of Singapore, Singapore;* [4]*The Hong Kong Polytechnic Univ., Hong Kong*. We propose density-aware clustering-based non-uniform quantization for hardware-efficient Volterra equalizers in DML-based IM/DD systems. 135-Gb/s PAM-8 transmission can be achieved at only 6-bit precision DSP, reducing memory by 27.3%/18.4%/15.9% compared with UQ/APoT/AGNQ.

**W2A.41**
**PCIe-Over-Optics With OSFP DR8 LPO and an Optical Circuit Switching Fabric for Composable CPU-GPU Resource Pooling,** Peng Wang[1], Sai Chen[1], Rui Lu[1], Yazhu Lan[1], Qingxu Li[1], Qin Chen[1], Liang Dou[1], Zhiping Yao[1], Binzhang Fu[1], Yuanchao Su[1], Qingwen Zeng[2], Xinyang Chen[2]; [1]*Alibaba Cloud Computing, China;* [2]*Ruijie Networks, China*. We experimentally demonstrate PCIe5.0-over-optics interconnects using standard OSFP DR8 LPO modules. The x16 PCIe link achieve 100m error-free transmission. System-level benchmarking including dynamic OCS fabric validates the feasibility of composable CPU-GPU resource pooling.

**W2A.42**
**300-Gb/s/λ PAM4 IM/DD Link Enabled by GeSi Electro-Absorption Modulator and BU-GRU Equalization,** Dan Li[1,2], Yevhenii Osadchuk[3], Armands Ostrovskis[4,5], Tianyu Jiang[1,2], Francesco Da Ros[6], Richard Schatz[2], Darko Zibar[6], Minkyu Kim[7], Peter De Heyn[7], Lu Zhang[8], Xianbin Yu[8], Vjaceslavs Bobrovs[4], Xiaodan Pang[8,4], Oskars Ozolins[4,2]; [1]*Department of Physics, Kungliga Tekniska Hogskolan, Sweden;* [2]*Kista High-Speed Transmission Lab, RISE Research Inst.s of Sweden AB, Sweden;* [3]*Center for Digital and Computational Humanities, Kobenhavns Universitet, Denmark;* [4]*Inst. of Photonics, Electronics and Telecommunications, Rigas Tehniska universitate, Latvia;* [5]*Keysight Technologies Deutschland GmbH, Germany;* [6]*DTU Electro, Danmarks Tekniske Universitet, Denmark;* [7]*Interuniversitair Micro-Elektronica Centrum, Belgium;* [8]*College of Information Science and Electronic Engineering, Zhejiang Univ., China*. A 300-Gb/s/λ net data rate PAM4 link based on a >67-GHz GeSi electro-absorption modulator is demonstrated. By using a BU-GRU equalizer, we achieve BER below 6.25% overhead HD-FEC threshold after 100-meter SMF transmission.

**W2A.43**
**Linear Pluggable Optics Module Adaptation for a 102.4 Tbps Switch With Insertion Loss Exceeding 39 dB,** Ye Tao[1], Zhibin Jiang[2], Anbin Wang[2], Shunqiang Gao[1], Zhiping Yao[3]; [1]*Ruijie, China;* [2]*Alibaba Cloud, China;* [3]*Alibaba Cloud, USA*. We established a simulation model for the linear switch system and experimentally validated LPO module adaptation for a 102.4 Tbps switch with insertion loss exceeding 39 dB. The measured BER ranges from 1E-9 to 1E-13.

**W2A.44**
**A 0.6 pJ/bit Analog Equalizer ASIC for Nonlinearity Compensation in IM/DD Links,** Jakob Finkbeiner[1], Raphael Nägele[1], Markus Grözing[1], Manfred Berroth[1], Georg Rademacher[1]; [1]*Universität Stuttgart, Germany*. We experimentally demonstrate an analog neural network-based equalizer ASIC with direct symbol decision. It mitigates nonlinearities caused by high currents in directly modulated lasers to enable longer reach at high baud rates without optical amplifiers.

**W2A.45**
**High-Speed Turbo Equalization for 224 Gb/s PAM4 IM/DD Systems With Standardized FEC,** Tianyuan Kong[1,2], Nebojsa Stojanovic[1], Balazs Matuz[1], Tom Wettlin[1], Emna B. Yacoub[1], Stefano Calabro[1], Xianbo Dai[1], Maxim Kuschnerov[1], Stephan Pachnicke[2]; [1]*Huawei Technologies Deutschland GmbH, Germany;* [2]*Chair of Communications, Christian-Albrechts-Universitat zu Kiel, Germany*. We investigate a turbo equalization algorithm for bandwidth-limited IM/DD systems, integrating a BCJR detector with the standardized (128,120) extended Hamming decoder. Simulation and experiment for 224Gbps PAM4 demonstrate 1.35dB performance gain at KP4 pre-FEC.

**W2A.46**
**Low-Complexity Hybrid Neural Compensation for Dispersion and Nonlinearity in Coherent Transmission,** Luhan Jiang[1], Ying Wu[1], Ying Wang[1], Jianyu Long[1], Yifan Chen[1], Wen Zhou[1], Kaihui Wang[1], Jianjun Yu[1]; [1]*Fudan Univ., China*. We propose a low-complexity hybrid neural network replacing traditional CDC while jointly mitigating nonlinearity, achieving up to 1.47-dB and 2.25-dB SNR gains in 896-Gb/s high-speed and 16640-km long-haul coherent systems, respectively.

**W2A.47**
**Rate-Adaptive Hierarchical Distribution Matcher for 1.6Tbps+ Coherent Optical Modules,** Yizhao Chen[1], Shuai Wei[1], Wang Yongben[1]; [1]*State Key Laboratory of Mobile Network and Mobile Multimedia Technology, ZTE Corporation, China*. We propose a flexible HiDM scheme based on a unified LUT configuration with bit redistribution. This design enables a wide 32-bit adjustable range in the input sequence length while limiting the SNR penalty to below 0.064 dB for 16/64QAM formats.

**W2A.48**
**Real-Time FPGA Prototype of an Optimal Interpolation-Based Clock Recovery Algorithm for MPPM-QPSK,** Shuai Wei[1], Yan Li[1], Yaning Sun[1], Ao Li[1], Xiaobin Hong[1], Jian Wu[1]; [1]*Beijing Univ. of Posts and Telecommunications, China*. We proposed and implemented a real-time optimal interpolation algorithm for MPPM-QPSK based on a single FPGA chip. In the real-time experiment, the receiver achieved a 1 dB improvement over previous works.

**W2A.49**
**Accuracy of LPM-Based NLI Estimation Over a Heterogeneous Link,** Dario Pilori[1], Stefano Straullu[2], Antonino Nespola[2], Lorenzo Andrenacci[1], Stefano Piciaccia[3], Gabriella Bosco[1]; [1]*Dipartimento di Elettronica e Telecomunicazioni, Politecnico di Torino, Italy;* [2]*Fondazione LINKS, Italy;* [3]*Cisco Systems Inc, Italy*. We experimentally assess the accuracy of NLI estimation using Longitudinal Power Monitoring over a 1483-km heterogeneous link (comprising SMFs and PSCFs) with unequalized channel powers, comparing two different SCI/XCI correction factors.

**W2A.50**
**DSP Optimization for $CO_2$ Absorption Impact in Hollow Core Fiber Coherent Optical Transmission Systems,** Chengbo Li[1], Hong Liu[1], qiang qiu[1], Zhuo Wang[1], Hexun Jiang[1], Yizhao Chen[1], Wang Yongben[1], Huan Chen[1], Baoluo Yan[1], Hu Shi[1], Xiang Li[1], Hengqi Liu[1]; [1]*ZTE corporation, China*. We compare different DSP approaches to address narrow-band $CO_2$ absorption impact in hollow-core fibers. The experiments demonstrate that the pre-emphasis and digital subcarrier multiplexing techniques can reduce the penalty caused by $CO_2$ absorption.

**W2A.51**
**Impact of Effective Area Tilt on Raman Gain Coefficient for Analytical SRS Modeling in UWB Transmissions,** Salma Escobar Landero[1], Xin Yang[1,2], Gabriel Charlet[1], Yann Frignac[1], Abel Lorences-Riesgo[1]; [1]*Huawei Technologies France, France;* [2]*Politecnico di Milano, Italy*. We propose a simple analytical model to account for the frequency-dependent Raman gain in real-time power evolution modeling, showing improved accuracy over conventional CZ SRS method when compared to ODE and experimental results.

**W2A.52**
**Optimal Spatial Step Size in Longitudinal Power Monitoring,** Runa Kaneko[1], Takeo Sasai[1], Etsushi Yamazaki[1]; [1]*NTT Network Innovation Laboratories, Japan*. We propose an optimal selection of LPM step size that suppresses attenuation-coefficient bias while achieving 1.0-dB-level loss detectability. This spatial step size ensures high detection sensitivity and estimation fidelity, which are essential for LPM application.

**W2A.53**
**80 Tb/s Real-Time Demonstration by an E2E-Unified C+L-Band System Across a Seamless 102 nm Bandwidth,** Yuqian Zhang[1], Dechao Zhang[1], Mingqing Zuo[1], Dawei Ge[1], Dong Wang[1], Yingbo Chu[2], Yang Chen[2]; [1]*Department of Fundamental Network Technology, China Mobile Research Inst., China;* [2]*Wuhan Changjin Photonics Technology Co., Ltd., China*. We demonstrate real-time 82-channel transmission over 80 km using an E2E-unified C+L-band system across a seamless 102 nm spectrum. The unified system employing a single-stage EBDFA achieves 80 Tb/s total capacity with most channels at 1 Tb/s.

**W2A.54**
**Robust Phase Unwrapping Algorithm Based on 2D Convolutional Neural Network for Φ-OFDR,** Duojun Yin[1], Keyuan Yang[1], Zhihao Wang[1], Changjian Ke[1]; [1]*Huazhong Univ of Science and Technology, China*. We propose a 2D CNN-based phase unwrapping algorithm for Φ-OFDR strain sensing. Over a strain measurement range of 0-3000με, it achieves a phase unwrapping RMSE of 0.0142rad, yielding a strain measurement RMSE of 5.48με.

**W2A.55**
**Dual-Pulse Delay-Beat Coherent Phase-Sensitive OTDR for Laser Phase Noise Compensation,** Jingchi Cheng[1], Can Zhao[2], Tao Shang[1], Jing Jiang[1], Ming Tang[3]; [1]*Xidian Univ., China;* [2]*Shenzhen Univ., China;* [3]*Huazhong Univ. of Science and Technology, China*. We proposed a dual-pulse delay-beat coherent φ-OTDR for laser phase noise compensation. Using a 300-kHz-linewidth DFB laser, we achieved 15-dB noise reduction and 9.3 pe/sqrt(Hz) sensitivity over 10-km-long fiber, comparable to using a 9.5-kHz-linewidth laser.

**W2A.56**
**Optical Positioning System With High Ranging Accuracy and Long Unambiguous Range Using Multi-Tone Interferometry,** Yu-Chuan Chang[1,4], Pei-Hsun Wang[2], You-Chia Chang[3], Tzyy-Sheng Horng[5], Jin-Wei Shi[4], Chia Chien Wei[1]; [1]*Department of Photonics, National Sun Yat-Sen Univ. (Taiwan), Taiwan;* [2]*International College of Semiconductor Technology, National Yang Ming Chiao Tung Univ., Taiwan;* [3]*Department of Photonics, National Yang Ming Chiao Tung Univ., Taiwan;* [4]*Department of Electrical Engineering, National Central Univ., Taiwan;* [5]*Department of Electrical Engineering, National Sun Yat-sen Univ. College of Engineering, Taiwan*. We present a multi-frequency interferometric LiDAR that launches and processes multiple optical tones simultaneously. This single-shot approach eliminates time-dependent phase drift, achieving 40-μm precision and 2.5-m unambiguous range—offering a practical, robust, and accurate solution.

**W2A.57**
**Active Distributed Acoustic Sensing for Soil Salinity Classification,** Steven Binder[1], Mable Fok[1]; [1]*Univ. of Georgia, USA*. A deep learning model is trained on the propogation characteristics of an active tone measured with a distributed acoustic sensor to classify soils based on their salinities.The model achieves validation and test accuracies of 96% and 91%, respectively.

**W2A.58**
**A Time-Division Multiplexed Ultrasonic Detector Array for Multi-Channel Parallel Demodulation and Imaging,** Weili Li[1], Dongchen Xu[1], Fujun Zhang[1], Shaoling Zhang[1], Hao Li[1], Qizhen Sun[1]; [1]*School of Optical and Electronic Information, Huazhong Univ. of Science and Technology, China*. We present a parallel demodulation and imaging system using a fiber-optic ultrasonic sensor array. Functionally verified with a tri-sensor setup, it achieves threefold faster imaging, high consistency, and 100-μm resolution.

**W2A.59**
**Large-Dynamic-Range Strain Sensing Based on Frequency Division Multiplexed Distributed Acoustic Sensing,** Jiazhen Ji[1], Jiageng Chen[1], Zhengyuan Xiao[1], Zhengwen Li[1], Zuyuan He[1]; [1]*Shanghai Jiao Tong Univ., China*. We propose a multi-frequency sequence and a phase-unwrapping algorithm to extend the strain measurement range of FDM-φ-OTDR, enabling accurate recovery of 2.0 kHz and 65 $n\varepsilon_{p\text{-}p}$ strain on a 10-km fiber beyond conventional unwrapping capability.

## W2A • Joint Poster Session I—Continued

**W2A.60**
**Linear Frequency Modulation Based Forward Optical Phase Sensing for Passive Optical Networks,** Zhihang Tang[1], Shuai Qu[1], Yaxi Yan[1], Alan Pak Tao Lau[1]; *[1]Hong Kong Polytechnic Univ., Hong Kong*. We propose a passive, single-fiber, single-end transceiver based-forward optical phase sensing system using linear-frequency-modulated (LFM) continuous waves to enable easy integration of sensing into PONs. Experiments demonstrates accurate localization of spur-like vibrations over a 20-km fiber.

**W2A.61**
**Monolithic Integration of Metasurface With Photonic-Crystal Surface-Emitting Laser (PCSEL) for Beam Manipulation in Free Space Optical Communication,** Yun-Han Chang[2,1], Wen-Chien Miao[2,3], Fu-He Hsiao[2,3], Yuan-Zeng Lin[1], Yu-Heng Hong[2], Hao-Chung Kuo[2], Chi-Wai Chow[1]; *[1]National Yang Ming Chiao Tung Univ., Taiwan; [2]Hon Hai Research Inst., Taiwan; [3]Department of Electrophysics, National Yang Ming Chiao Tung Univ., Taiwan*. A monolithically integrated metasurface with photonic-crystal-surface-emitting-laser (PCSEL) was fabricated. The metasurface was designed to generate left- and right-handed-circular-polarizations at specific diffraction angles. Experimental results show that 1.88-Gbit/s per polarization channel free-space transmission is achieved.

**W2A.62**
**Digital Estimation of Doppler Shift With Gardner Timing Error Detector for Coherent Optical Satellite Communications,** Yan Ma[2], Zhenming Yu[2], Zhengyang Li[2], Hongyu Huang[2], Xiangyong Dong[2], Wei Zhang[2], Nan Cui[2], Minghua Chen[1], Yongli Zhao[2], Shanguo Huang[2], Kun Xu[2]; *[1]Tsinghua Univ., China; [2]Beijing Univ. of Posts and Telecommunications, China*. Based on the correlation between Doppler shifts and the Gardner TED, we propose a novel frequency offset estimation algorithm. It offers a significantly wider estimation range and improved noise tolerance, as experimentally validated.

**W2A.63**
**Nonlinearity Mitigation for Coherent Ground-to-Satellite Optical Links,** Stella Civelli[1,3], Marco Secondini[3,2], Luca Poti[2,4]; *[1]IEIIT-CNR, Italy; [2]Consorzio Nazionale Interuniversitario per le Telecomunicazioni, Italy; [3]Scuola Superiore Sant'Anna, Italy; [4]Universitas Mercatorum, Italy.* We propose digital signal processing techniques for nonlinearity mitigation in high power optical amplifiers used in satellite communications. The acceptable link loss increases by 6 dB with negligible complexity.

**W2A.64**
**Optical Wireless Communication Using an Arbitrarily Shaped "Bottle" Beam Array,** Jin Tao[2,1], Yu Cai[2], Qingyu He[2], Yuhan Gong[2], Mian Wu[2], Zhen Li[2], Yidi Feng[2], Tingyi Zhou[2], Chao Yang[2], Bohao Sun[2], Hanbing Li[2], Zichen Liu[2], Chao Li[1], Zhixue He[1], Lin Wu[2]; *[1]PCL, China; [2]CICT, China*. We demonstrate a 540 Gbit/s 16-QAM optical wireless communication link with three wavelengths and two multicast channels using an arbitrarily shaped "bottle" beam array based on complex-amplitude modulation to circumvent obstructions.

**W2A.65**
**Hybrid FSO/RF Communication System Enabled by PDOA-Based Coarse Pointing and MCF-Assisted Fine Alignment,** Qirun Fan[1,2], Yifei Zhu[1], Qirui Xu[1], Haohan Bo[1], Yi Liu[1,3], Xile Zhang[1], Haoran Fang[1], Chen Liu[1]; *[1]Huazhong Univ of Science and Technology, China; [2]The 34th Research Inst., China Electronics Technology Group Corporation, China; [3]FiberHome Telecommunication Technologies Co., Ltd., China*. We demonstrate a hybrid FSO/RF communication system enabled by PDOA-based coarse pointing and MCF-assisted fine alignment, achieving automatic beam alignment and stable high-speed optical communication in an outdoor scenario.

**W2A.66**
**Sensor-Free Wavefront Compensation for Free-Space Optical Communication,** xun yu[1], Ruixue Guo[1], Xurui Peng[2], Zhengzhao Xu[2], Li Zhang[2], Yu Hou[2], Zichen Zhang[2], Haining Yang[1]; *[1]Southeast Univ., China; [2]Beihang Univ., China*. This paper proposes a free-space optical communication system that can compensate for the channel turbulence through the wavefront compensation at the transmitter with a sensor-free feedback loop, achieving >12× improvement in the transmission efficiency.

**W2A.67**
**EKF-Based Polarization Demultiplexing for Multi-Path Free Space Coherent Optical Communication,** Xinyue Liu[1,2], Ye Wang[2], Penghao Luo[1], Junwen Zhang[1], Yi Yan[2], Fang Wei[2], Haiwen Cai[2]; *[1]Fudan Univ., China; [2]Zhangjiang Laboratory, China*. We propose a Multi-Path EKF algorithm for polarization demultiplexing in multi-path coherent optical systems. This algorithm handles high-rate RSOP without per-path polarization controllers, reducing chip area and ensuring robust BER performance.

**W2A.68**
**Impact of Space Radiation-Induced Optical Transients in Ring Modulators on IM/DD Links for Satellite Applications,** Brett L. Ringel[1], Jackson Moody[1], Delwyn Sam[1], Christopher Snyder[1], John Cressler[1]; *[1]Georgia Inst. of Technology, USA*. Effects of experimentally collected space radiation-induced optical transients in micro-ring modulators on IM/DD links are determined. Data rate, modulation order, and signal-to-noise ratio affect error probability. Data corruption occurs at conditions relevant for satellite applications.

**W2A.69**
**Enhanced Self-Heating 8-Wavelength Monolithic DFB Laser Array for Broadly Tunable CW Terahertz Generation,** Yue Zhang[1], Zhenxing Sun[1], Rulei Xiao[1], Xiangfei Chen[1]; *[1]Nanjing Univ., China*. A compact monolithic 8-wavelength DFB laser array enables broadband, continuously tunable CW THz generation with wavelength spacing of 5.49–48.5 nm (0.69–6.09 THz), offering high stability and compactness for integrated THz applications.

**W2A.70**
**Experimental Demonstration of Power-Efficient ACO-OTFS in an Actively Phase-Controlled 2D Beam Steering OPA-Based Cooperative FSO Communication System,** Geyang WANG[1], Kuokuo Zhang[2], Caiming Sun[2], Zhaoming Wang[3], liankuan chen[1]; *[1]The Chinese Univ. of Hong Kong, Hong Kong; [2]Shenzhen Inst. of Artificial Intelligence and Robotics for Society, China; [3]Univ. of Oxford, UK*. We experimentally demonstrate novel power-efficient ACO-OTFS in 1Gb/s cooperative 1550nm-FSO systems using actively phase-controlled 2D OPAs-based relay. It achieves steering range of 43.2°×29.6°and ~4 dB gain over ACO-OFDM with enhanced multi-path effect robustness.

**W2A.71**
**Comprehensive Study on CV/DV-QKD Co-Propagation With Deployed C/C+L DWDM OTN,** Dongchen Zhang[1], Nishan Wu[1], Baoluo Yan[1], Hong Liu[1], Hu Shi[1], FanFan Zhong[1], Dong Wang[1], Yangguang Liu[1], Kezhi Qiao[1], Yong Chen[1]; *[1]ZTE CORPORATION, China*. Co-propagation of QKD and deployed OTN in shared fiber requires consideration various noise, including stimulated Raman scattering. This work systematically compares the transmission performance of CV/DV-QKD co-propagation with deployed DWDM C-100G/C+L-400G OTN signal.

**W2A.72**
**Sub-Nanosecond Time-Gated SNSPDs,** Antonio Guardiani[1], Lieuwe Locht[1], Henri Vlot[1], Andreas Fognini[1]; *[1]Single Quantum B.V., Netherlands*. SNSPDs provide excellent sensitivity but suffer from limited dynamic range in high-photon environments. We introduce a time-gated approach with sub-nanosecond switching, enabling higher count rates, reduced dark counts, and enhanced sensitivity. This method broadens the applicability of SNSPDs in fast, timing-critical experiments.

**W2A.73**
**SiPh Transmitter PIC Optimized for 200G per Lane LPO Applications,** Jiejiang Xing[1], Yi Huang[2], Wanting Li[1], Xuanting Zhu[1], Yinxing Zhang[1], Yalan Jiang[1], Lei Guo[3]; *[1]Shanghai Kaiyong Information Technology Co., Ltd., China; [2]Shanghai Xphor Technology, China; [3]Douyin Vision Co., Ltd., China*. 100G/lane SiPh LPO DR+ modules demonstrate TDECQ <2.5dB with 37GHz MZM. For 200G/lane LPO PIC, the MZM bandwidths are optimized to 70~85GHz, keeping Vpi and total loss unchanged by optimizing edge couplers.

## Show Floor Programming

**NOSK • Keynote: Evolving Transmission Networks: Towards Disaggregation and Automation**
10:15–10:45, *Theater I*

**SF7 • Ethernet's Accelerating Evolution - Enabling the Expansion of AI**
10:30–11:30, *Theater II*

**Technology Showcase: Leading the Way – Future-ready Test Strategies for PIC and CPO Manufacturing**
QUANTIFI PHOTONICS
10:45-11:15, *Theater III*

**SF8 • 800ZR/LR and 1600ZR/ZR+/CL - Changing the Game...Again**
10:45–11:45, *Theater II*

**NOS1 • Realizing IP over DWDM: Benefits, Challenges and Customer Deployments**
10:45–12:15, *Theater I*

**SP3 TFLN Photonics at the Inflection Point: Product Readiness,, Manufacturing Scaling, Packaging, and Deployment**
HYPERLIGHT
11:30-12:30, *Theater III*

**NOS2 • What's Next in Long-Haul and Carrier Networks?**
12:30–14:00, *Theater I*

**SF20 Bridging Silicon and Light: Innovations at the Intersection of Semiconductors and Photonics**
12:45–13:45, *Theater III*

## Room 403A

**14:00–16:00**
**W3A • Optical Network Optimization and Scaling I**
*Presider: Nicola Sambo; Scuola Superiore Sant'Anna, Italy*

**W3A.1 • 14:00** Invited
**The Role of Pluggables vs. Embedded Transponders in Optical Networks,** Sebastien Gareau[1]; [1]*Ciena Corporation, Canada.* This paper explores the evolving roles of pluggable optics and embedded transponders in optical networks, highlighting trade-offs in performance, scalability, and deployment across data center, metro, regional, and long-haul applications.

**W3A.2 • 14:30**
**Performance of Core WDM Networks Equipped With 800Gb/s Coherent Pluggable Interfaces,** Thierry Zami[2,1], Annalisa morea[1], Nicola rossi[2,1], bruno lavigne[2,1]; [1]*Nokia Corporation, France;* [2]*Alcatel Submarine Network, France.* This paper quantifies the benefit of next-generation 800 Gb/s coherent pluggable interfaces for examples of German, Indian and North American core WDM networks thanks to PCS modulation and better performance than the OpenROADM specifications.

## Room 403B

**14:00–16:00**
**W3B • Coding, Modulation and DSP**
*Presider: Stella Civelli; IEIIT-CNR, Italy*

**W3B.1 • 14:00**
**Neural Probabilistic Amplitude Shaping for Nonlinear Fiber Channels,** Mohammad Taha Askari[1,2], Lutz Lampe[1], Amirhossein Ghazisaeidi[2]; [1]*The Univ. of British Columbia, Canada;* [2]*Nokia Bell Labs, France.* We introduce neural probabilistic amplitude shaping, a joint-distribution learning framework for coherent fiber systems. The proposed scheme provides a 0.5-dB signal-to-noise ratio gain over sequence selection for dual-polarized 64-QAM transmission across a single-span 205-km link.

**W3B.2 • 14:15**
**THP-Based Faster-Than-Nyquist Coherent System With All-Digital Baud-Rate Timing Recovery,** Wei Wang[1], Dongdong Zou[2], JInqi Xiong[1], Yuheng Liu[1], Hongyi Gan[1], Fan Li[1]; [1]*Sun Yat-Sen Univ., China;* [2]*Soochow Univ. School of Electronic and Information Engineering, China.* This paper demonstrates a short-reach coherent system employing a single symbol-rate DSP, which is aided by faster-than-Nyquist signaling with the THP technique. An all-digital baud-rate timing recovery is successfully implemented in this FTN framework.

**W3B.3 • 14:30** Invited
**Designing Concatenated RS-BCH Codes With Good Performance-Complexity Trade-Offs,** Alvin Y. Sukmadji[1], Frank R. Kschischang[1]; [1]*Univ. of Toronto, Canada.* We provide two rules-of-thumb for designing concatenated codes, each comprising of an outer Reed-Solomon code and an inner BCH code, that achieve good trade-offs of performance and complexity.

## Room 408A

**14:00–16:00**
**W3C • Photonic AI Computing**
*Presider: Farshid Ashtiani; Nokia Bell Labs, USA*

**W3C.1 • 14:00** Invited
**Hyperdimensional Photonic AI Computing,** Apostolos Tsakyridis[1], Miltiadis Moralis-Pegios[1], Stefanos Kovaios[1], Antonios Prapas[1], Theodoros Moschos[1], Christos Pappas[1], Nikos Pleros[1]; [1]*Aristoteleio Panepistimio Thessalonikis, Greece.* We discuss our work on hyperdimensional photonic AI accelerators, that leverage time-space- and wavelength-division multiplexing towards enhancing compute power and energy efficiency. We benchmark their performance against state-of-the-art GPUs, demonstrating superior throughput and low-energy operation.

**W3C.2 • 14:30**
**212 GOPS Programmable Large Scale Hopfield-Inspired Integrated Photonic Ising Machine Enabled by DSP,** Charles St-Arnault[1], Nayem AL-Kayed[2], Hugh Morison[2], Aadhi Al-Rahim[2,3], Alexander Tait[2], David V. Plant[1], Bhavin Shastri[2]; [1]*McGill Univ., Canada;* [2]*Queen's Univ., Canada;* [3]*Indian Inst. of Technology Delhi, India.* We report a DSP enabled programmable, record scale and speed photonic Ising machine operating at 212 GOPS with best-in-class solution quality for Max-Cut problems and ground state solutions for protein folding problems.

## Room 408B

**14:00–15:45**
**W3D • Distributed Sensing I**
*Presider: Tomoyuki Kato; Finity Inc., Japan*

**W3D.1 • 14:00** Invited
**DAS Technology Breakthroughs Enabling Ultra-Long Range,** Erlend Ronnekleiv[1]; [1]*Alcatel Submarine Networks Norway AS, Norway.* Raman, ROPA, and repeater techniques have enabled DAS with hundreds to thousands of km range. We discuss the capabilities of different solutions, and how they may be incorporated into commercial systems.

**W3D.2 • 14:30**
**Frequency-Division Multiplexed Time-Interleaved Phase-OTDR With Nested Phase References,** Ezra Ip[1], Yue-Kai Huang[1], Fatih Yaman[1], Junqiang Hu[1], Ting Wang[1]; [1]*NEC Laboratories America Inc., USA.* We propose a method to compensate the phase offset between samples from different tributaries in time-interleaved phase OTDR using nested phase reference channels. We demonstrate our method for a four-span bidirectional link with high-loss loopback.

## Room 411

**14:00–16:00**
**W3E • Laser Sources and Optical Engines for Optical Interconnection**
*Presider: Connie J. Chang-Hasnain, Berxel, China*

**W3E.1 • 14:00** Invited
**Ultra-High Optical Output Power External Laser Sources for Co-Packaged Optics,** Taketsugu Sawamura[1], Kohei Umeta[1], Takuma Yoshida[1], Akihiro Imamura[1], Hiroyuki Ishii[1], Hideyuki Nasu[1]; [1]*Furukawa Electric Co., Ltd., Japan.* We describe the design and characteristics of an 8-channel TOSA employing high-power SOA-integrated DFB-LDs. We also describe a 16-channel ELSFP module integrated with the two TOSAs.

**W3E.2 • 14:30**
**DFB Laser Array Based on two-Dimensional Sampling Structure and Tilted Bragg Grating,** Zhuoying Wang[1], Zhenxing Sun[1], Zizhuo Li[1], Xiangfei Chen[1]; [1]*Nanjing Univ., China.* The DFB laser array based on two-dimensional sampling structure and tilted grating is demonstrated with high uniform wavelength spacing at 300 GHz, provides an extraordinary avenue for designing wavelength-selective devices in photonic integrated circuits.

## Room 501ABC

**14:00–15:45**
**W3F • Optical Signal Processing**
*Presider: Zhixin Liu; Univ. College London, UK*

**W3F.1 • 14:00** Invited
**Optical Arbitrary Waveform Generation Using Spectro-Temporal Unitary Transforms,** Callum Deakin[1]; [1]*Nokia Bell Labs, USA.* We discuss the prospect of using cascaded phase modulators and dispersive elements to achieve arbitrary optical waveform generation. This transform is not limited by the bandwidth of its constituent modulators and is theoretically lossless.

**W3F.2 • 14:30**
**Wavelength-Domain Pairwise Transmission (WD-PT) for CD-Tolerant WDM Multilane IM-DD Systems,** Paikun Zhu[1], Yuki Yoshida[1], Kouichi Akahane[1], Kenichi Kitayama[1,2], Bahram Jalali[1]; [1]*NICT, Japan;* [2]*Hamamatsu Photonics Central Research Laboratory, Japan.* We extend the recently-proposed pairwise transmission to wavelength domain, enabling dispersion-tolerant WDM multilane IM-DD systems. C-band 110Gb/s/λ 80km and 200Gb/s/λ 30km SMF transmissions using commercial WDM Mux/DeMux and low-complexity digital equalizers are demonstrated.

## Room 502A

### 14:00–16:00
### W3G • Panel: How Do We Model Novel Fiber Designs Such as SDM Fibers, Hollow-Core Fibers and Other New Fibers?

**Organizers:**
Yi Cai, *ZTE TX Inc., USA*
Tristan Kremp, *Lightera, USA*
Chiara Lasagni, *Universita degli Studi de Parma, Italy*
Darli Mello, *UNICAMP, Brazil*

**Speakers:**
Cristian Antonelli, *Universita degli Studi dell-Aquila, Italy*
John Downie, *Corning, USA*
Md Selim Habib, *Florida Inst. of Technology, USA*
Gregory Jasion, *Univ. of Southampton, UK*
Masashi Kikuchi, *NTT, Japan*
Peng Li, *YOFC, China*
Kunimasa Saitoh, *Hokkaido Univ., Japan*
Yingying Wang, *Linfiber, China*

Advancements in multicore and hollow-core fiber technologies require sophisticated numerical modeling and simulation techniques, ranging from geometrical analysis and multiphysics simulations to the creation of digital twins for optical networks. In recent years, the modeling landscape has been transformed by high-performance computing, leveraging graphical processing units, parallel algorithms, and AI-driven approaches to solve previously intractable numerical challenges.

Despite their central role in the innovation process, these methods are often mentioned only in passing, with the emphasis typically placed on results rather than the employed techniques. This panel provides an opportunity to explore established and novel modeling tools, as well as the underlying processes and methods, featuring insights from leading experts in industry and academia.

## Room 502B

### 14:00–16:00
### W3H • Panel: The Return of TWDM-PON!

**Organizers:**
Frank Effenberger, *Futurewei Technologies Inc., USA*
Ryo Koma, *NTT, Japan*
Paola Parolari, *Politecnico de Milano, Italy*
Md Saifuddin Faruk, *Bangor Univ., UK*
Haipeng Zhang, *CableLabs, USA*

**Speakers:**
Denis Khotimsky, *Verizon, USA*
Curtis Knittle, *CableLabs, USA*
Jaimie Lenderman, *Omdia, USA*
Takahiro Suzuki, *NTT, Japan*
Antonio Teixeira, *PICadvanced SA, Portugal*

The 10G TWDM-PON standardized in 2014 as G.989 has largely underperformed in the marketplace. There are various reasons why this came to pass, such as that the market didn't need the upgrade at that moment, and that single channel 50G systems became technically practical. Currently, there are investigations into the 50G version of TWDM-PON based on conventional coherent technology. This may see more success because the coherent link is inherently tunable, and its high sensitivity permits more deployment flexibility. On the other hand, if the reduction of the penalty due to chromatic dispersion and the provision of wavelength tunability and selectivity can be realized in a cost-effective manner, the application of IMDD technology can be a good candidate. This can facilitate the deployment of this system as a special services overlay (and not a mass-market upgrade). At this stage, many technical features of this system are being developed, and this panel will consider the current status and future outlook.

## Room 515A

### 14:00–16:00
### W3I • Symposium: Generative AI for Optical Networking I
*Presider: Harish Babu Arunachalam; Cyber AI Services, USA*

**W3I.1 • 14:00** Invited
**Generative AI for Optical Networking: From Design Automation to Self-Operating Networks Introduction,** Harish Babu Arunachalam[3], Behnam Shariati[1], Ricard Vilalta[2]; *[1]Fraunhofer Heinrich Hertz Inst., Germany; [2]Centre Tecnologic de Telecomunicacions de Catalunya, Spain; [3]Verizon Communications Inc, USA.* This paper explores how Generative AI is transforming optical systems and networks, focusing on network digital twins, optimization, synthetic data generation, LLM-driven planning,and intent-to-policy pipelines, with insights from experts on real-world use cases.

**W3I.2 • 14:30** Invited
**GenAI and Digital Twins for Network Automation,** Yvan Pointurier[1]; *[1]Huawei Technologies, France.* This talk will review current efforts to leverage genAI to design and operate optican networks to facilitate their automation, going from LLM-enhanced to LLM-native design and operation, and focusing on recent proofs of concept.

## Room 515B

### 14:00–15:30
### W3J • Transmission Systems for Data Center Networks
*Presider: Yuta Wakayama; KDDI Research, Japan*

**W3J.1 • 14:00**
**Real-Time S+C+L- Band 134-Tb/s DCI Bidi Transmission With All Channels at 1.2-Tb/s Enabled by SiPh Transceiver,** Baoluo Yan[1], Dongchen Zhang[1], Zhenqian Yang[1], Hu Shi[1], Mingqing Zuo[2], Dawei Ge[2], Jun Wu[3], Zhaolong Liao[3], Xingzhou Xu[4], Taili Wang[4], Hong Liu[1], Huan Chen[1], qiang qiu[1], Yan Zhao[1], Wenbo Yu[1], Zhenhua Feng[1], Zhiyong Zhao[1], Kezhi Qiao[1], Yong Chen[1], Ruichun Wang[3], Qiang Wang[1]; *[1]ZTE Corporation, China; [2]China Mobile Research Inst., China; [3]Yangtze Optical Fibre and Cable Joint Stock Limited Company, China; [4]ZTE Photonics Technology Japan Co. Ltd, Japan.* We demonstrate real-time transmission of 134-Tb/s capacity with all channels operating at 1.276-Tb/s, supporting bidirectional transmission across 15.75-THz triple-band over 75-km G.654.E fiber for data centre interconnection.

**W3J.2 • 14:15**
**Advanced Noise Whitening Filter Based on Equalizer Autocorrelation for 122-Gbps PAM-4 IM/DD Transmission With Severe Bandwidth Limitation,** Fei Xie[1], Hao Zhou[1], Yingjie Jiang[1], Chenglin Bai[2], Hengying Xu[2], Yaojun Qiao[1]; *[1]Beijing Univ. of Posts & Telecom, China; [2]Liaocheng Univ., China.* We propose a high-performance noise whitening filter based on equalizer autocorrelation (EA-NWF) to suppress colored noise, which achieves a 99.2% reduction in complexity while improving receiver sensitivity by 2.8 dB compared to the conventional NWF in experiments.

**W3J.3 • 14:30**
**O-Band Closed-Form GN Model Verification With Wavelength-Dependent System Parameters,** Zelin Gan[1], Romulo Aparecido de Paula Junior[1], Jiaqian Yang[1], Eric Sillekens[1], Henrique Buglia[2], Vitaly Mikhailov[3], Jiawei Luo[3], Mindaugas Jarmolovicius[1], Ronit S. Sohanpal[1], David DiGiovanni[3], Robert Killey[1], Polina Bayvel[1]; *[1]Univ. College London, UK; [2]Nokia, USA; [3]Lightera Labs, USA.* We experimentally validated an O-band closed-form Gaussian Noise model with wavelength-dependent parameters in a 16.5 THz WDM transmission over 50.3 and 75.5 km fibre spans, achieving a mean SNR prediction error below 0.27 dB.

## Room 518

### 14:00–16:00
### W3K • Quantum–Classical Coexistence and Access Networks
*Presider: Andrew Lord; BT Applied Research, UK*

**W3K.1 • 14:00**
**Implementing QKD Over Multi-Fiber Ribbon Cables: How Dark is the "Dark Fiber"?,** Florian Honz[2], Vana Pezelj[2], Theodor Strobl[2], Florian Kutschera[2], Valeria Saggio[2], Philip Walther[1], Hannes Hübel[2], Bernhard Schrenk[2]; *[1]Vienna Center for Quantum Science and Technology (VCQ), Universitat Wien Fakultat fur Physik, Austria; [2]Austrian Inst. of Technology GmbH, Austria.* We identify inter-lane crosstalk as main cause for QKD degradation in 1×12 bend-loss insensitive fiber ribbon cables. Despite allocating QKD to unused fiber lanes, neighboring classical signals can lead to total saturation of single-photon detectors.

**W3K.2 • 14:15**
**Enabling QKD in Passive Optical Access Networks by Adaptive GPON Scheduling,** Seyed Morteza Ahmadian[1], Jun Li[2], Farhad Arpanaei[3], Lena Wosinska[1], Rui Lin[1]; *[1]Chalmers tekniska hogskola AB, Sweden; [2]Soochow Univ., China; [3]Universidad Carlos III de Madrid, Spain.* We demonstrate a novel scheduling approach for implementing QKD in optical access networks. By applying adaptive time-division coordination, we achieve 95\% improvements in secret key rate while maintaining acceptable quality-of-service for classical data services.

**W3K.3 • 14:30**
**Seamless QKD Integration in 20-km 32-User Coherent PON and NG-PON2 Without Fiber Architecture Modification,** Jing Wang[1], Brian J. Rollick[1], Zhensheng Jia[1]; *[1]CableLabs, USA.* We first experimentally demonstrated the seamless integration of an O-band BB84 QKD channel into a 20-km 32-user coherent PON and NG-PON2 coexisting with 13.1-dBm classical data traffic without adding fiber or architecture changes.

## Show Floor Programming

**SF9 • AIM Photonics Presents PICs, Heterogeneous Integration & Packaging for Next-Gen Integrated Photonics**
13:15–14:15, *Theater II*

**SF10 • Capitalizing on Optics in 5G, 6G and Cloud RAN with Higher Data Rates and Longer Reaches**
14:00–15:00, *Theater III*

**MW4 • Advanced Packaging and CoPackaging for Efficient Optical Systems**
14:15–15:45, *Theater I*

**Scaling the AI Data Center: Optical Technologies Redefining Data Center Interconnection**
LIGHTWAVE + BTR
14:30-15:30, *Theater II*

**Technology Showcase: Open-Tooled Gold Box Kit for ELSFP Applications: Unlocking High Power External Laser Solutions for Scalable Co-Packaged Optics**
HITACHI
15:15-15:45, *Theater III*

**Engineering the Future of Connectivity: How Optical Technologies are Redefining Data Center Performance**
Amphenol
15:45-16:45, *Theater II*

## Room 403A

### W3A • Optical Network Optimization and Scaling I—Continued

**W3A.3 • 14:45**
**Impact of Tight Channel Spacing With Fiber Switching in WDM Networks Using 800ZR+ Interfaces,** Ihtesham Khan[1], Thierry Zami[3], Jesse E. Simsarian[1], Colin Kelly[2], David Neilson[1], Roland Ryf[1]; *[1]Nokia Bell Labs, USA, USA; [2]NOKIA, Canada; [3]NOKIA, France.* This paper investigates network performance with pure fiber switching, exploring tighter channel spacings unconstrained by wavelength-routing granularity. It evaluates adjacent crosstalk and nonlinear transmission penalties using 800ZR+ coherent pluggables interfaces with two core topologies.

**W3A.4 • 15:00**
**A Progressive First-hit RWA Framework for Optical Networks With Blocking Optical Cross-Connects,** Dannan Hong[1], Tong Ye[1]; *[1]Shanghai Jiao Tong Univ., China.* A progressive first-hit routing and wavelength assignment framework is proposed for multi-fiber optical networks equipped with blocking optical cross-connects, which can achieve up to 460-fold reduction in running time without any sacrifice in blocking probability.

## Room 403B

### W3B • Coding, Modulation and DSP—Continued

**W3B.4 • 15:00**
**Deterministic-ISI Mitigation and Adaptive Equalization for Bandwidth-Limited Coherent Optical Communications,** Zhongxing Tian[1], Zeyu Feng[1], Qingyu He[2], Yuhan Gong[2], Ziang Chen[1], Dongdong Zou[1], Huan Huang[1], Lin Sun[1], Ming Luo[2], Gordon Ning Liu[1], Gangxiang Shen[1], Yi Cai[1]; *[1]School of Electronic and Information Engineering, Soochow Univ., China; [2]State Key Laboratory of Optical Communication Technologies and Networks, China Information Communication Technologies Group, China.* We propose a deterministic-ISI-mitigation-assisted adaptive equalization scheme for bandwidth-limited coherent optical systems. Using a 60-GBd signal with 7.5 GHz 3-dB bandwidth over 900-km transmission, the scheme achieves a 2.3-dB *Q*-factor improvement relative to CMA.

## Room 408A

### W3C • Photonic AI Computing—Continued

**W3C.3 • 14:45**
**Photonic Kolmogorov Arnold Networks Utilizing SOA-Based SPM Broadening and Filtering Learnable Activations,** Stefanos Kovaios[1], Themistoklis Chrysostomidis[1], Dimitrios Spanos[1], Apostolos Tsakyridis[1], Miltiadis Moralis-Pegios[1], Nikolaos Passalis[1], Charis Mesaritakis[2], Adonis Bogris[2], Anastasios Tefas[1], Konstantinos Vyrsokinos[1], Nikos Pleros[1]; *[1]Aristoteleio Panepistimio Thessalonikis, Greece; [2]Panepistemio Dytikes Attikes, Greece.* We experimentally demonstrate a range of learnable optical activations using SOA-based SPM-induced spectral broadening followed by spectral filtering, deploying them in a photonic Kolmogorov Arnold Network with excellent performance in both regression and classification tasks.

**W3C.4 • 15:00**
**Reconfigurable Optical Dilated Convolution Accelerator for Semantic Segmentation,** Yixuan Zheng[3], Ruilin Liao[3], Xiyao Jia[3], Yunping Bai[3], Yifu Xu[3], Shifan Chen[3], Zhihui Liu[3], Sai T. Chu[1], Xiaotian Zhu[1], Brent E. Little[2], Roberto Morandotti[5], David J. Moss[4], Kun Xu[3], Xingyuan Xu[3]; *[1]City Univ. of Hong Kong, Hong Kong; [2]Chinese Academy of Sciences Xi'an Inst. of Optics and Precision Mechanics, China; [3]State Key Laboratory of Information Photonics and Optical Communications, Beijing Univ. of Posts and Telecommunications School of Electronic Engineering, China; [4]Swinburne Univ. of Technology, Australia; [5]Institut national de la recherche scientifique Centre energie Materiaux Telecommunications, Canada.* We first experimentally demonstrated a Reconfigurable Optical Dilated Convolution Accelerator (RODCA) based on a wavelength–dispersion co-tuning mechanism, accelerating multi-scale feature extraction for semantic-segmentation applications, achieving an equivalent computing speed up to 13.858 TOPS.

## Room 408B

### W3D • Distributed Sensing I—Continued

**W3D.3 • 14:45**
**Ultra-low-Frequency Large-Dynamic-Range DAS Based on Rayleigh Signature Spectral Stitching in Coherent OTDR,** Vahid Sharif[1], Mikel Sagues[1], Alayn Loayssa[1]; *[1]Universidad Publica de Navarra, Spain.* We demonstrate a novel method that extends the capability of conventional coherent-detection φ-OTDR distributed acoustic sensors (DAS) to the ultra-low-frequency, large-dynamic-range measurements required in seismic and structural health monitoring.

**W3D.4 • 15:00**
**Leveraging Video Data to Improve Feature Learning for Distributed Acoustic Sensing,** Junyi Duan[1], Jiageng Chen[1], Zuyuan He[1]; *[1]Shanghai Jiao Tong Univ., China.* We present an enhanced framework for learning distributed acoustic sensing (DAS) data features by incorporating video data into the pre-training phase. It demonstrates high capability and generalization, and pioneers video-to-DAS cross-modal pre-training.

## Room 411

### W3E • Laser Sources and Optical Engines for Optical Interconnection—Continued

**W3E.3 • 14:45**
**Athermally Fixed-Wavelength Operation of Twin Electro-Optically Tunable RTF Laser for Cost-Effective Scale-Out in Coherent Network,** Yuta Ueda[1], Yusuke Saito[1], Takahiko Shindo[1], Shigeru Kanazawa[1], Makoto Shimokozono[1], Fumito Nakajima[1]; *[1]Device Innovation Center, NTT, Inc., Japan.* We developed an athermal laser emitting a fixed-wavelength light in the temperature range of 20–70 °C without mode hop. Laser performance for a coherent format was also demonstrated at 30, 45, and 60 °C.

**W3E.4 • 15:00**
**A 6.4 Tbps Optical Transmitter With Low-Loss and High-Uniformity Inverse-Designed Multiplexer on a 300-mm CMOS Platform,** Ruoyu shen[1], Xin Wang[2], Bingzhou Hong[1], Fenghe Yang[1], Haiwen Cai[1], Wei Chu[1]; *[1]Zhangjiang Laboratory, China; [2]Fudan Univ., China.* We demonstrate a 6.4 Tbps transmitter by integrating 400 Gbps micro-ring modulators with an inverse-designed multi-dimensional multiplexer on a 300-mm CMOS platform, achieving low loss <1.5 dB, crosstalk <–18 dB, and ultra-low uniformity (σ<0.15 dB).

## Room 501ABC

### W3F • Optical Signal Processing—Continued

**W3F.3 • 14:45**
**Crosstalk Reduction in Bidirectional Transceiver Using Phase-Sensitive Parametric Amplifier,** Shimpei Shimizu[1], Takushi Kazama[1,2], Akira Kawai[1], Katsuaki Higashimori[1], Masanori Nakamura[1], Masashi Abe[2], Koji Enbutsu[2], Kazumitsu Sakamoto[1], Yosuke Fujino[1], Takeshi Umeki[1,2], Takayuki Kobayashi[1], Yutaka Miyamoto[1]; *[1]Network Innovation Laboratories, NTT, Inc., Japan; [2]Device Technology Laboratories, NTT, Inc., Japan.* We propose a bidirectional transceiver architecture based on PPLN-based optical parametric amplifiers. A crosstalk suppression of 14 dB is experimentally achieved by exploiting the gain contrast between received signal and transmitted-signal-induced crosstalk using selective phase-sensitive de-amplification.

**W3F.4 • 15:00** Invited
**High Speed and Low Power Consumption Optical DAC Transmitter Using Fully Integrated CMOS and Silicon Segmented Modulator,** Yohei Sobu[1,2], Hanwei Chen[1,2], Shinsuke Tanaka[1,2]; *[1]PETRA, Japan; [2]1FINITY inc., Japan.* We study optical DAC transmitters offloading electronic functions to photonics for compact, low-power applications such as Coherent-Lite and IM-DD systems. This talk covers oDAC performance and challenges for achieving higher-speed operation.

## Room 502A

### W3G • Panel: How Do We Model Novel Fiber Designs Such as SDM Fibers, Hollow-Core Fibers and Other New Fibers?—Continued

The key discussions to address in this panel are:

- Challenges and advancements in modeling fibers with more complex geometries, such as HCF and MCF
- Suitable simulation methods (e.g., finite elements, beam propagation, etc.) and boundary conditions
- Modeling of fabrication tolerances and environmental factors (micro-bending, temperature, etc.)
- Application of machine learning and AI techniques in fiber design
- Computational scalability toward large-scale fiber networks
- Computational evaluation of the impact of different fiber designs on the system performance

## Room 502B

### W3H • Panel: The Return of TWDM-PON!—Continued

The key discussions to address in this panel are:

- Technical solutions under consideration for use in a 50 Gb/s TWDM-PON, such as coherent and advanced IM-DD
- New service applications and network architectures that are enabled by TWDM-PON
- Progress in standardization of such systems to promote widespread adoption
- Commercial prospects for such a system, including market size and techno-economic factors

## Room 515A

### W3I • Symposium: Generative AI for Optical Networking I—Continued

**W3I.3 • 15:00** Invited

**Leveraging Small and Large Language Model Agents for Optical Network Control,** Takahito Tanimura[1]; [1]*Hitachi Ltd, Japan.* We present an architecture driven by Generative AI that deploys LLMs in the cloud and SLMs on-premises. This approach uses physics-informed reasoning to minimize computational overhead while ensuring high accuracy in complex network tasks.

## Room 515B

### W3J • Transmission Systems for Data Center Networks—Continued

**W3J.4 • 14:45** ★ Top-Scored

**153.8 Tb/s O-Band Coherent Transmission Over SMF With Low-Complexity DSP,** Romulo Aparecido de Paula Junior[1], Jiaqian Yang[1], Zelin Gan[1], Mindaugas Jarmolovicius[1], John D. Downie[2], Lidia Galdino[2], Vitaly Mikhailov[3], Jiawei Luo[3], Eric Sillekens[1], Ronit S. Sohanpal[1], David DiGiovanni[3], Ruben S. Luis[4], Robert Killey[1], Polina Bayvel[1]; [1]*Univ. College London, UK;* [2]*Corning Research and Development Corporation, Corning Incorporated, USA;* [3]*Lightera Labs, USA;* [4]*Kokuritsu Kenkyu Kaihatsu Hojin Joho Tsushin Kenkyu Kiko, Japan.* We demonstrate record 153.8 Tb/s (50.3 km) and 141.1 Tb/s (75.5 km) O-band (16.5 THz) WDM transmission with simplified DSP using geometrically-shaped 256-QAM with no chromatic dispersion compensation and a short 7-tap adaptive equaliser.

**W3J.5 • 15:00** Invited

**Wideband SOA for WDM Systems and Datacenter Interconnects,** Xiaohui Zhao[1,2], Trung-Hien Nguyen[2], Hartmut Hafermann[2], Loig Godard[2], Maha Bouhadida[2], Massimo Tornatore[1], Sami Mumtaz[2], Romain Brenot[2], Abel Lorences-Riesgo[2], Yann Frignac[2], Gabriel Charlet[2]; [1]*Department of Electronics, Information and Bioengineering, Politecnico di Milano, Italy;* [2]*Optical Communication Technology Lab, Huawei Technologies France SAS, France.* This paper reviews wideband SOAs for WDM and DCI systems, characterizes their nonlinear impairments across different system-level parameters, and demonstrates transmitter-side mitigation of SOA nonlinearities to extend achievable power budgets.

## Room 518

### W3K • Quantum–Classical Coexistence And Access Networks—Continued

**W3K.4 • 14:45**

**Coexistence of Commercial DV-QKD With High-Capacity Super C+L-Band Transmission in Amplified ROADM-Based Links and Frequency Allocation Strategies,** Antonio Melgar[1], Juan Pedro Fernández-Palacios Giménez[1], Jose Rivas Moscoso[1], Rafael Cantó[1], Jesús Folgueira[1], James F. Dynes[2], Andrew J. Shields[2], Sourabh Khandelwal[2]; [1]*Telefónica CTIO, Spain;* [2]*Toshiba Europe Ltd, UK.* We demonstrate the coexistence of an O-band DV-QKD channel with 11.7 THz C+L-band transmission at a launch power of 22.4 dBm over 50 km of fiber. L-band channels do not degrade DV-QKD performance, and two C-band frequency allocation strategies are evaluated to optimize system performance.

**W3K.5 • 15:00**

**LightGBM-Assisted Rapid QBER Prediction and Adaptive Joint Multi-Parameter Optimisation for QKD-Classical Coexistence Transmission,** Xun Zhu[1], Qianhui Guo[1], Zhuoming Yang[1], Shang Gao[1], Zikun Zhang[1], Yanlu Huang[1], Liyan Wu[1], zhipeng wang[1], Shangya Han[1], kai jin[1], Mingyang Guo[1], Kun Xu[1], Yanni Ou[1]; [1]*Beijing Univ. of Posts and Telecommunications, China.* We propose a rapid QBER prediction and a joint optimisation scheme for QKD-classical coexistence, experimentally achieving accurate QBER estimation of 5.85e-5 mean-squared-error and 23.8% secret-key rate improvement under large QBER fluctuations from 2.6% to 13.9%.

## Show Floor Programming

**SF10 • Capitalizing on Optics in 5G, 6G and Cloud RAN with Higher Data Rates and Longer Reaches**
14:00–15:00, *Theater III*

**MW4 • Advanced Packaging and CoPackaging for Efficient Optical Systems**
14:15–15:45, *Theater I*

**Scaling the AI Data Center: Optical Technologies Redefining Data Center Interconnection**
LIGHTWAVE + BTR
14:30-15:30, *Theater II*

**Technology Showcase: Open-Tooled Gold Box Kit for ELSFP Applications: Unlocking High Power External Laser Solutions for Scalable Co-Packaged Optics**
HITACHI
15:15-15:45, *Theater III*

## Room 403A

### W3A • Optical Network Optimization and Scaling I—Continued

**W3A.5 • 15:15**
**Survivable Hybrid FXC-WXC Architecture for Cost-Effective Core/Regional Optical Networks,** Shunya Shimoi[1], Hayato Yuasa[1], Taisei Sekizuka[1], Takuma Kuno[1], Yojiro Mori[2,1], Wakako Maeda[3], Shigeyuki Yanagimachi[3], Hiroshi Hasegawa[1]; [1]*Nagoya Univ., Japan;* [2]*Toyota Technological Inst., Japan;* [3]*NEC Corp., Japan*. We propose a design algorithm for low-loss, low-cost, and resilient network architecture applicable to core/regional optical networks. Simulations show improved transmission quality enables wider ZR+ adoption, yielding a 14–24% reduction in total network cost.

**W3A.6 • 15:30** ★ Top-Scored
**Low-Loss and Infinitely Scalable Flat Modular OXC for Metro-Scale Optical Networks,** Atsuki Wada[1], Takuma Kuno[1], Yojiro Mori[2,1], Hiroshi Hasegawa[1]; [1]*Nagoya Univ., Japan;* [2]*Toyota Technological Inst., Japan*. We propose a flat modular OXC offering low loss and cost reduction through sparse intra-node interconnections. Numerical simulations and 100-Gbaud DP-16QAM transmission experiments confirm superior performance and practical feasibility for metro-scale optical networks.

## Room 403B

### W3B • Coding, Modulation and DSP—Continued

**W3B.5 • 15:15**
**Real-Time Active Power Management for DSCM Coherent Subcarriers Performance Equalization,** Pablo Torres-Ferrera[1], Jacqueline Sime[1], Giuseppe Parisi[1], Alberto Otero-Casado[1], Carlos Castro[1], Bo Liu[1], Thomas Duthel[1], Chris Fludger[1], Antonio Napoli[1]; [1]*Nokia Corporation, Germany*. We investigate a real-time digital active power management algorithm at subcarrier level, developed on a 400G transceiver, to compensate for frequency-dependent system impairments. We report significant required OSNR improvement, achieving uniform performance for all subcarriers.

**W3B.6 • 15:30**
**Low-Complexity Adaptive Digital Backpropagation via Clock-Tone Strength in Coherent Optical Systems,** Zhongxing Tian[1], Zeyu Feng[1], Qingyu He[2], Yuhan Gong[2], Wanzhen Guo[3], Ziang Chen[1], Dongdong Zou[1], Huan Huang[1], Lin Sun[1], Jian Zhao[3], Ming Luo[2], Gordon Ning Liu[1], Gangxiang Shen[1], Yi Cai[1]; [1]*School of Electronic and Information Engineering, Soochow Univ., China;* [2]*State Key Laboratory of Optical Communication Technologies and Networks, China Information Communication Technologies Group, China;* [3]*School of Electronic and Information Engineering, South China Univ. of Technology, China*. We propose a low-complexity clock-tone-guided adaptive digital backpropagation (ADBP) that self-tunes the nonlinear coefficient. Over a 1200-km link, it achieves comparable performance while reducing complexity by 51.7% and 43.7% relative to phase-variance and intensity-noise-variance ADBP.

## Room 408A

### W3C • Photonic AI Computing—Continued

**W3C.5 • 15:15** ★ Top-Scored
**Photonic Analog-to-Digital Conversion (ADC) Using Photonic Neural Network-Assisted Quantization,** Antonios Prapas[1], Georgios Tsamis[1], Apostolos Tsakyridis[1], Miltiadis Moralis-Pegios[1], David Lazovsky[2], Nikos Pleros[1]; [1]*Computer Science, Aristoteleio Panepistemio Thessalonikes, Greece;* [2]*Celestial AI, USA*. We demonstrate a 2-bit photonic ADC architecture using optical sampling and quantization via a silicon photonic Crossbar-based Neural Network. Successful operation for analog signals is experimentally presented with an accuracy of 97.73% at 30GSa/s.

**W3C.6 • 15:30** Invited
**Universal Photonic Artificial Intelligence Acceleration,** Darius Bunandar[1]; [1]*Lightmatter, USA*. We introduce a photonic AI processor capable of executing advanced models—ResNet, BERT, and reinforcement learning—with near-electronic precision. The processor integrates six chips and achieves 65.5 TFLOPS, marking an essential step toward post-transistor computing.

## Room 408B

### W3D • Distributed Sensing I—Continued

**W3D.5 • 15:15**
**Time-Frequency-Agility Modulation Enabled Long-Distance Dynamic Strain Sensing Using φ-OTDR,** Can Chen[1], Zhonghong Lin[1], Shuyan Chen[1], Zhiyong Zhao[1], Ming Tang[1]; [1]*Huazhong Univ of Science and Technology, China*. Time-frequency-agility modulation (TFAM) φ-OTDR is demonstrated, which enables quantitative vibration signal measurements over 45 km sensing fiber, achieving an 80-fold improvement in effective sampling rate relative to traditional frequency-scanned φ-OTDR.

**W3D.6 • 15:30**
**Coded-Pulse-Compression Frequency-Multiplexed DAS for Fading Suppression and SNR Enhancement,** Jiazhen Ji[1], Zhicheng Jin[1], Jiageng Chen[1], Yangyang Wan[1], Hanzhao Li[2], Xuhui Yu[2], Zuyuan He[1]; [1]*Shanghai Jiao Tong Univ., China;* [2]*Ningbo AllianStream Photonics Technology Co. Ltd., China*. We propose a coded-pulse-compression frequency-multiplexed distributed acoustic sensing scheme that integrates coding and multiplexing to enhance SNR, suppress interference fading, and pave the way for integrated sensing and communication over existing optical communication networks.

## Room 411

### W3E • Laser Sources and Optical Engines for Optical Interconnection—Continued

**W3E.5 • 15:15**
**Toward 400 G/Lane Silicon Differential-Drive Mach-Zehnder Modulator With > 80 GHz Bandwidth for Optical Interconnects,** Haibo Wang[1], Qianni Zhang[1], Yanming Zhang[1], Pengfei Guo[1], Jindian Wei[1], Wenxu Gu[1], Tingyu Teo[1], Haiyang Zheng[1], Chao Li[1], Patrick Guo-Qiang Lo[1]; [1]*Advanced Micro Foundry Pte Ltd, Singapore*. A differential-drive Silicon Mach–Zehnder modulator is demonstrated, achieving a 3-dB bandwidth of 81.8 GHz. Despite limitations in the eye-diagram measurement setup, a PAM-8 eye-diagram was obtained at 100 Gbaud.

**W3E.6 • 15:30**
**180 GBaud PAM4 Driver-Modulator Engine for IM/DD Transmissions in the O-Band,** Son Tran[1], Sebastian Lauck[1], Gerrit Fiol[1], Jonathan Andree[1], Felix Ganzer[1], Robert Emmerich[1], Colja Schubert[1], Patrick Runge[1], Martin Schell[1,3], Ronald Freund[1,3], Shawn Parker[2], Trong Phan[2], Billy Allen[2]; [1]*Fraunhofer HHI, Germany;* [2]*MACOM, USA;* [3]*Technische Universitat Berlin, Germany*. A co-packaged 76 GHz InP-based Mach-Zehnder modulator and a 224 GBaud-class linear differential EML driver was demonstrated, achieving 180 GBaud PAM4 back-to-back in an IM/DD transmission for O-Band operation.

## Room 501ABC

### W3F • Optical Signal Processing—Continued

**W3F.5 • 15:30**
**Adaptive Resonant Wavelength Tracking for High-Q Second-Order MRR in Carrier-Extracted Self-Coherent Detection Systems,** Lei Pang[2], Haojie Zhu[1], Yuhao Fang[1,2], Xue Cheng[2], Jianghao Shan[2], Jinhong Xu[2], Weiqi Lu[1], Dayu Shi[1], William Shieh[1]; [1]*Westlake Univ., China;* [2]*Westlake Inst. for Optoelectronics, China.* We demonstrate a wavelength tracker for second-order silicon micro-ring resonators featuring full C-band operation range, 2-ms convergence time and 57-mW power consumption. 224-Gbps transmission over 50-km SSMF with the wavelength tracker is successfully demonstrated.

## Room 502A

**W3G • Panel: How Do We Model Novel Fiber Designs Such as SDM Fibres, Hollow-Core Fibers and Other New Fibers?—Continued**

## Room 502B

**W3H • Panel: The Return of TWDM-PON!—Continued**

## Room 515A

**W3I • Symposium: Generative AI for Optical Networking I—Continued**

**W3I.4 • 15:30** Invited

**From Automation to Autonomy: AI Multi-Agents Dynamic Workflow Powering Next-Gen IP/Optical Operations,** Reza Rokui[1]; [1]*Ciena Canada Inc, Canada*. In this talk, I will discuss the concepts of Generative AI (GenAI) and Agentic AI, and their relevance to the operation and automation of multi-layer IP/Optical networks. I will also present several operator scenarios in the areas of network assurance, network optimization, and network automation. A few practical use-cases will also be discussed.

## Room 515B

**W3J • Transmission Systems for Data Center Networks—Continued**

## Room 518

**W3K • Quantum–Classical Coexistence And Access Networks—Continued**

**W3K.6 • 15:15**

**Dynamic Switched Quantum Key Distribution Network With PUF-Based Authentication,** Persefoni Konteli[1], Nikolaos Makris[1], Evgenia Niovi Sassalou[2], Stylianos A. Kazazis[2], Alkinoos Papageorgopoulos[1], Stefanos Vasileiadis[3,5], Konstantinos Tsimvrakidis[1], Symeon Tsintzos[2], Georgios M. Nikolopoulos[4,6], George Kanellos[1]; [1]*Informatics and Telecommunications, Ethniko kai Kapodistriako Panepistemio Athenon, Greece;* [2]*QUBITECH, Greece;* [3]*UBITECH Limited, Greece;* [4]*Inst. of Electronic Structure and Laser, Idruma Tekhnologias kai Ereunas, Greece;* [5]*Universita degli Studi di Trento, Italy;* [6]*Center for Quantum Science and Technologies, Idruma Tekhnologias kai Ereunas, Greece*. We demonstrate a centrally controlled dynamic switched-QKD network, with integrated PUF-based dynamic authentication for each QKD link. The performance of the dynamic switched-QKD network with real-time PUF-based authentication is analyzed.

**W3K.7 • 15:30** Invited

**Standardization Progress on Networking Technologies of Quantum Key Distribution Networks (QKDN),** Xiaosong Yu[1], Yuhang Liu[1], Yongli Zhao[1]; [1]*Beijing Univ. of Posts and Telecommunications, China*. This paper identifies key topics related to networking technologies in quantum key distribution networks (QKDNs) and evaluates ongoing standardization efforts. It also discusses the standardization trend toward next-generation quantum networks.

## Show Floor Programming

**MW4 • Advanced Packaging and CoPackaging for Efficient Optical Systems**
14:15–15:45, *Theater I*

**Scaling the AI Data Center: Optical Technologies Redefining Data Center Interconnection**
LIGHTWAVE + BTR
14:30-15:30, *Theater II*

**Technology Showcase: Open-Tooled Gold Box Kit for ELSFP Applications: Unlocking High Power External Laser Solutions for Scalable Co-Packaged Optics**
HITACHI
15:15-15:45, *Theater III*

**Engineering the Future of Connectivity: How Optical Technologies are Redefining Data Center Performance**
Amphenol
15:45-16:45, *Theater II*

## Room 403A

### W3A • Optical Network Optimization and Scaling I—Continued

**W3A.7 • 15:45**
**CDC Network Element for Petabit-per-Second Randomly-Coupled MCF Networks,** Besma Kalla[1,2], Ruben S. Luis[1], Stefano Gaiani[1,3], Daniele Orsuti[1], Robson A. Colares[1,4], Patrick Blown[5,6], Menno van den Hout[2], Darli Mello[4], Pierpaolo Boffi[3], Thomas Bradley[2], Chigo Okonkwo[2], Hideaki Furukawa[1]; *[1]Photonics Network Lab, National Inst. of Information and Communication Technology, Japan; [2]Technische Universiteit Eindhoven, Netherlands; [3]Politecnico di Milano, Italy; [4]Universidade Estadual de Campinas, Brazil; [5]Univ. of Sydney, Australia; [6]Finisar Australia, Australia.* We demonstrate a 4 line sides C+L-Band, colorless, directionless, contentionless network node supported by randomly-coupled multicore fibers. We address full add&drop, express and optical grooming scenarios with 1.19 Pb/s per line side.

## Room 403B

### W3B • Coding, Modulation and DSP—Continued

**W3B.7 • 15:45**
**Low-Complexity 2-Order IIR Notch Filter With Adaptive Frequency Tracking for Inter-Channel FWM Mitigation in IMDD-WDM Transmission With 1.6-dB Sensitivity Gain,** Yicheng Xu[1], Yixiao Zhu[1], Leyan Fei[1], Zhiyuan Yang[1], Weisheng Hu[1], Qunbi Zhuge[1]; *[1]Shanghai Jiao Tong Univ., China.* We propose an FWM crosstalk tracking and removal scheme with accurate frequency estimation and a low-complexity IIR notch filter. 1.6-dB sensitivity improvement and 13.2-dB FWM crosstalk tolerance gain are experimentally achieved with 112-Gb/s PAM-4 signals.

## Room 408A

### W3C • Photonic AI Computing—Continued

## Room 408B

### W3D • Distributed Sensing I—Continued

## Room 411

### W3E • Laser Sources and Optical Engines for Optical Interconnection—Continued

**W3E.7 • 15:45** ★ Top-Scored
**Highly Reliable 210-GHz Vertical-Illumination Photodiode With Interference-Based Enhanced Absorption in O-Band,** Yuki Yamada[1], Ikue Hiraoka[1], Yusuke Araki[1], Takuya Hoshi[1], Yoshiho Maeda[1], Shohei Kosuga[1], Takahiro Nakamura[1], Fumito Nakajima[1]; *[1]NTT Inc, Japan.* We demonstrate a 210-GHz, 0.55-A/W vertical-illumination InGaAs/InP photodiode for the O-band, achieving over 180 Gbaud received eye opening. The inverted p-down structure ensures excellent reliability.

## Room 501ABC

### W3F • Optical Signal Processing—Continued

NOTES

## Room 403A

**16:30–18:30**
**W4A • Optical Network Optimization and Scaling II**
*Presider: Yvan Pointurier; Huawei Technologies, France*

**W4A.1 • 16:30**
**Evaluating Capacity Scaling Strategies for Cost-Efficient Optical Network Evolution,** Muhammad Umar Masood[1], Sanwal Zeb[1], Ihtesham Khan[2], Vittorio Curri[1]; [1]*Politecnico di Torino, Italy;* [2]*Nokia Bell Labs, USA.* We present a techno-economic framework assessing transceiver, spectral, and spatial scaling strategies on the German core network, quantifying capacity, CAPEX, and Cost/Tb, and deriving operator strategies for cost-efficient, scalable optical network evolution.

**W4A.2 • 16:45**
**Impairment Aware Dynamic Routing and Resource Assignment in Multi-Granular Optical Node Networks,** Varsha Lohani[1], Farhad Arpanaei[2], Raul Muñoz[1], Ramon Casellas[1], Jose Rivas Moscoso[3], David Larrabeiti[2]; [1]*Centre Tecnològic Telecom de Catalunya, Spain;* [2]*Universidad Carlos III de Madrid Escuela Politecnica Superior, Spain;* [3]*Telefónica CTIO, Spain.* This paper presents a dynamic routing and resource assignment algorithm accounting for nodes integrating wavelength and waveband switching and physical layer impairments for waveband selective switches. Its performance is compared to baseline WDM network.

## Room 403B

**16:30–18:15**
**W4B • Fiber-to-Chip Coupling**
*Presider: Takako Hirokawa; GlobalFoundries, USA*

**W4B.1 • 16:30**
**Low Loss Optical Coupling to Photonic Integrated Circuits via Adaptive-Facet-Attached Microlenses,** Matthew Mitchell[1], Becky Lin[1], Robin Kim[1], Mustafa Hammood[1], Ben Cohen-Kleinstein[1,2], Ella Yan[1,2], Kirsty A. Gardner[1], Sudip Shekhar[1,2], Lukas Chrostowski[1,2]; [1]*Dream Photonics, Canada;* [2]*The Univ. of British Columbia, Canada.* Reflow-compatible, facet-attached microlenses (FaMLs) with fiber-to-chip coupling insertion loss < 1 dB are demonstrated, with a misalignment sensitivity of 5 µm at a 1 dB excess loss. As a proof of concept, we demonstrate FaMLs that are capable of adaptively correcting translational placement misalignment of up to 30 µm.

**W4B.2 • 16:45**
**All-Dielectric Integrated Microlens Coupler for Scalable and Efficient Photonic I/Os,** Sirui Tang[1]; [1]*Univ. of California Berkeley, USA.* We develop a wafer-scale SiON process for all-dielectric integrated microlens couplers, enabling efficient, broadband, polarization-insensitive, and environmentally robust fiber-to-chip coupling with 1.0 dB measured loss.

## Room 408A

**16:30–18:30**
**W4C • Wireless Integrated Sensing and Communications**
*Presider: Kevin Shortt; Airbus Defence & Space GmbH, Germany*

**W4C.1 • 16:30**
**Photonics-Assisted THz ISAC System Based on a Time-Frequency Efficient SF-LFM-OFDM Waveform,** Mingzheng Lei[1,2], Junhao Zhang[1,2], Junjie Ding[1], Min Zhu[1,2], Hongjia Liu[2], Qing Zhong[1,2], Long Zhang[1], Bingchang Hua[1], Jiao Zhang[1], Cai Yuancheng[1], Chen Xingyu[1], Sha Zhu[3], Jianjun Yu[1,4]; [1]*Purple Mountain Laboratories, China;* [2]*Southeast Univ., China;* [3]*Nankai Univ., China;* [4]*Fudan Univ., China.* We design a time-frequency efficient ISAC waveform by embedding a SF-LFM signal into a Z-OFDM signal. A photonics-assisted THz system with concurrent 87.7-Gbps data rate and 7-mm radial resolution is realized using the designed waveform.

**W4C.2 • 16:45**
**Integrated Optical Phased Array LiDAR Using Coherent Line Scanning,** Jinung Jin[1], Eun-Su Lee[1], Kwon-Wook Chun[1], Min-Cheol Oh[1]; [1]*Pusan National Univ., Korea (the Republic of).* We demonstrate an integrated coherent LiDAR using a monolithic Si3N4–polymer OPA with edge-emitted line-beam scanning and direct DFB modulation, achieving simultaneous distance and velocity measurement.

## Room 408B

**16:30–18:15**
**W4D • Distributed Sensing II**
*Presider: Steinar Bjørnstad; Tampnet, Norway*

**W4D.1 • 16:30** Invited
**Distributed Fiber Sensing: Opportunities and Challenges,** Elie Awwad[1], Diane Prato[1], Pierre Pruvost[1], Maria Freire-Hermelo[1], Renaud Gabet[1], Yves Jaouen[1]; [1]*Télécom Paris, France.* We review opportunities and challenges of deploying Rayleigh-based distributed sensing over existing networks. Focusing on deployment possibilities, sensitivity, phase noise, and large-scale data analysis, we highlight recent advances and future directions.

## Room 411

**16:30–18:30**
**W4E • Advanced Semiconductor Laser Sources**
*Presider: Daniel Kuchta; NVIDIA Corporation, USA*

**W4E.1 • 16:30** Invited
**Dynamic and Static Properties of Photonic-Crystal Surface-Emitting Lasers (PCSELs),** Susumu Noda[1]; [1]*Inst. for Advanced Study, Kyoto Univ., Japan.* Photonic-crystal surface-emitting lasers (PCSELs) have attracted much attention as high-brightness, high-functionality, and high-coherence lasers. In this presentation, I will review the latest progress of PCSELs in terms of static and dynamic properties.

## Room 501ABC

**16:30–18:30**
**W4F • High-Speed Coherent PON Systems and Enabling Technologies**
*Presider: Haipeng Zhang; CableLabs, USA*

**W4F.1 • 16:30**
**Experimental Demonstration of a Large Dynamic Range Burst-Mode Receiver for 200G Upstream Coherent PON Based on Static Gain TIA,** Jad Sarkis[1,2], Robert Palmer[1], Patrick Schulte[1], Ivan Cano[1], Simone Cambursano[1,2], Stefano Calabro[1], Giuseppe Talli[1], Maxim Kuschnerov[1], Valter Ferrero[2], Roberto Gaudino[2]; [1]*Huawei Technologies Duesseldorf GmbH, Germany;* [2]*DET, Politecnico di Torino, Italy.* We experimentally demonstrate a net 200 Gb/s burst-mode coherent transmission using DP-QPSK and a commercial integrated coherent receiver with fixed-gain mode TIA, supporting 20 dB dynamic range for burst detection over a 40 km fiber link.

**W4F.2 • 16:45**
**Spectrum-Notch-Coded Modulation Enabled Pilot-Tone-Aided Carrier Recovery for Single Carrier 200G Coherent PON,** Yuheng Liu[1], Wei Wang[1], Weihao Ni[1], Yifan Chen[1], Zuyu Li[1], Fan Li[1]; [1]*Sun Yat-Sen Univ. (CHINA), China.* We propose a spectrum-notch-coded modulation scheme and demonstrate it in 200G PON downstream transmission for the first time. This scheme enables in-band pilot-tone insertion for CPR in single-carrier systems, with lower complexity than DSCM.

## Room 502A

**16:30–18:30**
**W4G • Panel: Is the Ecosystem Ready for Multicore Fibers?**

**Organizers:**
Andrea D'Amico, *NEC Laboratories America Inc., USA*
Gustavo Ocampo, *Hokkaido, Univ., Japan*
Deepa Venkitesh, *Indian Inst. of Technology Madras, India*
Masaki Wada, *NTT, Japan*

**Speakers:**
Vincent Ferretti, *Corning, USA*
Eduardo Mateo, *NEC, Japan*
Kazuhide Nakajima, *NTT, Japan*
Pascal Pecci, *Meta, France*
Takashi Sasaki, *Sumitomo Electric Industries, Ltd., Japan*
Yu Sun, *Google, USA*

The exponential rise in global data traffic from cloud computing, IoT, AI, and 5G is straining single core optical fiber networks to their physical and economic limits. Multicore fiber (MCF) technology offers a viable path to boost capacity, efficiency, and scalability in the telecom ecosystem. Worldwide field trials have demonstrated MCF's capabilities, supported by advances in fan in/fan out devices for backward compatibility, multicore transceivers, connectors, and amplifiers. These developments make MCF attractive for data centers and backbone networks, yet challenges persist. The lack of unified global standards hampers design interoperability and infrastructure integration, while technical hurdles in splicing and fan in/fan out devices complicate single core interconnection. High costs for new components and transitioning from legacy systems further slow adoption. Overcoming these barriers will require coordinated industry action to refine manufacturing, ensure interoperability, and strengthen the business case. This panel convenes experts from industry, academia, and standards bodies to evaluate MCF readiness and chart deployment pathways.

## Room 502B

**16:30–18:30**
**W4H • Next-Gen Pluggables & High-Reliability DCI**
*Presider: Rene Schmogrow; AttoTude, USA*

**W4H.1 • 16:30** Invited
**Drivers, Requirements and Performance Analysis of Next Generation Optical Pluggables From an Operator Perspective,** Juan Pedro Fernández-Palacios Giménez[1], Edward Echeverry[1]; [1]*Telefónica Innovación Digital S.L.U., Spain*. We validate multi-vendor IPoDWDM through independent laboratory evaluations: optical performance testing of 400G ZR+ and 100G ZR-DCO over a six-span ROADM setup, and separate SDN control-plane validation, confirming CMIS 5.x maturity and multi-layer interoperability.

## Room 515A

**16:30–18:30**
**W4I • Symposium: Generative AI for Optical Networking II**
*Presider: Ricard Vilalta; Centre Tecnològic Telecom de Catalunya, Spain*

**W4I.1 • 16:30** Invited
**Agentic AI and Autonomous Networks: Shaping the Future of Connectivity,** Akhil Gokul[1]; [1]*Ericsson, USA*. Autonomous Networks powered by Agentic AI enable intent-driven automation, real-time decisions, and zero-touch operations. By fusing cognitive intelligence with differentiated connectivity, they elevate performance, accelerate innovation, unlock new revenue, and transform networks into adaptive, self-evolving digital platforms.

## Room 515B

**16:30–18:30**
**W4J • Ultra-High-Speed Subsystems**
*Presider: Ming-Fang Huang; NEC Laboratories America Inc., USA*

**W4J.1 • 16:30**
**Improved Multi-Path Interference Detection With Calibrated Variance Difference,** Likai Zhu[1], Junqing Sun[1], Nina Krainova[1], Tianchen Luo[1]; [1]*Credo Semiconductor, USA*. An improved MPI detection method is proposed based on the Calibrated Variance Difference of the modulation levels. The influences of noise and extinction ratio on the MPI indicator are minimized.

**W4J.2 • 16:45**
**Adaptive Periodically Time–Variant Background Calibration for Joint Time– and Frequency–Interleaved 160 GSa/s Analog to Digital Converter,** Sunningchang Zhang[1], Yuming Zhao[1], Shuren Mao[2], Xin Zhang[1], Yang Zou[1], Linsheng Zhong[1], Jing Li[1], Shenmao Zhang[1], Xiaoxiao Dai[1], Mengfan Cheng[1], Lei Deng[1], Qi Yang[1], Deming Liu[1]; [1]*Huazhong Univ of Science and Technology, China;* [2]*Wuhan Research Inst. of Posts and Telecommunications, China*. A periodically time–variant based background calibration method is proposed and experimentally demonstrated on a 160 GSa/s JFTI-ADC comprising four frequency-interleaved 128-channel TI-ADCs, achieving a 2.4 dB SNR improvement for 100 GBaud PAM4 signal reception.

## Room 518

**16:30–18:30**
**W4K • Photonic Integrated Quantum Devices: Sources, Detectors & Receivers**
*Presider: Davide Bacco; Universita degli Studi di Firenze, Italy*

**W4K.1 • 16:30**
**Silicon-Based Bidirectionally Multiplexed Single-Photon Source,** Baojie Hou[1], Haoran Ma[1], Zichao Zhao[1], Qishen Liang[1], bin zhang[1], Donghui Chen[1], Denghui Wang[1], Fanjie Ruan[1], Yuehai Wang[1], Huihui Zhu[1], Jianyi Yang[1]; [1]*Zhejiang Univ., China*. Multiplexed single-photon sources enhance photon generation probability by actively routing heralded photons from multiple channels to a single output. Here, we propose a CMOS compatible multiplexed spiral single photon source based on bidirectional pumping to significantly improve integration density.

**W4K.2 • 16:45**
**Silicon-Based Integrated Four-way Spatially Multiplexed Multi-Port Single-Photon Source,** Jie B. Hou[1], Qishen Liang[1], Haoran Ma[1], Zichao Zhao[1], Bin Zhang[1], Donghui Chen[1], Yawen Tu[1], Yuehai Wang[1], Huihui Zhu[1], Jianyi Yang[1]; [1]*Zhejiang Univ., China*. Heralded single-photon sources represent a key enabling solution for enhancing the single-photon generation probability. This work introduces an innovative combinatorial distribution multiplexing scheme for the simultaneous creation of multi-port single photons with high probability.

## Show Floor Programming

**Engineering the Future of Connectivity: How Optical Technologies are Redefining Data Center Performance**
**Amphenol**
15:45-16:45, *Theater II*

**SP1 Architecting the AI Network Infrastructure at Scale**
CISCO ACACIA COMMUNICATIONS, INC.
16:00–17:00, *Theater I*

**Network Operator Briefing**
16:00-17:00, *Theater III*

## Room 403A

### W4A • Optical Network Optimization and Scaling II—Continued

**W4A.3 • 17:00**
**Network Design With Overlapping Spectrum Allocation in DSCM-Enabled Optical Transport,** Sai Vikranth Pendem[1], Carlos Natalino[1], Giuseppe Parisi[2], Pablo Torres-Ferrera[2], Antonio Napoli[2], Paolo Monti[1]; [1]*Electrical Engineering, Chalmers tekniska hogskola AB, Sweden;* [2]*Nokia Oy, Germany.* This paper investigates a design strategy for bi-directional transmission with overlapping spectrum allocation under back-scattering noise penalties. Results show up to 18% fewer transceivers and 116% higher carried traffic compared to non-overlapping allocations.

**W4A.4 • 17:15**
**Forecast-Guided Reinforcement Learning for Extended-Access Metro P2MP Networks,** Polizois Soumplis[1,2], Konstantinos Christodoulopoulos[3,2], Konstantinos Yiannopoulos[4,2], Emmanouel Varvarigos[1,2]; [1]*School of Electrical and Computer Engineering, Ethniko Metsobio Polytechneio, Greece;* [2]*Inst. of Communication and Computer Systems, Greece;* [3]*Department of Informatics and Telecommunications, Ethniko kai Kapodistriako Panepistemio Athenon, Greece;* [4]*Department of Informatics and Telecommunications, Panepistemio Peloponnesou, Greece.* Static resource allocation in coherent P2MP networks is inefficient under dynamic traffic. We present a scalable multi-agent reinforcement learning framework that leverages ML-based forecasts to balance throughput and stability, overcoming the limitations of centralized schedulers.

## Room 403B

### W4B • Fiber-to-Chip Coupling—Continued

**W4B.3 • 17:00** Invited
**Ultra-low Loss Fiber-to-PIC Coupling Solutions for Scalable Quantum Computing Infrastructure,** Inna Krasnokutska[1]; [1]*Xanadu Quantum Technologies Inc., Canada.* Scalable photonic quantum computing necessitates ultra-low loss fiber-to-chip coupling. To overcome the critical barrier of high optical insertion loss, we have developed novel packaging solutions, enabling the creation of fault-tolerant quantum computers.

## Room 408A

### W4C • Wireless Integrated Sensing and Communications—Continued

**W4C.3 • 17:00** Invited
**Large-Scale True-Time Delay Beamforming for Integrated Sensing and Communications,** Xiaoxiao Xue[1], Mian Wang[1], Zeyu Ren[1], Shangyuan Li[1], Xiaoping Zheng[1]; [1]*Electronic Engineering, Beijing National Research Center for Information Science and Technology, Tsinghua Univ., China.* We present a quasi-true-time-delay beamformer without physical delay lines for scalable, low-cost phased arrays. Centimeter-scale radar imaging and Gbps communications are demonstrated with a 1X16 antenna array.

## Room 408B

### W4D • Distributed Sensing II—Continued

**W4D.2 • 17:00** ★ Top-Scored
**Hybrid Photonic Integrated Interrogator for Distributed Acoustic Sensing,** Zhicheng Jin[1], Jiageng Chen[1], Zhengwen Li[1], Hanzhao Li[2], Keke Hu[2], Xuhui Yu[2], Zuyuan He[1]; [1]*Shanghai Jiao Tong Univ., China;* [2]*Ningbo AllianStream Photonics Technology Co., Ltd., China.* We demonstrate a highly integrated DAS interrogator via hybrid integration of an InP external-cavity laser and an SOI PIC, achieving 73.27 pε/√Hz strain resolution and ~4 m spatial resolution over 10 km fiber.

**W4D.3 • 17:15**
**MHz-Scale Temperature Fluctuation Detection Using OFDR-Based Distributed Acoustic Sensing,** Tatsuya Okamoto[1], Daisuke Iida[1], Kunihiro Toge[1]; [1]*NTT Corporation, Japan.* Exploiting the low-frequency sensitivity of OFDR, we detect mHz-scale temperature fluctuations in underground fibers and identify manhole water presence from the distinct thermal responses of water and air.

## Room 411

### W4E • Advanced Semiconductor Laser Sources—Continued

**W4E.2 • 17:00** ★ Top-Scored
**500 mW O-Band Photonic-Crystal Surface-Emitting Lasers and Scalable 2D Arrays for Multi-Channel CPO Applications,** Yuhki Itoh[3,1], Takeshi Aoki[3,1], Makoto Ogasawara1[3,1], Kosuke Fujii[3], Yusuke Sawada[3,1], Shun Kimura[3], Takumi Hoya[3], Hiroyuki Yoshinaga[3,1], Naoki Fujiwara[3,1], Hideki Yagi[3], Masaki Yanagisawa[3], Masahiro Yoshida[1], Takuya Inoue[1], Menaka De Zoysa[1], Kenji Ishizaki[1], Susumu Noda[1,2]; [1]*Department of Electronic Science and Engineering, Kyoto Daigaku, Japan;* [2]*Kyoto Daigaku Koto Kenkyuin, Japan;* [3]*Transmission Devices Laboratory, Sumitomo Denki Kogyo Kabushiki Kaisha, Japan.* We demonstrate O-band photonic-crystal surface-emitting lasers achieving over 500 mW output, 20% wall-plug efficiency, and 82 kHz linewidth for CPO applications. A 4-channel 2×2 array on a 1x1 mm chip exhibits stable 2.0±0.09 nm spacing.

**W4E.3 • 17:15**
**200-Gb/s 1060-nm Single-Mode Coupled-Cavity VCSEL Enabling Modal-Dispersion Free >50-GHz Bandwidth Over 500-m Multimode Fiber,** Hameeda Ibrahim[1,2], Ahmed Hassan[1,3], 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 modal-dispersion-free transmission over 500-m multi-mode-fiber (MMF) using high-speed 1060-nm single-mode coupled-cavity VCSEL and SMF-patch center launch, achieving 200-Gb/s data transmission over 500-m MMF(OM4), resulting in the record data-rate-link length product of 100-Gbps*km.

## Room 501ABC

### W4F • High-Speed Coherent PON Systems and Enabling Technologies—Continued

**W4F.3 • 17:00** Invited
**Technologies for Very High Speed PONs,** Dora van Veen[1], Vincent Houtsma[1]; [1]*Nokia Corporation, USA.* Overview and analysis of possible technologies and architectures for Very High Speed PON which will feature line rates above 50 Gb/s per wavelength. We specifically focus on cost-effective schemes and co-existence with previous PON generations.

## Room 502A

### W4G • Panel: Is the Ecosystem Ready for Multicore Fibers?—Continued

The key questions to address in this panel are:

- Which applications (submarine cables, data centers, metro/backbone) are most ready for MCF adoption?
- How mature are the manufacturing processes for MCFs and related components, and what are the bottlenecks?
- What are the challenges in retrofitting or co-deploying legacy fibers and MCFs?
- What is the business case for MCF versus simply increasing the number of single-core fibers?
- How will MCF adoption reshape the competitive landscape for network operators and vendors?
- What is the current state of global standardization efforts across the product spectrum: fibers, connectors, amplifiers, and measurement equipment?
- How can public-private partnerships, research consortia, and policymakers support the transition?
- What are the next milestones for ecosystem readiness?
- What are the latest results from commercial pilots and large-scale trials/testbeds?

## Room 502B

### W4H • Next-Gen Pluggables & High-Reliability DCI—Continued

**W4H.2 • 17:00**
**Analysis and Future-Guided Prediction for Optical Transceiver Failures in AI Data Center Networks,** Jingyi Su[1], Dianxuan Fu[1], Qizhi Qiu[1], Xiangtao Ding[2], juan wang[2], Cheng Chen[2], Bowen Zhang[2], Peilong Wang[2], Xi Chen[3], Zonglong He[3], Hongchen Yu[3], Zhiyong Feng[3], Weisheng Hu[1], Qunbi Zhuge[1]; [1]*Shanghai Jiao Tong Univ., China;* [2]*Baidu Inc, China;* [3]*Huawei Technologies Co Ltd, China*. We propose a failure prediction framework for live time-series data collected from operational optical transceivers in real-world data centers, which achieves an F1 score of up to 0.964 and a Recall of up to 100%.

**W4H.3 • 17:15**
**Cluster- and Reach-Scalable Optical Switching for Scale-Across AI System,** Han Wang[1], Cen Wang[1], Kazuaki Ueda[1], Genichi Mouri[1], Po-Lung Tien[2], Noboru Yoshikane[1], Yuta Wakayama[1], Takehiro Tsuritani[1]; [1]*KDDI Research, Inc., Japan;* [2]*GeNopsys Technologies, Inc., Taiwan*. We propose an OCS-based scale-across architecture with reach- and cluster-scalability, while reducing the number of deployed cables. Experimental results demonstrate that 30-km extending between clusters does not deteriorate AI job completion time.

## Room 515A

### W4I • Symposium: Generative AI for Optical Networking II—Continued

**W4I.2 • 17:00** Invited
**AI Native MNO: Incumbents Lose Ground as AI Take Over,** Sangit Rawlley[1]; [1]*JLA Advisors, USA*. AI-native wireless architectures are driving autonomy across the stack, cutting costs, and enabling ~12–15% EBITDA uplift. Incumbents constrained by legacy debt risk disruption as AI-first players control the intelligence layer and ecosystems.

## Room 515B

### W4J • Ultra-High-Speed Subsystems—Continued

**W4J.3 • 17:00** ★ Top-Scored
**Up to 200 GBd PAM Signal Reception With 33 GHz ADCs Using 256 GSa/s Analog Demultiplexer (ADeMUX) Chip,** Qian Hu[1], Shengpu Niu[2], Haoshuo Chen[1], Robert Borkowski[1], Roland Ryf[1], Xin Yin[2]; [1]*Nokia Bell Labs, USA;* [2]*IDLab, imec – Ghent Univ., Belgium*. A 256 GSa/s SiGe 1-to-4 ADeMUX chip is shown to enable ultrahigh-speed IM/DD by demultiplexing received ultrabroadband optical signal for sampling using ADCs with only 33 GHz bandwidth. First ADeMUX-based reception of 200 GBd PAM-4 and 176 GBd PAM-8 signals is achieved, yielding record net bitrate of 464.1 Gbit/s.

**W4J.4 • 17:15**
**A 420 Gb/s/Lane O-Band PAM-4 TOSA Based on Thin-Film Lithium Niobate for IM-DD Applications,** Haijiang Yu[2,1], Ming Su[2], Ruizhi Zhang[2], Hao Zhang[2], Peng Gao[2], Yuan Yao[2], Li Huang[2], Shusheng Peng[2], Xiaoyu Li[2], Hongbo Zhan[2], Wenjia Xu[2], Xudong Gao[2], Chuanneng Luo[2], Madhav Bhatta[1], Changfei Hu[2]; [1]*Genuine Optics, USA;* [2]*Wuhan HG Genuine Optics Tech Co.,Ltd, China*. We demonstrate a 210 GBaud O-band TOSA using co-designed thin-film lithium niobate and a high-speed driver. It achieves 420 Gb/s PAM-4 operation for 400G/lane-and-beyond IM-DD systems.

## Room 518

### W4K • Photonic Integrated Quantum Devices: Sources, Detectors & Receivers—Continued

**W4K.3 • 17:00**
**High-Performance Laser Written Heterodyne Receiver for Photonic Quantum Information Processing,** Andrea Peri[1], Giulio Gualandi[3,4], Tommaso Bertapelle[1], Mattia Sabatini[1], Giacomo Corrielli[4], Yoann Pietri[1], Davide G. Marangon[1,2], Giuseppe Vallone[1,2], Paolo Villoresi[1,2], Roberto Osellame[4], Marco Avesani[1,2]; [1]*Universita degli Studi di Padova, Italy;* [2]*Padua Quantum Technologies Research Center, Italy;* [3]*Dipartimento di Fisica, Politecnico di Milano, Italy;* [4]*Istituto di Fotonica e Nanotecnologie Consiglio Nazionale delle Ricerche, Italy.* We present a tunable, low-loss, polarization-insensitive Photonic Integrated Circuit for quantum heterodyne detection, fabricated via Femtosecond Laser Micromachining. The device achieves a > 73 dB CMRR, enabling high-performance CV-QKD and a record 42.74 Gbps QRNG.

**W4K.4 • 17:15**
**Fully Packaged Thin-Film Lithium Niobate Receiver for Gigahertz-Rate, Post-Selection-Free Time-Bin Quantum Communication,** Andrea Bernardi[1,3], Marco Clementi[1], Marcello Bacchi[1], Matias Ruben Bolanos Wagner[2], Sara Congia[1,4], Francesco Garrisi[3], Andrea Martellosio[3], Marco Passoni[3], Alexander Wrobel[3], Costantino Agnesi[2], Giuseppe Vallone[1], Paolo Villoresi[2], Federico A. Sabattoli[3], Matteo Galli[1], Daniele Bajoni[1]; [1]*Universita di Pavia, Italy;* [2]*Universita degli Studi di Padova, Italy;* [3]*Advanced Fiber Resources Milan, Italy;* [4]*CEA Leti, France*. We report on the realization of a high-throughput quantum receiver based on a packaged Thin-film Lithium Niobate photonic integrated circuit. A time-bin entanglement-based quantum key distribution (QKD) protocol with no temporal post-selection is experimentally demonstrated.

## Show Floor Programming

**SP1 Architecting the AI Network Infrastructure at Scale**
CISCO ACACIA COMMUNICATIONS, INC.
16:00–17:00, *Theater I*

**Network Operator Briefing**
16:00-17:00, *Theater III*

## Room 403A

### W4A • Optical Network Optimization and Scaling II—Continued

**W4A.5 • 17:30**
**Cost-Efficient Optical Network Capacity Upgrade via ROADM Bypassing,** Mirko N. Zitkovich[1], Anjali Sharma[1], Carmen Mas Machuca[1]; [1]*Chair of Communication Networks, Universität der Bundeswehr München, Germany.* This paper evaluates the advantages of ROADM bypass by splicing dark fibers to meet increasing capacity demands in a brownfield EON scenario. Techno-economic analysis shows savings of 5.6%–17% over multi-fiber and multi-band solutions.

**W4A.6 • 17:45**
**Minimal-Hardware Single-WSS ROADM Enabling Contention-Less Optical 1+1 Protection With a Multi-Input-Port N×N WSS Employing Joint Switching,** Ryunosuke Sasaki[1,2], Takashi Miyamura[2], Satoru Okamoto[2], Naoaki Yamanaka[2], Masahiko Jinno[1,2]; [1]*Kagawa Univ., Japan;* [2]*Keio Frontier Research & Education Collaborative Square, Japan*. We present a minimal-hardware single-WSS ROADM architecture that achieves colorless, directionless, and partially contention-less operation using joint switching. With a multi-input-port 4×4 WSS, we experimentally demonstrate contention-less optical 1+1 ring protection.

## Room 403B

### W4B • Fiber-to-Chip Coupling—Continued

**W4B.4 • 17:30**
**Efficient and Polarization-Independent Coupling of Silicon Photonic Chips With 7-Core Multicore Fibers,** Xianyi Feng[1], Wu Zhou[1], Hao Chen[1], Wenzhang Tian[1], Yeyu Tong[1]; [1]*Hong Kong Univ of Sci & Tech (Guangzhou), China*. We demonstrated efficient and polarization-diverse coupling of silicon photonic chips to 7-core fibers, achieving an experimental loss of -2.4 dB, a 55 nm 3-dB bandwidth, and a polarization-dependent loss of < 0.7 dB.

**W4B.5 • 17:45**
**Efficient Spatial and Polarization Mode Multiplexer for Few-Mode Fibers Using Silicon-Based Grating Couplers,** Wu Zhou[1], Xianyi Feng[1], Yeyu Tong[1]; [1]*Hong Kong Univ of Sci & Tech (Guangzhou), China.* We demonstrated a grating-based spatial and polarization mode multiplexer for few-mode optical fibers on a silicon photonics platform, enabling selective excitation of eight orthogonal beam channels with experimental peak coupling losses < -2.4 dB.

## Room 408A

### W4C • Wireless Integrated Sensing and Communications—Continued

**W4C.4 • 17:30**
**310Gbps Integrated Sensing and Communication Dual-Polarization IM/DD Photonic THz System,** Dayu Shi[1], Weiqi Lu[1], Yuhao Fang[1], puzhen yuan[1], Haojie Zhu[1], William Shieh[1,2]; [1]*Westlake Univ., China;* [2]*Westlake Inst. for Optoelectronics, China.* We propose a 300GHz DP-IM/DD photonic THz ISAC system, achieving 310.4 Gb/s and 8.18bit/Hz spectrum efficiency for data transmission, while realizing training-free ranging over 0.3-1.0 m within 2.7 cm accuracy.

**W4C.5 • 17:45**
**Experimental Demonstration of a Photonics-Assisted MmWave ISAC System Using ODDM Waveform,** Yanyiw Wang[1], Wenlong Lu[1], Yingxiong Song[1]; [1]*Shanghai Univ., China*. We propose and experimentally demonstrate a photonics-assisted millimeter-wave integrated sensing and communication (ISAC) system employing ODDM waveform, achieving a data rate of 23 Gbit/s and a sensing resolution of 3 cm.

## Room 408B

### W4D • Distributed Sensing II—Continued

**W4D.4 • 17:30**
**Dual-Sequence Global Matching Algorithm Based on Image Demodulation for Distributed Strain Sensing by OFDR,** tenghua ai[1], Cunzheng Fan[1], weiliang zhao[1], Hao Li[1], Zhijun Yan[1], Qizhen Sun[1]; [1]*Huazhong Univ of Science and Technology, China*. A dual-sequence global matching algorithm based on image demodulation is proposed to suppress the spectral mismatch in OFDR systems, achieving an experimental strain measurement range of 6000 με and a 4.7 dB improvement in SNR.

**W4D.5 • 17:45**
**Brillouin Optical Time Domain Reflectometry With Time Expansion Scheme Based on Dual Optical Frequency Combs for 5 cm Spatial Resolution,** Jae Hyeong Youn[1], María R. Fernández-Ruiz[1], Sonia Martin-Lopez[2], Miguel Gonzalez-Herraez[2]; [1]*Universidad de Alcala Escuela Politecnica Superior, Spain;* [2]*Consejo Superior de Investigaciones Cientificas, Spain*. Brillouin optical time domain reflectometry with a 5 cm spatial resolution and 1 MHz frequency resolution is experimentally demonstrated using a time expansion scheme, reducing the required sampling rate 2000-fold to 2GSa/s.

## Room 411

### W4E • Advanced Semiconductor Laser Sources—Continued

**W4E.4 • 17:30**
**High-Performance, Cost-Effective SWIR VCSELs: a New Source for Optical Interconnects,** JIN-HO KANG[1,2], chenziyi mi[1,2], Ying Ke[3], Cheng-jie Wang[3], Chia-Feng Lin[3], Jung Han[1]; [1]*Yale Univ., USA;* [2]*Inphred Inc., USA;* [3]*Inphred Inc., Taiwan.* We demonstrated mass-producible InP-based SWIR VCSELs with a 3λ-thick cavity, achieving nearly 30% peak PCE and a 9 GHz modulation bandwidth from 10-um apertures, showing strong potential for low-power and high-speed optical interconnects in O- and C-bands.

**W4E.5 • 17:45**
**O-Band Membrane Surface-Emitting Laser on a Si Substrate Demonstrating 100-Gbps PAM-4 Operation,** Takuma Tsurugaya[1], Yoshiho Maeda[1], Nikolaos-Panteleimon Diamantopoulos[1], Takuma Aihara[1], Takuro Fujii[1], Erina Kanno[1], Tomonari Sato[1], Fumio Koyama[2], Shinji Matsuo[1]; [1]*Device Technology Labs., NTT, Inc., Japan;* [2]*Inst. of Integrated Research, Inst. of Science Tokyo, Japan.* We demonstrate an O-band surface-emitting laser on a Si substrate, based on an in-plane membrane distributed-reflector laser with a second-order surface grating, exhibiting a high modulation efficiency and 100-Gbps PAM-4 operation over 2-km SSMF.

## Room 501ABC

### W4F • High-Speed Coherent PON Systems and Enabling Technologies—Continued

**W4F.4 • 17:30** ★ Top-Scored
**Advanced Digital FOE Methods for Ultra-Wide Carrier Frequency Offset Handling in Coherent TDM PON,** Haipeng Zhang[1], Zhensheng Jia[1], Luis Alberto Campos[1], Curtis Knittle[1]; [1]*CableLabs, USA.* We propose two digital FOE methods achieving ±20 GHz CFO compensation for coherent TDM PONs. Experimental results demonstrated resilient super-rated 100G/200G transmissions over 50 km under severe CFO without additional hardware requirements, enabling cost-effective coherent access networks.

**W4F.5 • 17:45** ★ Top-Scored
**DC Leakage-Induced ONU Interference and Mitigation in 200G Burst-Mode Coherent PON,** Ognjen Jovanovic[1], Gabriele Di Rosa[1], M. Ahmed Leghari[1], Martin Kuipers[2], Jim Zou[3], Jörg-Peter Elbers[1]; [1]*Adtran Networks SE, Germany;* [2]*Adtran Networks SE Berlin, Germany;* [3]*Adtran Networks North America, USA.* We study interference from DC leakage of non-transmitting ONUs for 200Gbit/s coherent PON and evaluate mitigation strategies. Experiments and simulations show that a low-complexity OLT digital high-pass filter outperforms adaptive equalization for signal-to-interference-ratio ≤10dB.

## W4G • Panel: Is the Ecosystem Ready for Multicore Fibers?—Continued

## W4H • Next-Gen Pluggables & High-Reliability DCI—Continued

**W4H.4 • 17:30**
**Auto-Allocating OCS Based on Real Time Flow-Granularity Controller for LM Training,** liang gao[1], Shikui Shen[2], jiameng pan[3], fengtao chen[4], siyi liao[4], wei chen[3], Huiqin Liu[1], Wenzhe Li[5], Yakun Hu[2], bowen han[2], runing wang[3], Bingli Guo[1], Xiongyan Tang[2], Shanguo Huang[1], Xuwei Xue[1]; [1]*Beijing Univ. of Posts and Telecommunications Inst. of Information Photonics and Optical Communications, China;* [2]*China Unicom Research Inst., China;* [3]*Infrawaves, China;* [4]*China United Network Communications Group Co. Ltd. Shanghai, China, China;* [5]*Inst. of Computing Technology Chinese Academy of Sciences, China*. We present a per-flow controlling system for an O/E hybrid network that decreases All-Reduce time by 50.3% and increases bandwidth-utilization by 47.1%, delivering faster LM training than all-electrical network with a 32.14% reduction in power-consumption.

**W4H.5 • 17:45** ★ Top-Scored
**Field Trials of 600-km Large Language Model Distributed Training Across Long-Haul Multi-AIDCs,** Baoluo Yan[1], Hu Shi[1], Yafeng Pan[1], Dongchen Zhang[1], Zhijian Feng[1], Yan Zhao[1], Hong Liu[1], Huan Chen[1], Lei Zhang[2], Jie Luo[2], Kezhi Qiao[1], Yong Chen[1]; [1]*ZTE Corporation, China;* [2]*Yangtze Optical Fibre and Cable Joint Stock Ltd Co, China*. We achieved 1,024-GPUs, LLaMA2-70B, distributed training across long-haul 600-km muti-AIDCs with <5% DP and <1% PP efficiency degradation using 16-λ×800 Gb/s OTN. Inter-AIDC traffic and latency requirements were thoroughly analyzed.

## W4I • Symposium: Generative AI for Optical Networking II—Continued

**W4I.3 • 17:30** Invited
**Self-Governing Networks With Agentic AI and Data-Centric Approaches,** Imen Grida Ben Yahia[1]; [1]*Amazon Web Services, UK*. This presentation will discuss self-governing networks with agentic AI and data-centric approaches.

## W4J • Ultra-High-Speed Subsystems—Continued

**W4J.5 • 17:30** Tutorial
**Coherent Optics in the 2030s: Emerging Technologies and Subsystem Architectures,** Di Che[1]; [1]*Nokia Bell Labs, USA*. This tutorial forecasts the emerging technologies defining the next decade of coherent optics. We analyze the potential of these innovations to reshape future subsystem architectures and deployment models.

Di Che joined Nokia Bell Labs in 2018. His research interests include advanced modulation formats, novel digital subsystems, integrated transceivers and ultrahigh-speed transmissions. He has authored over 150 publications and presented 10+ post-deadline papers at OFC and ECOC. He is a recipient of the Tingye Li Innovation Prize and the Marconi Society Young Scholar Award.

## W4K • Photonic Integrated Quantum Devices: Sources, Detectors & Receivers—Continued

**W4K.5 • 17:30**
**Compact GHz-Gated InGaAs/InP SPAD Arrays for Quantum Key Distribution,** Louise Wells[1], Joseph Dolphin[1], Rose Scowen[1], David Ellis[2], Abbie Lowe[2], Benjamin Ramsey[2], Iwan Davies[3], Andrew J. Shields[1], Mark Stevenson[1], Taofiq Paraiso[1]; [1]*Toshiba Europe Ltd- Cambridge Research, UK;* [2]*Univ. of Cambridge Department of Physics, UK;* [3]*IQE, UK*. This work addresses scalable photonic integration of non-cryogenic detectors for quantum key distribution. Using GHz-gated InGaAs/InP SPAD arrays and silica waveguides, we achieve secure key rates over 15 kbps across 100 km.

**W4K.6 • 17:45** Invited
**Low-Loss Cryo-Compatible Optical Packaging for Photonic Quantum Interconnects,** Chawina De-Eknamkul[1], Prithvi Gundlapalli[1], Bart Machielse[1]; [1]*IonQ Inc., USA*. We present an ultra-low-loss, cryogenically compatible fiber-to-chip packaging technology based on adiabatic optical interfaces. This approach meets the stringent loss and environmental requirements imposed by quantum applications and helps drive the performance of quantum photonic circuits.

## Room 403A

### W4A • Optical Network Optimization and Scaling II—Continued

**W4A.7 • 18:00** Invited

**Design of Generative AI Analytic Agents for Fiber Network Optimization,** Zhengye Liu[1]; [1]*AT&T Corp, USA*. This talk explores leveraging Generative AI analytic agents to autonomously retrieve and analyze fiber network data. The approach enables optimization for diverse design goals, supporting both network-wide assessments and targeted analysis of individual fiber lines.

## Room 403B

### W4B • Fiber-to-Chip Coupling—Continued

**W4B.6 • 18:00**

**Broadband Dual-Mode Grating Coupler for Efficient Fiber to Chip Interface in Mode Division Multiplexing Systems,** Guanyu Chen[1], Ziyao Zhang[1], Mengyuan Ye[2], Siyuan Zhou[1], Shuwei Wu[2], Tao Zhu[1]; [1]*Chongqing Univ., China*; [2]*China Univ. of Geosciences, China*. We demonstrate a dual-mode coupler using blazed subwavelength gratings, achieving 3.03 dB ($TE_0$–$LP_{01}$) and 3.75 dB ($TE_1$–$LP_{11}$) insertion losses with >50 nm 1 dB bandwidth for broadband MDM interfaces.

## Room 408A

### W4C • Wireless Integrated Sensing and Communications—Continued

**W4C.6 • 18:00**

**Integrated sub-pε/√Hz Flexible DAS and 26×20 GBd Comb-Based Coherent-Lite Transmission With an LFM Probe,** Chenbo Zhang[1], Yi Zou[1], Yixiao Zhu[2], Xu Liu[1], Jingjing Lin[1], Jiachuan Yang[1], Weiwei Hu[1], Weisheng Hu[2], Zhangyuan Chen[1], Xiaopeng Xie[1]; [1]*Peking Univ., China*; [2]*Shanghai Jiao Tong Univ., China*. We demonstrate win-win ISAC architecture enabled by a shared linear-frequency-modulated probe, simultaneously achieving unprecedented DAS sensitivity of 0.6pε/√Hz@10m spatial resolution, reconfigurable resolution down to 0.52m, and comb-based phase-related-DSP-free coherent-lite transmission of 62.4-Tb/s CPRI-equivalent-rate signals.

**W4C.7 • 18:15**

**Si-SiN Focal Plane Switch Array Chip Enabled Parallel Solid-State LiDAR,** Yingzhi Li[1], Baisong Chen[1], Ziming Wang[1], Jie Li[1], Xiangyi Sun[1], Huan Qu[1], heming hu[1], Weipeng Wang[1], Zihao Zhi[1], Min Tao[1], Xiaolong Hu[1], Xueyan Li[1], Junfeng Song[1]; [1]*Jilin Univ., China*. We demonstrate a solid-state LiDAR based on a Si-SiN focal plane switch array (FPSA). The system achieves 117.55 μm ranging precision over 100.82 m and realizes 3D point-cloud imaging in parallel detection mode.

## Room 408B

### W4D • Distributed Sensing II—Continued

**W4D.6 • 18:00**

**Laser Diode Based Demodulation for Spatially Resolved Fiber Fault Detection,** Lukas Bernhardt[2], Esther Renner[2], Bernhard Schmauss[2,1]; [1]*Max-Planck-Institut fur die Physik des Lichts, Germany*; [2]*Friedrich-Alexander-Universitat Erlangen-Nurnberg, Germany*. We achieve spatially resolved fiber fault detection using a single laser diode and its built-in photodiode. By utilizing IOFDR with homodyne down-conversion in the laser cavity, reflections below 1% can be detected.

## Room 411

### W4E • Advanced Semiconductor Laser Sources—Continued

**W4E.6 • 18:00** Invited

**Optical Frequency Combs Using Mode-Locked Quantum Dot Lasers for Ultra-Broadband Optical Interconnects,** Bozhang Dong[1], John Bowers[2]; [1]*Université Laval, Canada*; [2]*Univ. of California Santa Barbara, USA*. We present an O-band quantum-dot laser that exploits FM mode-locking to generate optical frequency combs with a record 3-dB bandwidth of 2.2 THz. This enables seamless integration with DWDM systems and supports >10 Tbps optical interconnects, making it a compelling solution for next-generation AI data centers demanding scalable, high-throughput, and energy-efficient optical links.

## Room 501ABC

### W4F • High-Speed Coherent PON Systems and Enabling Technologies—Continued

**W4F.6 • 18:00**

**240-Gbps Simplified Super-Rate Coherent TFDM-PON in Upstream With Dual-LO Adaptive Power Control in Both Time and Frequency Domain,** Penghao Luo[1], An Yan[1], Xuyu DENG[1], Renle Zheng[1], Yongzhu Hu[1], Junhao Zhao[1], Shuhong He[1], Aolong Sun[1], Boyu Dong[1], Zhixue He[2], Nan Chi[1], Junwen Zhang[1]; [1]*Fudan Univ., China*; [2]*Pengcheng Laboratory, China*. We experimentally demonstrate a 240-Gbps simplified super-rate coherent TFDM-PON upstream architecture employing dual local-oscillators with adaptive power control, achieving >25-dB time-domain burst dynamic range, robustness to >16-dB frequency-domain subcarrier-power difference, and effective DC-leakage mitigation capability.

**W4F.7 • 18:15**

**DSP Simplification for Coherent TDM and TFDM PON via CFO Reuse and Warm-Start Phase Recovery,** Haipeng Zhang[1], Zhensheng Jia[1], Curtis Knittle[1]; [1]*CableLabs, USA*. We experimentally demonstrate a CFO reuse and warm-start phase recovery for coherent TDM/TFDM PON, reducing DSP complexity significantly with <1 dB penalty for DP-16QAM and negligible penalty for DP-QPSK over 50-km transmission.

## W4G • Panel: Is the Ecosystem Ready for Multicore Fibers?—Continued

## W4H • Next-Gen Pluggables & High-Reliability DCI—Continued

**W4H.6 • 18:00** Invited

**Research and Practice of Optical Network Technology for High Reliability Interconnection of Large Scale Data Centers,** Yuyang Liu[1], Anxu Zhang[1], Hao Liu[1], Wenqiang Zhang[2], Xiaoli Huo[1], Junjie Li[1], Chengliang Zhang[1]; [1]*China Telecom Research Inst., State Key Laboratory of Optical Fiber and Cable Manufacture Technology, China;* [2]*China Telecommunications Corporation, China.* We have demonstrated a scalable optical network architecture integrating 800 Gbit/s or beyond coherent transmission, optical circuit switching, and telecom-grade ultra-fast rerouting technologies to enable highly reliable, low-latency and large-scale inter- and intra-data center networks, validated in both lab and field.

## W4I • Symposium: Generative AI for Optical Networking II—Continued

A discussion will follow the presentations.

## W4J • Ultra-High-Speed Subsystems—Continued

## W4K • Photonic Integrated Quantum Devices: Sources, Detectors & Receivers—Continued

**W4K.7 • 18:15**

**Sub-100-Hz Dark Count Rate O-Band-Optimized InGaAsP/InP Fiber-Pigtailed SPAD Module,** Elisa Collin[1], Pascal Rustige[1], Patrick Runge[1], Martin Schell[1,2]; [1]*Fraunhofer HHI, Germany;* [2]*Technische Universitat Berlin, Germany.* We present an InGaAsP/InP SPAD module with a DCR below 100 Hz for 22.5 % PDE at 229 K and 1 kHz for 35.5 % at 233 K. The NEP is fivefold lower than the state-of-the-art. The QBER estimation is 0.5 % over 100 km.

## Room 403A

**08:00–10:00**
**Th1A • Short Reach Optical and THz Interconnects**
*Presider: Xin Yin; Ghent Univ. - IMEC, Belgium*

**Th1A.1 • 08:00** Invited
**Intra-Data Center THz Interconnects,** David F. Welch[1]; [1]*AttoTude, USA*. Scale Up data center networks require high reliability, low power, scalable interconnects. Recent performance data achieved in THz ASICs near 800 GHz will be presented. Configurations include 224, 448 Gbps PAM4 & UCI/e data formats.

## Room 403B

**08:00–10:00**
**Th1B • Clock Recovery and EEPN Mitigation**
*Presider: Timo Pfau; Cisco Systems Inc., USA*

**Th1B.1 • 08:00** Invited
**Dynamic EEPN Impulse Response Modeling and DSP Compensation for Single-Carrier Coherent Receivers,** Wei-Ren Peng[1]; [1]*Omattrix Ltd., Co, USA*. We present a dynamic closed-form EEPN model capturing time-varying pulse distortion and accurately predicting waveform and SNR, enabling optimized equalizer design that leverages the model's structure to compensate EEPN in high-baud single-carrier systems.

## Room 408A

**08:00–09:45**
**Th1C • Datacenter Subsystems and High Data Rate Transceivers**
*Presider: Antonio Tartaglia; Ericsson, Italy*

**Th1C.1 • 08:00** Tutorial
**400G/Lane Signaling Ecosystem and Standard,** Ali Ghiasi[1]; [1]*Ghiasi Quantum LLC, USA*. AI Scale-UP and Scale-Out bandwidth demand are driving the SerDes rate to 400 Gb/s. For the first time electrical signaling will be based on PAM6/8 (~181/151 GBd), but optical signaling will remain PAM4 (~227 GBd).

Dr. Ghiasi serves as the president of Ghiasi Quantum LLC, a Silicon Valley consulting firm focused on high-speed signaling and optical interconnects. He has held senior roles at Broadcom, Sun Microsystems, 3M, and IBM, where his work consistently centered on high-speed signaling and optical interconnect technologies.

## Room 408B

**08:00–10:00**
**Th1D • Photonics Platforms, Fabrication Methods, and Low Loss Materials**
*Presider: Keita Yamaguchi; NTT Corporation, Japan*

**Th1D.1 • 08:00**
**Photonics Heterogeneous Integration (PHI) of Thin-Film Lithium Niobate and Hydrogen-Free Silicon Nitride on a 200-mm Silicon Photonics Platform,** Landobasa Tobing[1,2], Bo Li[1,2], Biwei Pan[2], Chen lau[2], Andrew W. Fong[2], Yiwen Zhang[2], Yanmei Cao[2], Jingkai Zhou[1], Suan Neng Foo[2], Wen Qi Tan[2], Chaeeun Lee[1,2], Jae Ok Yoo[1,2], Masahisa Fujino[1,2], Ling Xie[1], Nandini Venkataraman[1,2], Ser Choong Chong[1], Tanmay Ghosh[1,2], Mengyao Zhao[3], Di Zhu[3], Kah-Wee Ang[3,2], Navab Singh[1,2], Leh Woon Lim[1,2], Xianshu Luo[1,2], Yee-Chia Yeo[2]; [1]*Inst. of Microelectronics (IME), Singapore;* [2]*National Semiconductor Translation and Innovation Centre (NSTIC), Singapore;* [3]*National Univ. of Singapore, Singapore*. We demonstrate 200-mm wafer-scale photonic heterogeneous integration platform comprising TFLN modulator and hydrogen-free SiN using die-to-wafer bonding. High-efficiency light transmission between SiN and TFLN waveguides is demonstrated using MZI modulator with 2.9 Vcm modulation efficiency.

**Th1D.2 • 08:15**
**Dense Interconnect Routing of Visible Deuterated Silicon Nitride ($SiN_x$:D – $SiO_y$:D) Photonic Integrated Circuits,** Mohammad Rabbani[1], Sam Turkington[1], Abdur Rahman Akib[1], Keith Markham[1], Greg Allion[1], Eunso Shin[1], Collin Roy[1], Dakota Gray-Boneker[1], Jonathan Wierer[1], Fred Kish[1], Stanley Cheung[1]; [1]*Electrical and Computer Engineering, NC State Univ., USA*. We demonstrate a low-temperature (≤300°C), low loss deuterated $SiN_x$ – $SiO_y$ platform capable of dense optical routing (bend radii < 5 um) at wavelength = 450 nm. This platform provides new opportunity for visible photonics requiring dense integration of both active and passive devices.

## Room 411

**08:00–09:45**
**Th1E • Terrestrial Free Space Optics**
*Presider: Devin Brinkley; Google X, USA*

**Th1E.1 • 08:00**
**Full-Duplex MmWave/FSO Transmission Over Shared Aperture With Optical Focal Plane Array Feed,** Florian Honz[1], Bernhard Schrenk[1]; [1]*Austrian Inst. of Technology GmbH, Austria*. We show mm-wave/FSO transmission over a shared antenna aperture with multi-core fiber feed. Full-duplex 10Gb/s FSO and OFDM transmission at 26.5/33.7GHz is proven for a fiber-wireless link, using a simplified EAM transceiver at the fronthaul.

**Th1E.2 • 08:15**
**Experimental Monitoring and Data-Driven Modelling of Outdoor FSO Links,** Lorenzo Zerboni[1], Riccardo Benegiamo[1], Andres I. Martinez[1], Angelo Milani[2], Laura Resteghini[2], Lorenzo Luini[1], Andrea Melloni[1], Francesco Morichetti[1]; [1]*Politecnico di Milano, Italy;* [2]*Huawei Technologies Italia Srl Milan, Italy*. We report on the scintillation and polarization experimental characterization and their data-driven estimation of an 800-m-long outdoor FSO link using data acquired continuously over 60 days with 1-ms resolution using a polarization-sensitive optical analyzer.

## Room 501ABC

**08:00–10:00**
**Th1F • Optical Sources and Their Applications**
*Presider: Vladimir Gordienko; Aston Univ., UK*

**Th1F.1 • 08:00**
**Deep-Ultraviolet to Mid-Infrared Supercontinuum Generation in Chirped Poled Lithium Tantalate Waveguides,** hongzhi xiong[1], Xinmin Yao[1], Qingrui Yao[1], Zejie Yu[1], Ming Zhang[1], Daoxin Dai[1]; [1]*Zhejiang Univ., China*. We demonstrate a chirped poled Lithium Tantalate waveguide for ultrawideband supercontinuum with a 1550-nm femtosecond pulse source. The generated spectrum spans from less than 270 nm to over 2400 nm, from UVC to MIR.

**Th1F.2 • 08:15**
**Digital Fiber Interferometry for Measuring Low-Frequency Phase Noise of Single-Frequency Laser Sources,** Gregory Ivanov[1], Anton Y. Danilov[1], Edgard A. Fomiryakov[1], Oleg Nanii[1], Vladimir Treshchikov[1], Sergei P. Nikitin[1]; [1]*T8, LLC, Russian Federation*. A new method based on fiber-optical Mach-Zehnder interferometer was developed to measure low-frequency phase noise of single-frequency ultra-low-noise lasers. The technique is complimentary to self-heterodyning and demonstrates measurement capability across the range from 0.1 Hz to 5 MHz.

## Room 502A

### 08:00–09:30
### Th1G • Next-Generation Optical I/O
*Presider: Mahdi Nikdast; Colorado State Univ., USA*

**Th1G.1 • 08:00** Invited
**Programmable Network Interface Card Technology Enabling High-Bandwidth Low-Latency Data Transfer for Distributed AI Systems,** Katsumi Fukumitsu[1]; [1]*1Finity Inc., Japan*. This paper introduces programmable NIC technologies enabling scalable, high-bandwidth, low-latency, and distance-agnostic connectivity for distributed AI systems, addressing RDMA extension and dynamic bottleneck resolution in next-generation data center networks.

## Room 502B

### 08:00–10:00
### Th1H • Emerging Photonic Devices and Materials
*Presider: Wei Shi; Université Laval, Canada*

**Th1H.1 • 08:00**
**Low Threshold and RIN in 100-kHz-Class Linewidth Monolithic Dual-Mode DFB Laser With 300-GHz Frequency Spacing for sub-THz Transmission,** Chih-Hsien Cheng[1], Atsushi Matsumoto[1], Pham Tien Dat[1], Gong-Ru Lin[2], Kouichi Akahane[1]; [1]*National Inst. of Information and Communications Technology, Japan;* [2]*National Taiwan Univ., Taiwan*. 300-GHz monolithic two-mode DFB laser generated by the dicing angle change is preliminarily demonstrated to exhibit a low threshold of 12 mA, and a minimum RIN of -155 dB/Hz for future 6G and beyond networks.

**Th1H.2 • 08:15**
**Silicon-Organic Hybrid (SOH) Racetrack Modulators for 200 Gbit/s PAM4 Signaling With Ultra-low Drive Voltages,** Hend H. Kholeif[1,2], Adrian Schwarzenberger[1], Alexander Kotz[1], Sidra Sarwar[3,4], Dengyang Fang[1], Peter Erk[1,4], Stefan Bräse[3], Artem Kuzmin[1,2], Wolfgang Freude[1], Christian Koos[1,4]; [1]*Inst. of Photonics and Quantum Electronics (IPQ) / Inst. of Microstructure Technology (IMT), Karlsruher Institut für Technologie, Germany;* [2]*Inst. of Microstructure Technology, Karlsruher Institut fur Technologie, Germany;* [3]*Inst. of Biological & Chemical Systems and Functional Molecular Systems, Karlsruher Institut fur Technologie, Germany;* [4]*SilOriX GmbH, Germany.* We demonstrate a silicon-organic hybrid (SOH) racetrack modulator enabling 200 Gbit/s PAM4 signaling at drive voltages with a 220 $mV_{pp}$ peak-to-peak swing – a record-low value for technically relevant data rates. Our experiment represents the first demonstration of optical signaling in an SOH racetrack modulator.

## Room 515A

### 08:00–10:00
### Th1I • Security & AI-Driven Network Operation
*Presider: Cen Wang; KDDI Research Inc., Japan*

**Th1I.1 • 08:00**
**In-Service Laser Anomaly Detection via DSP-Enabled Optical Performance Monitoring,** Taisei Sekizuka[1], Koki Mano[1], Takuma Kuno[1], Hiroshi Hasegawa[1], Yojiro Mori[2,1]; [1]*Nagoya Univ., Japan;* [2]*Toyota Technological Inst., Japan*. We propose an in-service OPM technique for detecting laser anomalies from DSP data without extra hardware. 100-Gbaud transmission experiments over 1,600 km demonstrate linewidth accuracy within 7% and robustness under realistic network conditions.

**Th1I.2 • 08:15**
**Continuous-Oriented Edge Flow Graph Model for Root Alarm Identification in Optical Network,** Yuying Zhang[1], Chunyu Zhang[2], Cheng Xing[1], Min Zhang[1], Changjian Sun[1], Danshi Wang[1]; [1]*Beijing Univ. of Posts and Telecomm, China;* [2]*Univ. of Science and Technology Beijing, China*. A continuous-oriented edge flow graph model is proposed to address feature homogenization in optical network by modeling the directionality of causal alarm propagation, which preserves node distinctiveness, achieving the root alarm identification accuracy of 0.9795.

## Room 515B

### 08:00–09:45
### Th1J • Hollow-core Fiber Transmission Systems
*Presider: Gabriel Charlet; Huawei Technologies France, France*

**Th1J.1 • 08:00** Invited
**Real-Time Data Transmission Over Hollow-Core Fiber Links,** Abdallah Ali[1], Yang Hong[1], Morteza Kamalian-Kopae[1], Shahab Bakhtiari Gorajoobi[1], Yawei Yin[1], David Richardson[1], Jamie Gaudette[1], Benjamin J. Puttnam[1]; [1]*Microsoft, UK*. We present real-time transmission experiments demonstrating hollow-core fiber capabilities: record 301.7 km single-span metro transmission, 25.6 Tb/s full C-band over 200.5 km, and up to 11,000 km reach using recirculating-loop long-haul systems for future networks.

## Room 518

### 08:00–09:45
### Th1K • Optimization and Virtualization in Future PONs
*Presider: Lihua Ruan; Peng Cheng Laboratory, China*

**Th1K.1 • 08:00**
**Real-Time, 1-m Resolution Measurement of the Optical Distribution Network of a 21-km, 1:32 PON With a Coherent Optical Frequency Domain Reflectometer,** Patrick Iannone[1], Lauren Dallachiesa[1], Mikael Mazur[1], Nicolas K. Fontaine[1], Roland Ryf[1], Ells Burrows[1], Mohamad Hossein Idjadi[1], David Neilson[1]; [1]*Nokia Bell Labs, USA*. We demonstrate a coherent optical frequency-domain reflectometer (C-OFDR) measuring a 21-km, 1:32 split passive optical network, achieving detailed Rayleigh-limited fiber characterization and identification of all distribution fiber ends with only 60-ms acquisition time.

**Th1K.2 • 08:15**
**Cost-Effective 228-Gb/s Extended-Reach SC-PON Using a Dithered Uncooled DFB Laser and Hybrid Integrated Stokes Receiver,** Yuhao Fang[1], Haojie Zhu[1], Xue Cheng[2], Weiqi Lu[1], Puzhen Yuan[1], Dongxu Lu[2], Dayu Shi[1], Honglin Ji[3], William Shieh[1,2]; [1]*Westlake Univ., China;* [2]*Westlake Inst. for Optoelectronics, China;* [3]*Pengcheng Laboratory, China*. We demonstrate a 228 Gb/s extended-reach SC-PON over 40.72 km SMF with a 31.2-dB power budget, which is enabled by a fully integrated ONU receiver and a cost-effective, dithered uncooled TO-Can packaged DFB laser.

## Th1A • Short Reach Optical and THz Interconnects—Continued

**Th1A.2 • 08:30**
**200G/Lane 50-m Multimode VCSEL Link by Low-Material-Dispersion Graded-Index Plastic Optical Fiber,** Kenta Muramoto[1], Hongdi Mou[2], Yasuhiro Koike[1]; [1]*Keio Photonics Research Inst. (KPRI), Keio Univ., Japan;* [2]*Optical Systems Division, Broadcom Inc, USA.* We demonstrate 212.5 Gb/s per lane PAM4 transmission over a 50-m low-material-dispersion graded-index plastic optical fiber. This fiber overcomes chromatic dispersion limits in multimode VCSEL links, extending the speed and reach of short-reach optical interconnects.

**Th1A.3 • 08:45**
**180 Gb/s PAM-4 Optical Link by Cryogenic VCSEL,** Zetai Liu[1,2], Haonan Wu[1,2], Yulin He[1,2], Derek Chaw[1,2], Milton Feng[1,2]; [1]*Department of Electrical and Computer Engineering, Univ. of Illinois Urbana-Champaign, USA;* [2]*Holonyak Micro and Nanotechnology Laboratory, Univ. of Illinois Urbana-Champaign, USA.* We have developed 1/2-λ cavity Cryo-VCSELs with 4.5-μm oxide-aperture and achieved bandwidth $f_{-3dB}$ > 50 GHz at 2 mA. Record-speed 180 Gb/s PAM-4 link at 3 K is demonstrated toward energy efficient < 50 fJ/bit.

## Th1B • Clock Recovery and EEPN Mitigation—Continued

**Th1B.2 • 08:30**
**A Blind Domain-Informed Filter Ensemble for Equalization-Enhanced Phase Noise Mitigation,** Vladislav Neskorniuk[1], Andre Richter[1]; [1]*VPIphotonics, Germany.* We propose a blind compensator of equalization-enhanced phase noise (EEPN) that leverages domain knowledge to simplify its own training. Numerical results on a prospective 1.6-Tbit/s long-haul coherent link demonstrate significant SNR gains and performance robustness.

**Th1B.3 • 08:45**
**On the Similarity Between Equalization-Enhanced Phase Noise and Equalization-Enhanced Timing Jitter,** Ahmed M. Medra[1], Amirhossein Mohammadian[1], Chuandong Li[1], Mary Fung[1], Xuefeng Tang[1]; [1]*Huawei Technologies Co., Canada.* Mathematical formulations of equalization-enhanced phase noise (EEPN) and equalization-enhanced timing jitter (EETJ) are derived, demonstrating they can both be characterized as phase/jitter-induced multipath distortions. Thus, they can be compensated using a unified architectural approach.

## Th1C • Datacenter Subsystems and High Data Rate Transceivers—Continued

## Th1D • Photonics Platforms, Fabrication Methods, and Low Loss Materials—Continued

**Th1D.3 • 08:30**
**Glass Waveguides With 0.01 dB/cm Bend Loss for High-Speed, High-Density Optical Fan-Out for Co-Packaged Optics,** Jorge A. Holguin Lerma[1], Lars Brusberg[1], Matthew J. Dejneka[1], Lucas Yeary[1], Chad Terwilliger[1], Jason Hurley[1], Betsy Johnson[1], Charisse Spier[1], Jonathan E. Walter[1], Sean M. Garner[1], Chuan Che Wang[1], Qiumei Bian[1], Katerina Rousseva[1]; [1]*Corning Research and Development Corporation, USA.* Low bend loss (0.01 dB/cm, R>6 mm, λ=1310 nm) ion-exchanged waveguides in optimized glass (heat-resistant, >5-year, 110°C), enabled compact fan-outs for fiber-to-chip pitch conversion (16-waveguide, ≥50-μm), <0.3 dB fiber-coupling loss, and O-band 400-Gbit/s PAM4 transmission.

**Th1D.4 • 08:45**
**Low Loss and Mass Producible Multi-Core Fiber Fan-in/Fan-Out Device Based on Laser Direct Writting Glass Waveguides,** Xinliang Xu[1,2], Rongyi lin[1,2], kangkang wei[2], Ting Lei[2], Luping Du[2]; [1]*Shenzhen Univ., China;* [2]*Shenzhen Photonics Valley Technology Co., Ltd, China.* Using femtosecond laser direct writing technology, 4-core fiber 3D waveguide fan-in/fan-out chips were fabricated in glass. At 1310 nm wavelength, the average insertion loss is measured as ~0.26 dB and ~0.36 dB (pre and post-packaging), with max value <0.5 dB and writing speed >30 mm/s.

## Th1E • Terrestrial Free Space Optics—Continued

**Th1E.3 • 08:30**
**On Irradiance Distributions for Weakly Turbulent FSO Links: Log-Normal vs. Gamma-Gamma,** Carmen Á. Roa[1], Yunus Can Gültekin[1], Vincent van Vliet[1], Menno van den Hout[1], Chigo M. Okonkwo[1], Alex Alvarado[1]; [1]*Technische Universiteit Eindhoven, Netherlands.* Weak turbulence is commonly modeled using the log-normal distribution. Our experimental results show that this distribution fails to capture irradiance fluctuations in this regime. The Gamma-Gamma model is shown to be more accurate.

**Th1E.4 • 08:45**
**Bidirectional 3-km FSO Transmission Using Multi-Aperture Space Diversity and Digital Subcarrier Combining,** Aymeric Arnould[1], Abraham Johst[1,2], Robert Emmerich[1], Marcel Rothe[1], Peter Hanne[1], Colja Schubert[1], Nicolas Perlot[1], Markus Nölle[2], Georg Rademacher[1,3], Ronald Freund[1,4]; [1]*Fraunhofer-Institut fur Nachrichtentechnik Heinrich-Hertz-Institut HHI, Germany;* [2]*Hochschule fur Technik und Wirtschaft Berlin, Germany;* [3]*Universitat Stuttgart, Germany;* [4]*Technische Universitat Berlin, Germany.* Digital subcarrier combining is used for bidirectional FSO transmission between single- and multi-aperture terminals, with only one transmitter and receiver per direction. Two digital combining schemes are evaluated on a 3-km link over 24 hours.

## Th1F • Optical Sources and Their Applications—Continued

**Th1F.3 • 08:30** Invited
**Optical Parametric Oscillators,** Majid Ebrahim-Zadeh[1]; [1]*Nonlinear Optical Systems, Radiantis, Spain.* The latest advances in optical parametric oscillators for the generation of coherent radiation from the ultraviolet to mid-infrared, and from continuous-wave to femtosecond timescale, including new concepts for frequency combs and soliton formation are presented.

## Room 502A

### Th1G • Next-Generation Optical I/O—Continued

**Th1G.2 • 08:30**
**Three-Mode Reconfigurable Optical Add-Drop Multiplexer,** Zhaoqi Ma[1], Seyed Mohammad Reza Safaee Ardestani[1], José Garcia-Echeverria[1], Odile Liboiron-Ladouceur[1]; [1]*McGill Univ., Canada*. We design a three-mode ROADM building block using mode-selective phase shifters, achieving eight switching states. One add/drop state is experimentally demonstrated at two wavelengths, successfully routing 40 Gbps data per mode.

**Th1G.3 • 08:45**
**Low-Power and Short-Distance Wireless Optical Interconnection System Based on 1.6 GHz Bandwidth Red Micro-LED,** Yu Zhang[1], Runze Lin[1], Handan Xu[1], Erdan Gu[1], Pengfei Tian[1]; [1]*Fudan Univ., China*. The short-distance wireless optical interconnection system based on 1.6 GHz high-bandwidth red micro-LED transferred to diamond substrate achieved 1.5 Gbps at low current, with a DC power consumption of 0.22 pJ/bit.

## Room 502B

### Th1H • Emerging Photonic Devices and Materials—Continued

**Th1H.3 • 08:30**
**DC-to-GHz Modulators in Ferroelectric Nematic Liquid Crystal-on-Si Platforms,** Iman Taghavi[1], Alexander Tofini[1], Cory Pecinovsky[2], Nicolas Jaeger[1], Lukas Chrostowski[1], Sudip Shekhar[1]; [1]*Univ. of British Columbia, Canada;* [2]*Polaris Electro-Optics Inc, USA*. We introduce a proof-of-concept of a foundry-compatible ferroelectric nematic liquid crystal-on-silicon platform for miniaturized optical modulators. Its operation is based on a dual-mechanism phase shift, negating the need for power-intensive thermo-optic heaters or electrical poling.

**Th1H.4 • 08:45**
**High Efficiency and High Speed Electro-Optical Modulator Based on Hybrid Calcium Titanate and Lithium Niobate,** Wenqu Su[1], Guanyu Chen[1], Tao Zhu[1], Hua Yu[1]; [1]*Chongqing Univ., China*. We demonstrate a hybrid calcium titanate and thin film lithium niobate electro-optical modulator with 1.3 V•cm efficiency, > 110 GHz bandwidth and 0.86 dB insertion loss.

## Room 515A

### Th1I • Security & AI-Driven Network Operation—Continued

**Th1I.3 • 08:30**
**First Field-Operational GraphRAG Agent for Information Query in Large-Scale Hierarchical Optical Networks,** Xingyu Liu[1,3], Fan Gao[3], Boyuan Yan[3], Zhao Sun[2], Liang Dou[2], Yuanchao Su[3], Weisheng Hu[1], Qunbi Zhuge[1]; [1]*Shanghai Jiao Tong Univ., China;* [2]*Alibaba Cloud, Alibaba Group, China;* [3]*Alibaba Cloud, Alibaba Group, China*. We design and demonstrate the first field-operational GraphRAG agent for real-time information query in large-scale hierarchical optical networks, achieving 96.25% Natural Language-to-Gremlin accuracy via Knowledge Graph General Rules and iterative optimization.

**Th1I.4 • 08:45**
**Cross-Operator and Security-Preserving Federated QoT Estimation Over Heterogeneous SDM Optical Networks,** Zhiming Sun[1], Cen Wang[2], Xian Zhou[3], Fan Zhang[1]; [1]*State Key Laboratory of Photonics and Communications, Frontiers Science Centre for Nano-optoelectronics, School of Electronics, Peking Univ., China;* [2]*Photonics Division, Kabushiki Kaisha KDDI Sogo Kenkyujo, Japan;* [3]*School of Computer & Communication Engineering, Univ. of Science and Technology Beijing, China*. We propose a federated learning-based inter-operator collaborative network modeling while preventing secured data breach. International trials have demonstrated that a globally optimized model accurately estimated QoT over cross-operator heterogeneous SDM optical networks.

## Room 515B

### Th1J • Hollow-core Fiber Transmission Systems—Continued

**Th1J.2 • 08:30**
**Fiber Mixture Optimization of Future Hybrid HCF-SMF Multi-Span Transmission Systems,** Leonardo Sorensen Braga[1], Jeremie Renaudier[1], Amirhossein Ghazisaeidi[1]; [1]*Nokia Bell Labs France, France*. We demonstrate that, over various cases and constraints, hybrid HCF-SMF optical systems can exhibit equivalent performance as a full-HCF system of same reach, facilitating HCF implementation and giving a glimpse into HCF's main benefits.

**Th1J.3 • 08:45**
**Leveraging Digital Subcarrier Multiplexing for Long-Haul Transmission Over HCFs in the Presence of IMI,** Ruby Ospina[1], Carina Castineiras[1], Haik Mardoyan[1], Amirhossein Ghazisaeidi[1], Rajiv Boddeda[1], Peng Li[2], Lei Zhang[2], Jie Luo[2], Jeremie Renaudier[1]; [1]*Nokia Bell Labs France, France;* [2]*Yangtze Optical Fibre and Cable Joint Stock Ltd Co, China*. We experimentally compare the performance of single-carrier and digital multi-carrier schemes over long-haul transmission systems using low-loss hollow-core fibers. We show that digital subcarrier multiplexing provides enhanced tolerance to inter-modal interference (IMI) over long distances.

## Room 518

### Th1K • Optimization and Virtualization in future PONs—Continued

**Th1K.3 • 08:30**
**Simplified Bidirectional PON Over 22km AR-HCF With 200-Gb/s/λ Downstream and 50-Gb/s/λ Upstream,** Xumeng Liu[1], Yunhong Liu[1], Chao Li[1], Shupeng Li[1], Peng Sun[1], Songyuan Hu[1], Chao Yang[1], Qibing Wang[1], Xu Zhang[1], Zichen Liu[1], Peng Li[2], Lei Zhang[2], Zhixue He[1], Shaohua Yu[1]; [1]*Peng Cheng Laboratory, China;* [2]*Yangtze Optical Fibre and Cable Joint Stock Limited Company, China*. We demonstrate a simplified bidirectional PON over 22km AR-HCF, achieving 200-Gb/s downstream and 50-Gb/s upstream while maintaining >40dB power budgets, enabled by shared single laser source for downstream coherent detection and upstream intensity modulation.

**Th1K.4 • 08:45** Invited
**Virtualisation in Optical Access Networks: Challenges and PHY Softwarization,** Takahiro Suzuki[1], Jun-ichi Kani[1], Tatsuya Shimada[1]; [1]*Access Network Service Systems Laboratories, NTT, Inc., Japan*. The virtualisation of optical access networks is being studied, including not only control functions but also PHY functions, to realize flexibility and high efficiency. We review challenges and recent progress in virtualisation and PHY softwarization.

## Room 403A

### Th1A • Short Reach Optical and THz Interconnects—Continued

**Th1A.4 • 09:00**
**Record 91-mW Cryogenic VCSEL Enabling 140-Gb/s PAM-4 Transmission From 3 K to 40 K for Quantum Optical Interconnects,** Etina Zou[2], Zetai Liu[1], Yun-Cheng Yang[3], Milton Feng[1], Chao Hsin Wu[2,3]; [1]*Department of Electrical and Computer Engineering, Univ. of Illinois Urbana-Champaign, USA;* [2]*Graduate Inst. of Photonics and Optoelectronics, and Department of Electrical Engineering, National Taiwan Univ., Taiwan;* [3]*Graduate Inst. of Electronics Engineering, and Department of Electrical Engineering, National Taiwan Univ., Taiwan.* An 850-nm Cryo-VCSEL delivers record 91 mW at 3 K and 140 Gb/s PAM-4 operation from 3–40 K, maintaining <0.6-nm RMS width, meeting IEEE 802.3 standards for cryogenic optical links.

**Th1A.5 • 09:15** Invited
**Optical Automotive Ethernet: IEEE Std 802.3cz / Optical Communications Requirements for Automotive Applications,** Luisma Torres[1]; [1]*Knowledge Development for POF, S.L., Spain.* IEEE 802.3cz specifies 2.5G, 5G, 10G, 25G, and 50GBASE-AU for automotive applications, supporting extended temperature range, reliability, EMC, and segmented harnesses up to 40 m with four in-line connectors.

## Room 403B

### Th1B • Clock Recovery and EEPN Mitigation—Continued

**Th1B.4 • 09:00**
**Feed-Forward Jitter Correction Using Symbol-Domain Timing Error Detector and Simplified Digital Compensation,** Meng Qiu[1], Xuefeng Tang[1], Jinyao He[2], Chuandong Li[1]; [1]*Huawei Technologies Canada Co., Ltd, Canada;* [2]*Huawei Technologies Co Ltd, China.* We propose a novel feed-forward timing error detector (TED) that can directly estimate small sampling phase errors based on signal symbols. In combination with a simplified compensation approach, we can achieve effective timing jitter correction with low complexity.

**Th1B.5 • 09:15**
**Lite-Equalizer-Aided Baud-Rate Clock and Data Recovery in 256-Gb/s PAM-4 Transmission Systems,** Jiahao Zhou[1], Jinjiang Li[1], Xue Zhao[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]*Pengcheng Laboratory, China.* We propose a one-tap noise canceller in Mueller-Müller-CDR to whiten the noise, achieving 8.3-dB-jitter and triple-TED-gain improvement. For CDR-path equalization, 7-tap FFE with noise canceller outperforms 11-tap FFE by 0.5-dB receiver sensitivity in 256-Gb/s-PAM-4 systems.

## Room 408A

### Th1C • Datacenter Subsystems and High Data Rate Transceivers—Continued

**Th1C.2 • 09:00**
**Dispersion Managed Transceiver Extending CWDM IMDD to 100G/Lane 20km, 200G/Lane 10km, and 400G/Lane 3km,** Li Zhang[1], Tianshu Wu[1], Linke Li[1], Richard Xiao[1]; [1]*Linktel Technologies Co., Ltd., China.* We demonstrate dispersion-managed transceivers that extend the reach of CWDM IMDD systems. By incorporating a self-locking DMD in the RX path of a standard FR module, the design achieves 20 km at 100G/lane, 10 km at 200G/lane, and 3 km at 400G/lane.

**Th1C.3 • 09:15**
**400G/Lane for Linear-Drive Optics Applications,** Jianying Zhou[1], Lei Xin[1], Xuelei Zhang[1], Fangyuan Meng[1], Yang Liu[1], Qisheng Zhao[1], Jin Hong[1]; [1]*Ligent Technologies Inc, USA.* We demonstrate performances of 400G/lane with a high bandwidth efficient thin-film lithium niobate Mach-Zehnder modulator and practical equalizations. Our studies indicate the feasibility of 400G/lane for linear-drive optics applications in NPO/CPO with an enhanced CTLE.

## Room 408B

### Th1D • Photonics Platforms, Fabrication Methods, and Low Loss Materials—Continued

**Th1D.5 • 09:00**
**Post Fabrication Permanent Tuning of Double Ring Filters for Narrow Linewidth Integrated Laser,** Jean-Philippe Berube[1], Philippe Lassonde[1,2], Loic Arias[1], Javier Perez-Santacruz[3], Peter Girouard[3], François Légaré[2], Louis-Rafaël Robichaud[1], Dongjae Shin[3], Ruud Oldenbeuving[3]; [1]*Femtum, Canada;* [2]*Institut national de la recherche scientifique, Canada;* [3]*Stichting imec Nederland, Netherlands.* We demonstrated permanent tuning of the effective index of functional $Si_3N_4$ integrated waveguides. The refractive index of a double-ring filter is changed locally using laser trimming to adjust the central wavelength of the main resonance.

**Th1D.6 • 09:15**
**Bridging Ultrahigh-Q Integrated Microresonators With Optical Fiber Manufacturing,** Hao-Jing Chen[1], Kellan Colburn[1], Hanfei Hou[1], Hongrui Yan[1], Bruno Moog[2], Oleksandr Buchnev[2], Christopher Holmes[2], James Gates[2], Henry Blauvelt[1], Kerry Vahala[1]; [1]*California Inst. of Technology, USA;* [2]*Univ. of Southampton, UK.* Flame hydrolysis deposition is used to generate Ge:silica integrated optical resonators on a silicon wafer. Q factors exceeding 100 million are achieved from violet to NIR with a maximum value of 566 million at 1064 nm.

## Room 411

### Th1E • Terrestrial Free Space Optics—Continued

**Th1E.5 • 09:00**
**Experimental Demonstration of Probabilistically Shaped QAM Signals in a Mid-Infrared FSO Link Under Fog Conditions,** Ruoyu Zeng[1], Huibin Zhou[1], Yue Zuo[1], Yingning Wang[1], Abdulrahman Alhaddad[1], Heng Wu[1], Yixuan Zhang[1], Yichen Li[1], Zile Jiang[1], Andrew Ross[2], adam heiniger[2], Moshe Tur[3], Alan Willner[1]; [1]*Univ. of Southern California, USA;* [2]*TOPTICA Photonics Inc., USA;* [3]*Tel Aviv Univ., Israel.* We experimentally demonstrate 2 Gbit/s probabilistically shaped (PS) 16-QAM signals at 4.5-μm in a mid-infrared FSO link under fog, achieving ~0.4 dB shaping gain over uniform distributions. 3 Gbit/s PS-64-QAM transmission is also demonstrated.

**Th1E.6 • 09:15**
**Time-Interleaved Joint Spread-Spectrum Enabled Ultra-Long-Range Ultraviolet Communication,** Fengyu Cao[1], Yang Tao[1], Zhiguo zhang[1]; [1]*Beijing Univ. of Posts and Telecommunications, China.* A record-breaking 2100-m/109-kbps UV-LED quasi-LOS link enabled by time-interleaved joint spread spectrum has been demonstrated. An integrated transceiver module was developed and field-validated, with error-free, FEC-free, alignment-free robustness confirmed in both daytime and nighttime.

## Room 501ABC

### Th1F • Optical Sources and Their Applications—Continued

**Th1F.4 • 09:00** Invited
**Precision Interferometry for Gravitational Waves: How Squeezed States Can Improve Astrophysical Observation Range,** Eleonora Polini[1]; [1]*CNRS, France.* Quantum noise fundamentally limits the sensitivity of gravitational-wave detectors. It has been demonstrated that injecting frequency-dependent squeezed vacuum states reduces quantum noise across the full detection band, extending the observable universevolume and paving the way for next-generation interferometers.

## Th1G • Next-Generation Optical I/O—Continued

**Th1G.4 • 09:00**
**Multicore Fiber Coupled Backside-Emitting VCSEL/PD Arrays for High-Bandwidth Optical Interconnects in Data Center,** Weipeng Zhang[1], Manchen Hu[1]; [1]*LightXcelerate Inc, USA*. We present a 19-core-MCF-coupled co-packaged optical chiplet integrating backside-emitting VCSEL and backside-illuminated PD arrays flip-bonded to driver–TIA EICs. Fundamental optical performance and thermal-path feasibility are demonstrated, with envisioned scalability toward multi-chiplet GPU optical interconnects.

**Th1G.5 • 09:15**
**Ethernet-Over-OWC Using VCSELs: Transparent Gigabit Links With Low Latency and Robust Alignment Tolerance,** Hossein Safi[1], Isaac Osahon[1], Iman Tavakkolnia[1], Harald Haas[1]; [1]*Cambridge Univ., UK*. We demonstrate a fully bidirectional 1-Gb/s Ethernet-over-OWC link over a 1-m free-space path using a VCSEL–PIN pair and only commercially available components. The unamplified, transparent system achieves error-free operation, $<25$-ns latency, and centimetre-scale alignment tolerance.

## Th1H • Emerging Photonic Devices and Materials—Continued

**Th1H.5 • 09:00** **Tutorial**
**High-Speed Plasmonic Modulator and Detector for Data Communication,** Juerg Leuthold[1]; [1]*ETH Zurich, Switzerland*. The principles of surface and local plasmon resonances to overcome the the high-speed limitations of photonics are going to be elaborated and the options towards a new generation of 500 GHz technology are discussed.

Juerg Leuthold is Head of the Institute of Electromagnetic Fields at ETH Zurich. His research focuses on photonics, plasmonics, and THz technologies for communication applications. He previously held positions at KIT in Germany and Bell Labs, Lucent Technologies, USA, and earned his Ph.D. in physics from ETH Zurich.

## Th1I • Security & AI-Driven Network Operation—Continued

**Th1I.5 • 09:00**
**Grey-box Digital Twin Model for QoT Estimation in Field-Deployed Networks,** Xiaotian Jiang[1], Xin Qin[1], Xiaofeng Wu[2], Boya Sun[2], Yuqing Han[1], Yadong Gong[1], Peng Sun[2], Rui Liao[2], Anxu Zhang[1], Xiaoli Huo[1], Junjie Li[1]; [1]*China Telecom Research Inst., China;* [2]*China Telecom Corporation Limited Intelligent Cloud-Network Operation Center, China*. We propose a grey-box digital twin model for QoT estimation of China Telecom's field-deployed networks, which adopts a branch-trunk network to bridge gap between theory and practice, achieving 0.16dB OSNR and 0.294dB channel power errors.

**Th1I.6 • 09:15**
**AI-Assisted Identification and Characterization of Intra-Span Hybrid Fiber Types via Longitudinal Power Profile Estimation,** Md Ghulam Saber[1], Choloong Hahn[1], Zhiping Jiang[1]; [1]*Huawei Technologies, Canada, Canada*. An AI-assisted approach is presented for identifying and characterizing hybrid fiber types within spans using longitudinal power profile estimation, achieving combined accuracy of 97% with simulated data and 90.9% with experimental measurements under zero-shot learning.

## Th1J • Hollow-core Fiber Transmission Systems—Continued

**Th1J.4 • 09:00** ★ **Top-Scored**
**222-km-Long Hybrid Span Transmission Systems Made of Support Tube Hollow Core Fiber and of Standard Single Mode Fiber Using High Power Doped Fiber Amplifier,** Haik MARDOYAN[1], Ruby Ospina[1], Carina Castineiras[1], Amirhossein Ghazisaeidi[1], Rajiv Boddeda[1], Peng Li[2], Lei Zhang[2], Jie Luo[2], Chengpeng Fu[3], Chifeng HU[3], Jeremie Renaudier[1]; [1]*Nokia Bell Labs, France;* [2]*Yangtze Optical Fibre and Cable Joint Stock Ltd Co, China;* [3]*Accelink Technology Co Ltd, China*. We demonstrate WDM long-haul transmission of 800G channels over 222-km-long hybrid spans systems with low-loss ST-HCF and SSMF. We report achieving information rate beyond 800G per channel over 1,000-km using 34-dBm high-Power doped fiber amplifiers.

**Th1J.5 • 09:15** ★ **Top-Scored**
**Transmitter Power Optimization for Uniform Performance Multi-Span Hollow-Core Fiber Transmission,** Yang Hong[1], Morteza Kamalian-Kopae[1], Abdallah Ali[1], Baset Gholizadeh[1], Simon Bawn[1], James Hooley[1], Shahab Bakhtiari Gorajoobi[1], Colin Wallace[1], Jamie Gaudette[1], David Richardson[1], Benjamin J. Puttnam[1]; [1]*Microsoft, UK*. We demonstrate real-time fully-loaded C-band (32×800G) transmission over a 442.7-km three-span HCF link. It is shown that transmitter power control can enable uniform performance despite the gas absorption impact, achieving >1.5-dB Q-margins across all channels.

## Th1K • Optimization and Virtualization in future PONs—Continued

**Th1K.5 • 09:15**
**Diagonal Turbo Product Coding for Combating PON Upstream Burst Errors,** Liga Bai[1], Lu Zhang[1], Xiaodan Pang[1], Qun Zhang[2], Xianbin Yu[1]; [1]*Zhejiang Univ., China;* [2]*Shandong Zhike Intelligence Computing Inc., China*. We present a novel diagonal turbo product coding (TPC) scheme for combating burst errors in optical communications, which optimizes post-FEC performance and achieves an additional 0.95 dB coding gain compared to the conventional TPC scheme.

## Room 403A

### Th1A • Short Reach Optical and THz Interconnects—Continued

**Th1A.6 • 09:45**
**Dynamic Evaluation of 2.32 Tbit/s Signal and 10 W Power co-Transmission Over 3 km AR-HCF,** Jianbo Zhang[1], Jianping Li[1], Xinkuo Yu[2], Wei Chen[1], Chunyu He[1], Zukai Sun[1], Peng Li[3], Lu Dai[3], Lei Zhang[3], Songnian Fu[1], Yuwen Qin[1]; [1]*School of Information Engineering, Guangdong Univ. of Technology, China;* [2]*School of Physics Science and Information Engineering, Liaocheng Univ., China;* [3]*State Key Laboratory of Optical Fiber and Cable Manufacture Technology, China.* We demonstrate the signal and power co-transmission over 3 km anti-resonant hollow-core-fiber, achieving the record-breaking optical power-bit-rate-distance performance of 17.4 W •Tbit/s • km, and showing the robust static and dynamic system stability.

## Room 403B

### Th1B • Clock Recovery and EEPN Mitigation—Continued

**Th1B.6 • 09:30**
**An Accurate and Robust Baud-Rate Clock Recovery for Coherent Systems,** Xiaofei Su[1], Tong Ye[1], Jingnan Li[1], Shinsuke Tanaka[2], Hisao Nakashima[2], Takeshi Hoshida[2], Yasuhiko Aoki[2], Zhenning Tao[1]; [1]*Fujitsu R&D Center Co., Ltd (China), China;* [2]*1Finity Inc., Japan.* In high baud-rate coherent systems, Mueller-Muller is not always the best performance clock recovery. Shifted-Mueller-Muller is proposed to guarantee the optimum performance under various scenarios. Simulations and experiments show 0.5~1.7 dB Q-factor improvement.

## Room 408A

### Th1C • Datacenter Subsystems and High Data Rate Transceivers—Continued

**Th1C.4 • 09:30**
**1.6 Tb/s Monolithic InP Transmitter PIC With DFB, MZM, and SOA Arrays,** Stefano Porto[1], Fengqiao Sang[1], Justin Lavrencik[1], Payam Abolghasem[1], Armand Rundquist[1], Julien Macario[1], Arie Meighan[1], Cenk Ozdemir[1], Yi-Ping Wang[1], Wei Fu[1], Sahil Sakpal[1], Paul Gavrilovic[1], Thomas Frost[1], Jiaming Zhang[1], Prashanth Turla[1], Josh Anthony[1], Koichi Hoshino[1], Carlo Di Giovanni[1], Abdou Diba[1], Sabyasachi Barik[1], Matthias Kuntz[1], Vikrant Lal[1], Peter Evans[1], Mehrdad Ziari[1]; [1]*Nokia Corporation, USA.* We report integration of laser sources and amplifiers with low-voltage of ≤1.5 V modulators in an eight-channel monolithic InP PIC and demonstrate single-channel 212 Gbps direct linear drive with fiber-coupled output power of +5 dBm.

## Room 408B

### Th1D • Photonics Platforms, Fabrication Methods, and Low Loss Materials—Continued

**Th1D.7 • 09:30** ★ Top-Scored
**Towards Fiber-Like-Loss for Photonic Integration From Violet to Near-IR,** Hao-Jing Chen[1], Kellan Colburn[1], Hanfei Hou[1], Peng Liu[1], Hongrui Yan[1], Phineas Lehan[1], Qing-Xin Ji[1], Zhiquan Yuan[1], Henry Blauvelt[1], Kerry Vahala[1]; [1]*California Inst. of Technology, USA.* CMOS-compatible fabrication processes are used to create germano-silicate integrated circuits with resonator *Q* factors greater than 180 million obtained from 458 to 1550 nm. Narrow-linewidth integrated lasers via self-injection locking are demonstrated.

**Th1D.8 • 09:45**
**Scalable Freeform fan-in 48 Waveguide Array in Glass,** Tobias Harter[1], Sergey Oshemkov[2], Alexander Gusarov[2], Stefan Richter[3], Vladimir Dmitriev[2], Uri Stern[2], Jonas Goek[3], Heiner Zwickel[3], Ivan Vishniakou[3], Johannes Zellner[1], Shao-Chi Wei[1], Diana Spengler[1], Thomas Scheruebl[1]; [1]*Carl Zeiss SMT GmbH, Germany;* [2]*Carl Zeiss SMS Ltd, Israel;* [3]*Carl Zeiss AG, Germany.* We developed a demonstrator for inscribing 3D multichannel waveguides in glass. To validate its performance, a fan-in structure was written transforming a 1D into a 2D array, showcasing state-of-the-art propagation loss and dense optical routing.

## Room 411

### Th1E • Terrestrial Free Space Optics—Continued

**Th1E.7 • 09:30**
**High-Speed, High-Sensitivity Mobile FSO Link Based on Avalanche Photodetector Array,** Zu-Kai Weng[4], Toshimasa Umezawa[4], Yuki Yoshida[4], Michikazu Hattori[1], Yuichiro Hara[1], Atsushi Kanno[2,4], Tetsuya Kawanishi[3,4], Atsushi Matsumoto[4], Kouichi Akahane[4], Naokatsu Yamamoto[4]; [1]*Toyo Electric Corporation, Japan;* [2]*Nagoya Kogyo Daigaku, Japan;* [3]*Waseda Daigaku, Japan;* [4]*NICT, Japan.* A mobile free-space optical communications system is experimentally demonstrated based on a high-speed, high-sensitivity avalanche photodetector array with spatial diversity reception. Receiving power sensitivity of -3 dBm with 26.7° field-of-view is realized in the 2.1-m line-of-sight link at 10.7°/sec.

## Room 501ABC

### Th1F • Optical Sources and Their Applications—Continued

**Th1F.5 • 09:30**
**High-Power Kerr Comb Source for Data Communications,** Swarnava S. Sanyal[1], Michael Cullen[1], Songli Wang[1], Yuyang Wang[1], Yoshitomo Okawachi[1], Karl J. McNulty[1], Michal Lipson[1], Keren Bergman[1], Alexander L. Gaeta[1]; [1]*Columbia Univ., USA.* We demonstrate a high-power Kerr comb source with configurable 300-, 200-, and 100-GHz spacings. Direct 32 Gbps modulation of multiple channels yields open optical eyes, highlighting its potential for scalable, high-bandwidth photonic interconnects based on wavelength-division multiplexing.

**Th1F.6 • 09:45** ★ Top-Scored
**A Photonic Integrated Mode-Locked Laser Based on Dispersion-Managed Mode-Locking Architecture,** Xurong Li[2], Zheru Qiu[2], Xuan Yang[2], Xinru Ji[2], Jiale Sun[2], Jianqi Hu[2], Grigorii Likhachev[2], Ulrich Kentsch[1], Tobias J. Kippenberg[2]; [1]*Helmholtz-Zentrum Dresden-Rossendorf, Germany;* [2]*Ecole polytechnique federale de Lausanne, Switzerland.* We demonstrate the first self-starting, photonic integrated femtosecond mode-locked laser, using a dispersion-managed mode-locking architecture. The laser has a 1.2-GHz repetition rate with an ultra-low mode-locking threshold, and generates a passively stable optical frequency comb.

## Room 502A

### Th1G • Next-Generation Optical I/O—Continued

## Room 502B

### Th1H • Emerging Photonic Devices and Materials—Continued

## Room 515A

### Th1I • Security & AI-Driven Network Operation—Continued

## Room 515B

### Th1J • Hollow-core Fiber Transmission Systems—Continued

**Th1J.6 • 09:30**
**Beyond 550 Tb/s S+C+L-Band Bidirectional Transmission Over 10.9-km Anti-Resonant Hollow-Core Fiber,** Xingfeng Li[1], Tianqian Zhang[2], Shuchao Mi[1], Xu Zhang[1], Honglin Ji[1], Hui Chen[1], Yao Lu[1], Chao Li[1], Ming Luo[1], Peng Sun[1], Siyue Jin[1], Xumeng Liu[1], Qibing Wang[1], Jingbin Feng[1], Zichen Liu[1], Jie Luo[3], Lei Zhang[3], Lei Wang[1], Zhixue He[1], Shaohua Yu[1]; [1]*Pengcheng Laboratory, China;* [2]*Central China Normal Univ., China;* [3]*Yangtze Optical Fibre and Cable Joint Stock Ltd Co, China.* We demonstrate a same-wavelength bidirectional transmission over a 10.9-km AR-HCF with 393×2 channels and 50-GHz spaced grid. The GMI-estimated net rate of 550.97 Tb/s indicates a record capacity for any single-core single-mode fiber.

## Room 518

### Th1K • Optimization and Virtualization in future PONs—Continued

**Th1K.6 • 09:30**
**PON Bitrate Optimization Adapting Flexible Header and FEC According to Field Data,** Gaël Simon[1], Philippe Chanclou[1], Stéphane Le Huérou[1], Jérémy Potet[1], Brendan Torillec[1], Fabienne Saliou[1]; [1]*Orange, France.* We estimate, using field data from 68000 ONUs, to which extent the XGS-PON upstream throughput could be improved by tuning the header and FEC parameters. A gain as high as 70% is estimated.

## 10:30–12:00
## Th2A • Joint Poster Session II

**Th2A.1**
**Hybrid Integration of O-Band InP SOA Array and PLC Using PLC/SiN Spot-Size Converter,** Amare Kindu Tesfa[1], Marijn Rombouts[1], Nicola Calabretta[1]; [1]*Eindhoven Univ. of Technology, Netherlands.* We design, fabricate and demonstrate O-band hybrid integration of PLC/SiN spot-size converter (SSC) and InP U-shaped SOA array PICs. The results show broadband operation and efficient coupling, achieving ~1.5 dB loss per facet.

**Th2A.2**
**Over-8000-GHzΩ/mW-FoM Transimpedance Amplifier for Processor Interconnection,** Tadashi Minotani[2,1], Tatsurou Hiraki[2,1], Yohei Saito[2,1], Yoshiho Maeda[2,1], Toru Miura[2,1], Tomonari Sato[2,1], Norio Sato[2,1], Shinji Matsuo[1]; [1]*NTT Device Technology Labs, Japan;* [2]*Nihon Denshin Denwa Kabushiki Kaisha NTT Device Innovation Center, Japan*. We report a transimpedance amplifier (TIA) embedded in an organic substrate for optical interconnects among computing processors. The TIA achieves a figure of merit of 9400 GHzΩ/mW, more than twice that of previous TIAs.

**Th2A.3**
**Programmable Optical Nonlinear Activation Function Device for Photonic Neural Networks,** Wenlu Zhong[1], Yida Dong[2], Wentao Zhong[1], Mei Shen[2,3], Lei Lei[1]; [1]*Shenzhen Univ., China;* [2]*Southern Univ. of Science and Technology, China;* [3]*Shenzhen Polytechnic Univ., China*. We propose and experimentally demonstrate a phase-change material assisted programmable optical nonlinear activation device (GST-$SL_3$-MRR), generating five different nonlinear activation functions with a minimum threshold of 1.76 mW.

**Th2A.4**
**Broadband Dual-Mode Splitter Based on a Slotted-MMI Coupler Using Subwavelength-Grating Structures,** Sora Izumisawa[1], Takanori Sato[1], Taichi Muratsubaki[1], Kunimasa Saitoh[1]; [1]*Hokkaido Daigaku Daigakuin Joho Kagaku Kenkyuka, Japan*. We experimentally demonstrate a dual-mode splitter using a subwavelength-grating slotted-MMI coupler, maintaining average insertion losses of 0.32 dB (TE0) and 1.05 dB (TE1) across a 140-nm low-loss bandwidth (1500–1640 nm).

**Th2A.5**
**DFM-Aware Characterization of Curvilinear Photonic Layouts: From Physical Geometry to Process Sign-off,** Ahmadreza Farsaei[1]; [1]*Intel Corporation, USA*. We present a geometry-aware extraction framework for photonic integrated circuits that reconstructs centerlines and curvature profiles from GDSII/OASIS layouts, enabling accurate characterization of curvilinear components and translating geometric fidelity into metrics for PIC verification and design optimization.

**Th2A.6**
**Energy-Efficient Non-Volatile Si Optical Phase Shifter Using Charge-Trap Flash MOS Stack With Graphene Electrode,** Gi Jun Ju[1,2], Kyunghwan Kim[1], Sunghyun Hwang[1], Kyul Ko[1], Yujeong Kang[1], Dae-Hwan Ahn[1], Donghee Park[1], In-Ho Lee[1], Yong-Won Song[1], Younghyun Kim[2], Jae-Hoon Han[1]; [1]*Center for Quantum Technology, Korea Inst. of Science and Technology, Korea (the Republic of);* [2]*Department of Photonics and Nanoelectronics, Hanyang Univ., Korea (the Republic of)*. We demonstrated a non-volatile silicon-based optical phase shifter employing a graphene transparent electrode and an $Al_2O_3/HfO_2/Al_2O_3$ flash MOS stack, exhibiting stable charge trapping and distinct optical bistability for programmable photonic integrated circuits.

**Th2A.7**
**Leveraging a Nonvolatile MEMS Switch for Sub-Lithography Silicon Photonics,** August Djuphammar[1], Pierre Edinger[1], Cleitus Antony[2], Sofie Janssen[4], Wim Bogaerts[4,3], Kristinn B. Gylfason[1]; [1]*Kungliga Tekniska Hogskolan, Sweden;* [2]*Tyndall National Inst., Ireland;* [3]*Information Technology, Universiteit Gent, Belgium;* [4]*3DSIP, Interuniversitair Micro-Elektronica Centrum, Belgium.* Silicon photonics is accelerating high-performance computing, and integrated MEMS devices offer low-power reconfiguration. However, MEMS device performance is limited by lithography resolution. Here, we unveil a post-fabrication technique to reduce a photonic foundry-defined 230 nm starting gap to 50 nm, using a nonvolatile MEMS switch.

**Th2A.8**
**Meta-Lens for co-Package Optics and Fiber Array Unit Coupling,** Vincent Lin[1], Hong-Shen Chen[1], Li-Yu Chen[1], Po-Kuan Shen[1], Chun-Chiang Yen[1], Chiu-Lin Yu[1], Jenq-Yang Chang[1], Mount-Learn Wu[1]; [1]*AuthenX Inc., Taiwan.* We demonstrate a meta-lens assisted co-package optics which enables multi-channel detachable fiber array unit to silicon photonics chip coupling and results in 1dB alignment tolerance up to ±18um.

**Th2A.9**
**Demonstration of a Low-Loss Ultra-Compact Silicon-Based Arrayed Waveguide Grating With 1.6 nm Channel Spacing,** Hang Chen[1], chengkun cai[1], xudong liu[1], Jian Wang[1]; [1]*Huazhong Univ. of Science and Technology, China.* Designed and fabricated a compact and overlapped arrayed waveguide grating with an insertion loss of less than 1 dB, adjacent channel crosstalk below 22 dB.

**Th2A.10**
**DFB Laser Stabilization Against on-Chip Parasitic Reflections Using Controlled Feedback From a Silicon Ring Resonator,** Hosna Haghighat[1], Dante Prins[1], Omid Esmaeeli[1], Lukas Chrostowski[1], Sudip Shekhar[1]; [1]*Electrical and Computer Engineering, The Univ. of British Columbia, Canada.* We report stabilization of a hybrid-integrated DFB laser using phase-controlled, spectrally filtered feedback from a compact silicon ring resonator, enabling isolator-free single-mode operation, tolerant to on-chip parasitic reflections up to –5 dB.

**Th2A.11**
**A 280 Gbps PAM6 Silicon Photonic Tabbed-Electrode Mach-Zehnder Modulator With Co-Optimized Modulation Efficiency and Electro-Optic Bandwidth,** Qian Liu[1], Jintao Xue[1], Chao Cheng[1], Yangming Ren[1], Xinyu Li[1], Wenfu Zhang[1], Binhao Wang[1]; [1]*Chinese Academy of Sciences Xi'an Inst. of Optics and Precision Mechanics, China*. A tabbed-electrode silicon Mach-Zehnder modulator is demonstrated, achieving a 1 dB electro-optic bandwidth of 66 GHz and a Vπ of 4.5 V through co-optimization of modulation efficiency and bandwidth, enabling 280 Gbps PAM6 transmission.

**Th2A.12**
**67 GHz Graphene Electro-Absorption Modulators on Silicon With 80 Gb/s C-Band and 40 Gb/s O-Band NRZ Data Rates,** Matteo Tiberi[1], Alberto Montanaro[2], Chao Wen[1], Jincan Zhang[1], Marco Romagnoli[3], Vito Sorianello[2], Andrea Ferrari[1]; [1]*Univ. of Cambridge, UK;* [2]*Photonic Networks and Technologies Lab – CNIT, Italy;* [3]*CamGraPhIC, Italy.* We report graphene electro-absorption modulators on silicon waveguides with 67 GHz electro-optical 3 dB bandwidth, achieving non-return-to-zero optical modulation up to 80 Gb/s in C-band and 40 Gb/s in O-band.

**Th2A.13**
**High-Efficiency Silicon Nitride Microcombs for Co-Packaged Optics,** Oskar B. Helgason[1], Marcello Girardi[1], Symeon Sideris[1], Liron Gantz[2], Mark A. Holm[1]; [1]*Solinide Photonics AB, Sweden;* [2]*NVIDIA Corp, USA*. We demonstrate high-efficiency silicon nitride dissipative Kerr soliton microcombs achieving record 69% optical conversion efficiency for co-packaged optics. The device generates 24 wavelength channels above 0 dBm with 199.1 GHz spacing, enabling scalable datacenter interconnects.

**Th2A.14**
**Record-High 90-GHz Silicon Microring Modulator With Compact RLC Modeling and 224-Gb/s PAM4 Operation Toward Co-Packaged Optics Integrations,** Ming-Wei Lin[1], Ching-Wei Peng[1], Hsiang-Chih Kao[2], Pei-En Huang[2], Hann-Huei Tsai[1], Ying-Zong Juang[1], Ming-Chang Lee[2]; [1]*Taiwan Semiconductor Research Inst., Taiwan;* [2]*National Tsing Hua Univ., Taiwan*. A high-speed silicon microring modulator with inductive and wavelength tuning achieves a 90-GHz EO bandwidth and 224-Gb/s PAM4 operation, validated by compact RLC modeling and experiment for next-generation CPO interconnects.

**Th2A.15**
**SiGe Photodetector Using a Tapered Ge Design for 400 Gbps Optical Links,** Santiago Bernal[1], Deng Mao[2], Charles Lin[2], Charles St-Arnault[1], Aleksandar Nikic[1], Benton Qiu[1], Kaibo Zhang[1], Yannick D'Mello[1], Masaki Kato[2], David V. Plant[1]; [1]*McGill Univ., Canada;* [2]*Marvell Semiconductor Inc, USA.* We report the DC, small- and large-signal performance of a CMOS-compatible tapered-germanium photodetector with 0.87 A/W responsivity and up to 400 Gbps PAM-8 operation, enabling high-speed silicon photonic interconnects.

**Th2A.16**
**Novel Hollow Core Nodeless Antiresonant Leakage Inhibited Fiber With Low Confinement Loss Over a Large Bandwidth,** Ilia Nikulin[1], Paulo Dainese[1], Dan Nguyen[1], Ming-Jun Li[1]; [1]*Corning Inc., USA.* A novel hollow core node-less antiresonant leakage inhibited fiber design is proposed. Simulations show that the design offers low confinement loss, high higher order mode extinction ratio in a wide wavelength window without loss peaks.

**Th2A.17**
**Data-Driven Estimation of Nonlinear Factors in Strongly Coupled Multicore Fibers Using Physics-Informed Machine Learning,** Koji Igarashi[1], Yu Uchino[1], Keisho Yamamoto[1], Tadashi Wadayama[2]; [1]*The Univ. of Osaka, Japan;* [2]*Nagoya Kogyo Daigaku, Japan*. We propose a physics-informed machine learning framework for data-driven estimation of the nonlinear factors in strongly coupled multicore fibers, quantitatively deriving their degenerate values as a function of the number of multiplexed modes.

**Th2A.18**
**Impact of Core Permutation on the Splice Losses for a Marker-Less 7-Core MCF,** Emil Spoiden[1,3], Aymeric Arnould[1], Sarah Cwalina[1], Tobias Tiess[2], Kay Schuster[2], Ronald Freund[1,4], Georg Rademacher[1,3]; [1]*Fraunhofer HHI, Germany;* [2]*Universitat Stuttgart, Germany;* [3]*Heraeus Quarzglas GmbH & Co. KG, Germany;* [4]*Technische Universitat Berlin, Germany.* We experimentally characterize splice losses for a marker-less, 60°-rotationally symmetrical 7-core fiber drawn from a single-preform yielding 2000 km. The observed penalty with core permutation was below 0.16 dB, indicating suitability for splicing without core identification.

**Th2A.19**
**Experimentally Characterized Digital Twin for Machine Learning Based EDFA Failure Prognostics,** Mashboob Cheruvakkadu Mohamed[1], Rocco D'Ingillo[1], Renato Ambrosone[1], Muhammad Umar Masood[1], Gulmina Malik[1], Stefano Straullu[2], Antonino Nespola[2], Sai Kishore Bhyri[3], Gabriele Galimberti[3], Joao Pedro[3,4], Antonio Napoli[3], Walid Wakim[3], Vittorio Curri[1]; [1]*Politecnico di Torino, Italy;* [2]*Fondazione LINKS, Italy;* [3]*Nokia - Optical Networks, USA;* [4]*Instituto de Telecomunicacoes Lisboa, Portugal.* This study introduces an experimentally characterized digital twin framework for training machine learning models to predict EDFA failures. Trained on failure scenarios under fully and partially loaded spectrum conditions, the model achieves 99.6% accuracy.

**Th2A.20**
**High-Efficiency Cladding-Pumped C+L-Band Uncoupled 4-Core EDFA With Integrated Multicore Isolators and FWDMs,** Shaofeng Xie[1], Runzhou Qiu[2], Wenhao Li[3], Bofan Guo[2], Jinkai Zhou[1], Chengxu He[1], Shecheng Gao[1], Jiajing Tu[1], Shikui Shen[4], Cheng Du[3], Guangquan Wang[4], Zhaohui Li[5]; [1]*Jinan Univ., China;* [2]*IV-VI PIC Technology Co., Ltd., China;* [3]*FiberHome Telecommunication Technologies Co., Ltd, China;* [4]*Research Inst. of China United Network Communications Co., Ltd., China;* [5]*Sun Yat-Sen Univ., China.* We demonstrate a C+L-band, cladding-pumped, uncoupled 4-core EDFA integrating multi-core isolators and FWDMs, achieved high output power with power conversion efficiency of 9.18%. The output powers are 22.1 dBm/core (C) and 26.4 dBm/core (L).

## Th2A • Joint Poster Session II—Continued

**Th2A.21**
**Evaluation of an Erbium Doped Waveguide Amplifier RF Performance in Microwave Photonics Applications,** Filippo Scotti[1], Md Masum Hossen[2], Muhammad Imran[2], Xinru Ji[3], Zheru Qiu[3], Xuan Yang[3], Grigorii Likhachev[3], Paolo Ghelfi[1], Tobias J. Kippenberg[3], Antonella Bogoni[2], Luca Rinaldi[1]; *[1]PNTLab, Consorzio Nazionale Interuniversitario per le Telecomunicazioni, Italy; [2]TECIP, Scuola Superiore Sant'Anna, Italy; [3]Ecole polytechnique federale de Lausanne, Switzerland.* Performance of an EDWA in Si3N4 platform is investigated for integrated MWP systems, showing stable performance under various RF conditions. The absence of induced nonlinearities confirms its suitability and reliability for integrated microwave photonic applications.

**Th2A.22**
**Optical Fiber Fluorescence Thermometers Based on K2SiF6 : Mn4+ Phosphor for Cryogenic Sensing,** Xiao Hua[1], fei wang[1,2], Zude Lin[1], Jingquan Liu[1], Minmin You[1]; *[1]Shanghai Jiao Tong Univ., China; [2]DCI Joint Team, Collaborative Innovation Center of IFSA, School of Integrated Circuits (School of Information Science and Electronic Engineering), Shanghai Jiao Tong Univ., China.* This study presents a high-sensitivity fiber-optic temperature sensor using a Mn4+:K2SiF6 phosphor-coated probe.It demonstrates a superior sensitivity of 0.03488ms/K over a broad -90°C to 50°C range, excellent stability, and strong EMI immunity.

**Th2A.23**
**Transformer-Based Prognostics: Enhancing Network Availability by Improved Monitoring of Optical Fiber Amplifiers,** Dominic Schneider[1], Lutz Rapp[1], Christoph Ament[2]; *[1]Adtran Networks SE, Germany; [2]Universitat Augsburg, Germany.* We enhance optical network availability and reliability through a lightweight transformer model that predicts optical fiber amplifier lifetime from condition-based monitoring data, enabling real-time, edge-level predictive maintenance and advancing deployable AI for autonomous network operation.

**Th2A.24**
**Multipath Protection Between Ground Stations Based on Virtual Concatenation in Optical Satellite Networks,** Yansong Fu[1], Yongli Zhao[1], wei wang[1], Meng Lian[1], jie zhang[1]; *[1]Beijing Univ. of Posts & Telecom, China.* This paper presents a resource-efficient multipath protection scheme based on virtual concatenation between ground stations in optical satellite networks. Compared with the Remove-Find algorithm, the blocking rate is reduced by 14.9%.

**Th2A.25**
**UniOpt: a Unified Foundation-Model Approach for Scalable and Autonomous Management of Optical Networks,** Khouloud Abdelli[1]; *[1]Nokia Bell Labs Germany, Germany.* We present UniOpt, a unified foundation-model-inspired framework for autonomous optical network management. Integrating multimodal-telemetry and task tokenization, it enables forecasting, localization, anomaly detection, and lifetime prediction within a single, scalable, generalizable system across heterogeneous network-domains.

**Th2A.26**
**Combinatorial Optimization With Kerr Solitons,** Yan Jin[2,1], Nitesh Chauhan[2,1], Jizhao Zang[2,1], Scott Papp[2,1]; *[1]Univ. of Colorado Boulder, USA; [2]Time and Frequency Division, National Inst. of Standards and Technology, USA.* We present a Kerr-soliton Ising machine with all-to-all connectivity. Using solitons as spins and optoelectronic feedback for bipartite and tripartite interactions, we carry out efficient combinatorial optimization of complex, NP-complete problems.

**Th2A.27**
**Photonic Linear Diffusion in Block Ciphers With AWG and Phase-Coded MZI Balanced Detection,** Yi Pan[2], Wenjia Zhang[1], Xin Ye[1], Jiayuan Guo[1], Zuyuan He[1]; *[2]Shanghai Jiao Tong Univ., China.* We propose a photonic linear diffusion approach with sparse 32×32 modular matrix operations and one-shot parity enabled by wavelength multiplexing and phased coded MZI balanced detection.Simulation and experimental results validate stable the one-shot parity across 8 channels with sub-ns decision latency.

**Th2A.28**
**Turbulence-Resilient all-Optical Classifier by Integrating Diffractive Deep Neural Networks With MPLC at the Communication Wavelength,** Junjie Chen[1], Xiaoxiao Ma[1], Zhenyu Wan[1], Jinfeng Liu[1], kangrui wang[1], Jian Wang[1]; *[1]Huazhong Univ. of Science and Techn, China.* We present a turbulence-resilient all-optical classifier that learns turbulence-resilient features using randomized phase screens. Our system achieves all-optical classification of MNIST digits through turbulent media, offering a new paradigm for robust free-space optical communication.

**Th2A.29**
**Ultra-Compact Quantum Dot Micro-Ring Laser Neuron for Photonic Spiking Neural Networks,** Bin Shi[1], Niloy Acharjee[1], Jongseo Baek[1], Antoine Descos[1], Geza Kurczveil[1], Raymond G. Beausoleil[1], Bassem Tossoun[1]; *[1]Hewlett Packard Labs, Hewlett Packard Enterprise Co, USA.* We demonstrate a heterogenous integrated, ultra-compact, low threshold micro-ring laser that generates up to 13.4 GHz spikes by controlling the DC current and injection locking laser, showing excitability with only 10 μA current change.

**Th2A.30**
**Novel Photonic Integrated Beam Steering Switch for Optical Wireless Data Center Networks,** shaojuan Zhang[1], Aref Rasoulzadeh Zali[1], Marijn Rombouts[1], Boyang Zheng[1], Nicola Calabretta[1], Eduward Tangdiongga[1]; *[1]Technische Universiteit Eindhoven, Netherlands.* We demonstrate a SiN photonic integrated beam steering switch enabling free space links for OW-DCN. It provides up to 42° beam steering and support 40Gb/s NRZ-OOK with < 0.5dB penalty and broadband operation across O-band.

**Th2A.31**
**Photonic Deep Learning Using in-Situ Optical Backpropagation for Training Photonic Linear Neural Layers,** Odysseas Asimopoulos[1], Stefanos Kovaios[1], Apostolos Tsakyridis[1], Miltiadis Moralis-Pegios[1], Loukia Avramelou[1], Nikolaos Passalis[1], Anastasios Tefas[1], Konstantinos Vyrsokinos[1], Nikos Pleros[1]; *[1]Aristoteleio Panepistimio Thessalonikis, Greece.* We demonstrate photonic deep learning with in-situ optical backpropagation using optical matrix-vector multiplication in both forward and backward-propagating paths. Experimental validation of the photonic NN with Iris dataset reveals a mean inference accuracy of ~97%.

**Th2A.32**
**End-to-End GSNR Estimation While Securing Vendors' Trade Secrets and Operators' Confidentiality,** Angela Mitrovska[1,2], Behnam Shariati[1], Hamze G. Koujani[1,3], Pooyan Safari[1], Johannes Fischer[1], Ronald Freund[1,2]; *[1]Fraunhofer-Institut fur Nachrichtentechnik Heinrich-Hertz-Institut HHI, Germany; [2]Technische Universitat Berlin, Germany; [3]Politecnico di Torino, Italy.* We propose a Secure Multi-Party Computation protocol for GSNR estimation in disaggregated networks without exposing per-domain values, including back-to-back TRx characteristics, while demonstrating accuracy comparable to GNPy and analytical models.

**Th2A.33**
**On-Premises Small Language Model Agent With Physics-Aware Reasoning for Optical Network Optimization,** Takahito Tanimura[1], Nobuhiko Kikuchi[1]; *[1]R&D Group, Kabushiki Kaisha Hitachi Seisakusho, Japan.* We evaluated an on-premises small language model for optical network optimization using structured, physics- and system-aware prompts. The 14B Qwen3 agent exhibited stable fiber input power control, approaching that of GPT4o in simulation.

**Th2A.34**
**Demonstration of Self-Healing in IPoWDM Network With Dual Protection Using MBoSDM and NetDevOps Solutions in Support of 6G,** Muhammad Rehan Raza[1], Abdelrahmane Moawad[1], Vignesh Karunakaran[2], Nikhil Dsilva[2], Andrea Sgambelluri[3], Ramon Casellas[4], Bashar Ali[3], Alessio Giorgetti[3,5], Pablo A. Robles[6], Pol Gonzalez[7], Vasilis Tsekenis[8], Sokratis Barmpounakis[8], P Demestichas[8], Luis Velasco[7], Filippo Cugini[3], Behnam Shariati[1], Johannes Fischer[1], Ronald Freund[1,9]; *[1]Fraunhofer HHI, Germany; [2]Adtran Networks SE, Germany; [3]Consorzio Nazionale Interuniversitario per le Telecomunicazioni, Italy; [4]CTTC-CERCA, Spain; [5]Universita degli Studi di Pisa, Italy; [6]Telefónica Innovación Digital, Spain; [7]Universitat Politecnica de Catalunya, Spain; [8]WINGS ICT Solutions, Greece; [9]Technische Universitat Berlin, Germany.* We demonstrate autonomous self-healing in an IPoWDM network testbed comprising commercial equipment and MBoSDM prototype. We measured service provisioning time of under one minute and healing time of under 30 seconds in the considered usecase.

**Th2A.35**
**HOCSS: a Hardware-Accelerated Optical Circuit Switch Scheduler for low-Latency Optimal Ports Matching,** Yangmiao Yu[1]; *[1]Inst. of Computing Technology, Chinese Academy of Sciences, Beijing 100190, China Univ. of Chinese Academy of Sciences, China.* We propose a low-latency optimal ports matching scheduler for optical circuit switches. Leveraging the hardware-accelerated computation architecture, in optimal cases, port matching latency is less than 1us, achieving up to a 68.8× speedup compared to CPU implementation.

**Th2A.36**
**AI-Driven Multi-User ODN Monitoring by Upstream Polarization-Sensing in IM/DD Passive Optical Networks,** Robbe Van Rompaey[1], Vincent Houtsma[1], Dora van Veen[1], Michiel Verplaetse[1], Sterenn Guerrier[1], Guangpeng Xu[1], Michael straub[1], Yannick Lefevre[1], jochen maes[1]; *[1]Nokia Bell Labs, Belgium.* This paper demonstrates the feasibility of AI-based ODN monitoring for upstream sensing in IM/DD PONs using polarization sensing. A multi-user upstream PON scenario validates classification/localization accuracy of up to 99.98% in a proof-of-concept setup.

## Show Floor Programming

**MW5 • Deployment and Architectural Challenges in Metro, Access and Mobile X-Haul**
10:15–11:45, *Theater I*

**Technology Showcase: Designing for Density: Direct-to-Plug Liquid Cooling for Next-Generation Pluggable Optics**
ciena STÄUBLI
10:15-10:45, *Theater III*

**SF14 • From Access Fiber to Awareness Grid: Deploying DFOS for Security, Reliability and New Services**
10:30–11:30, *Theater II*

**Technology Showcase: Beyond SiPh, Game-changing InP Photonic Integration for Next Gen Pluggables in AI Data Centers**
SMART PHOTONICS
11:00-11:30, *Theater III*

**SF18 • How Will Optical Interconnects Meet AI Demand?**
11:45–12:45, *Theater III*

**SF15 • Operationalizing Open XR Optics – Enabling Improved Economics in the Optical Networks**
12:00–11:00, *Theater II*

**SF11 • AI Scale-up Opportunities with Short-Reach Optical Interconnects**
12:15–13:15, *Theater I*

## Th2A • Joint Poster Session II—Continued

**Th2A.37**
**Enhancing Coherent PON Power Budget Through SOA Boosting and DSP Compensation,** Guilherme L. Araújo[3,1], Gil Fernandes[3,1], Nelson Costa[5], Fernando Guiomar[2], Joao Pedro[4], Paulo Monteiro[2], Maria Medeiros[3,1]; *[1]Department of Electrical and Computer Engineering, Universidade de Coimbra, Portugal; [2]Instituto de Telecomunicacoes, Portugal; [3]Instituto de Telecomunicacoes Coimbra, Portugal; [5]Nokia Oy, Portugal.* We experimentally demonstrate a 200 Gbps coherent PON using a SOA booster to extend the power budget. SOA-induced non-linear distortions are analyzed and partially mitigated through DSP, achieving up to 13.5dB power budget improvement.

**Th2A.38**
**Telemetry Database for Heterogeneous Optical Access Networks Enabling Monitoring and Sensing Data Fusion,** Ruoxi Zhu[1,2], Kovendhan vijayan[1], Vincent Houtsma[1], Dora van Veen[1], jochen maes[3], Robert Borkowski[1]; *[1]Nokia Bell Labs, USA; [2]Department of Electrical and Computer Engineering, Northwestern Univ., USA; [3]Fixed Networks, Nokia Bell Labs, Belgium.* We demonstrate telemetry database for large-scale monitoring/sensing data acquisition, storage and fusion. Using ODN with coexisting GPON/XGS-PON/25GS-PON/100ZR P2P overlay, we perform simultaneous monitoring of multiple metrics from all systems and show ODN tree discovery functionality.

**Th2A.39**
**100 Gbit/s Bidirectional Transmission in a Single Fiber With Twin Bidi Transceivers,** Théo Huguenin[1], Fabienne Saliou[1], Gaël Simon[1], Jérémy Potet[1], Philippe Chanclou[1], KORTI Mokhtar[2], Ronald Heron[3]; *[1]Orange Research, France; [2]III-V Lab, France; [3]Nokia, Canada.* Two 100G (PAM4) single wavelength transceivers are paired in single fiber using splitters instead of diplexers. We demonstrate error free transmissions and evaluate some limits in terms of isolation, impact of return losses and OBI.

**Th2A.40**
**AI Learns G-PON: Toward Adaptive T-CONT Configuration for Fixed-Mobile Convergence,** Lucas M. Inglés[1,2], Luiz Anet Neto[1,3], Claudina Rattaro[2], Michel Morvan[1,3], Alberto Castro[2], Loutfi Nuaymi[1]; *[1]IMT Atlantique, France; [2]Universidad de la Republica Uruguay, Uruguay; [3]Laboratoire des Sciences et Techniques de l'Information de la Communication et de la Connaissance, France.* We demonstrate the use of a commercial G-PON as an AI-enhanced self-optimizing substrate. We refine T-CONT configuration with deep reinforcement learning to optimize transmission latency and ensure stable and adaptive performances for fixed-mobile convergent scenarios.

**Th2A.41**
**Comparison of Single Carrier FTN-QAM and PCS-QAM for Amplifier-Less Coherent Communication Systems,** Dongdong Zou[1], Fan Li[2], Wei Wang[2], Zhongxing Tian[1], Yuheng Liu[2], Gangxiang Shen[1], Yi Cai[1]; *[1]Soochow Univ., China; [2]Sun Yat-Sen Univ., China.* A performance comparison of FTN-QAM and PCS-QAM for amplifier-less short-reach coherent communication systems is provided. With the applications of phase tracking partial response DFE and turbo equalization strategy, FTN-16QAM exhibits about 0.9dB power margin advantage over PCS-64QAM.

**Th2A.42**
**Joint Notch Coding and Nonlinear Equalization for Optical Multipath Interference Suppression in IM-DD Systems,** Weihao Ni[1], Yuheng Liu[1], yiming wei[1], Fan Li[1]; *[1]Sun Yat-Sen Univ. (CHINA), China.* A low-complexity joint scheme combining Tx notch coding and Rx PNLF equalization is proposed to mitigate MPI noise in IM-DD systems. Experiments with 80 Gbit/s and 112 Gbit/s PAM-4 transmission show that the system's signal-to-interference ratio tolerance is improved by 3.25 dB and 5.23 dB, respectively.

**Th2A.43**
**Space-Polarization-Coded Coherent Receiver for LO Polarization-Insensitive Detection,** Hossein Najafi[1], Ali Bakhshali[2], Yule Xiong[1], Zhuhong Zhang[1], Zhiping Jiang[1]; *[1]Huawei Technologies Canada, Canada; [2]Celero Communications Inc., Canada.* We propose a space-polarization-coded (SPC) coherent receiver to achieve local oscillator polarization-insensitive (LO-PI) detection. Utilizing space dimension to construct a unitary channel based on received LO, we show that LO power fading is avoided.

**Th2A.44**
**Reinforcement-Learning-Based Electro-Optical Parameter Optimization for 200G Linear Pluggable Optics in Data Center Interconnects,** Chengxi Wang[1], Xiaodao Meng[2], Huayuan Qin[1], Zhongya Li[1], An Yan[1], Junhao Zhao[1], Yingjun Zhou[1], Jianyang Shi[1], Nan Chi[1], Junwen Zhang[1]; *[1]Fudan Univ., China; [2]HiSilicon Research Laboratory, Huawei Technologies Co Ltd., China.* We experimentally demonstrate autonomous optimization of electro-optical parameters in a high-speed LPO system using reinforcement learning, achieving 3.5-dBm sensitivity improvement and 22-Gbps data-rate enhancement over electrical-only equalization, sustaining over 200 Gb/s across 16~22-dB insertion loss.

**Th2A.45**
**Sparse–Quantized Retraining Framework for Complexity-Efficient Volterra Equalizers With Performance Recovery in IM/DD Optical Data-Center Links,** govind sharan yadav[1], Benedictus Y. Widhianto[2], Sheng-Yuan Zheng[1], Chun-Yen Chuang[2], Kai-Ming Feng[1], Jyehong Chen[2], Young-Kai Chen[3]; *[1]Inst. of Communications Engineering, National Tsing Hua Univ., Taiwan; [2]Department of Photonics, National Yang-Ming Chiao Tung Univ., Taiwan; [3]Coherent/II-VI, USA.* We propose and experimentally demonstrate a Sparse–Quantized Retraining (SQR) framework for multi-precision Volterra equalizers in 106-Gb/s PAM4 IM/DD links, achieving over 90% complexity reduction while preserving near full-precision BER via pruning- and quantization-aware recovery.

**Th2A.46**
**Net 5.8 Tbps IM/DD Transmission Over 2 km Using 25 Simultaneous 100 GHz Comb Channels and a Single SOA,** Santiago Bernal[1], Charles St-Arnault[1], Benton Qiu[1], Aleksandar Nikic[1], Kaibo Zhang[1], Deng Mao[1], Prabhav Gaur[2], Premanand Chandramani[2], Ibrahim Yayla[2], John Simons[2], Janina Rautert[3], Alexy Gubenko[3], Ashok Krishnamoorthy[2], David V. Plant[1]; *[1]McGill Univ., Canada; [2]Axalume Inc., USA; [3]Innolume GmbH, Germany.* We demonstrate the first 25 channel O-band IM/DD transmission system over 2 km using a single SOA and a 100-GHz-spaced quantum-dot comb laser. We transmitted 3.2 Tbps PAM-4, 4.3 Tbps PAM-6, and 5.76 Tbps PAM-8.

**Th2A.47**
**Non-Integer Oversampled and Low-Complexity Real-Time Timing Recovery for Short-Reach Coherent Receivers,** Jianwei Tang[1,2], Bang Yang[2], Jianyu Wang[1,2], Bingchang Hua[3], Xinke Tang[1], Siyu Gong[2], Zhaopeng Xu[1], Tonghui Ji[1], Junpeng Liang[1], Zhixue He[1], Weisheng Hu[1], Yanfu Yang[1,2], Jinlong Wei[1]; *[1]Pengcheng Laboratory, China; [2]School of Electronics and Information Engineering, Harbin Inst. of Technology, China; [3]Purple Mountain Laboratories, China.* A low-complexity non-integer oversampling timing recovery scheme is proposed and specially designed for real-time FPGA implementation, which shows superior hardware efficiency and reliability under various roll-off and oversampling conditions.

**Th2A.48**
**Nonlinearity-Tolerant Temporal Sign Shaping for 64-QAM Optical Fiber Transmissions,** Xing Han[1], Kaiquan Wu[1], Søren O. Forchhammer[2], Alex Alvarado[1]; *[1]Technische Universiteit Eindhoven, Netherlands; [2]Danmarks Tekniske Universitet, Denmark.* A novel temporal sign shaping is proposed to mitigate nonlinear interference in probabilistically shaped 64-QAM transmissions. The proposed temporal sign shaping alone enables effective SNR gains up to 0.33 dB.

**Th2A.49**
**Coherent Optical Transmitter IQ Impairments Estimation in the Digital Subcarrier Multiplexing System Based on the Designed Training Sequence,** Hong Lin[1], Jing Zhang[1], Shaohua Hu[1], Bo Xu[1], Rui Wang[1], Jinjiang Li[1], Xuecheng Ren[1], Kun Qiu[1]; *[1]Univ of Electronic Science & Tech China, China.* We propose a joint estimation of transmitter IQ amplitude, phase imbalance and time skew based on paired subcarriers using designed training sequence, with the measurement error within 0.2dB, 1°, and 0.2ps, respectively.

**Th2A.50**
**Gas Line Absorption Mitigation in Hollow-Core Fibre Using Spectral Pre-Equalisation,** Eric Sillekens[1], Ronit S. Sohanpal[1]; *[1]Univ. College London, UK.* We study the impact of CO2 absorption on hollow-core fibre transmission. Using spectral pre-equalisation, we digitally post-compensate gas-line absorption and show a 5.5dB reduction in Q-factor penalty, outperforming a 383-tap equaliser by 1.3dB.

**Th2A.51**
**FPGA Implementation for SOP Fluctuation Localization Employing Practical Optical Supervisory Channel,** Yusuke Sasaki[1], Wakako Maeda[1]; *[1]NEC Corporation, Japan.* We demonstrate precise localization of rapid state-of-polarization fluctuations employing optical supervisory channel over FPGA. The method operates reliably under low-received-power and enables loopback-based localization without synchronized receivers, achieving sub-kilometer accuracy across wide fluctuation frequencies.

**Th2A.52**
**A Scalable Approach to Longitudinal Power Profile for Embedded Systems,** Pierre Escamilla[1], Fabien Boitier[1], Alix May[1], Patricia Layec[1]; *[1]Nokia Bell Labs France, France.* We present a memory-efficient, computationally optimized longitudinal power monitoring method scalable to numerous spatial samples for embedded systems. Results show $<0.6$ dB accuracy penalty across $>75\%$ of the link versus linear least squares.

**Th2A.53**
**A Digital Twin Assisted Raman Amplifier Failure Detection and Re-Optimization in Multi-Band Optical Networks,** Rui Wang[1], Hong Lin[1], Junyuan Nie[1], Jiaming Liu[1], Jing Zhang[1], Kun Qiu[1]; *[1]Univ of Electronic Science & Tech China, China.* We propose a digital twin assisted framework using forward and inverse dual-networks to localize pump failures and perform online re-optimization in C+L-band networks. Simulations verify accurate failed pump localization and re-optimization within 2.5 s

**Th2A.54**
**Improved QoT Estimation Through Input Parameter Refinement in Bidirectional Raman Amplified Links,** zihang wang[1], Yihao Zhang[1], Lilin Yi[1], Weisheng Hu[1], Qunbi Zhuge[1]; *[1]Shanghai Jiao Tong Univ., China.* We propose an input parameter refinement scheme for physical-layer models of systems with bidirectional Raman amplifiers. Experiments over C-band are conducted, demonstrating the scheme can lower the models' maximum estimation error by ~2.91 dB.

**Th2A.55**
**800G Data and Optical Power Transmission Over 5 km Double-Clad Fiber,** Douglas McCulloch[1], Muhammad Hilmi Othman[1], Yongmin Jung[1], Kyle Bottrill[1], Neil Parkin[2], Periklis Petropoulos[1]; *[1]Optoelectronics Research Centre, UK; [2]BT Group Plc, UK.* We demonstrate 5 km transmission of power-over-fiber, the longest reported distance using a double-clad fiber. A 107 GBd DP-16QAM signal was transmitted alongside 21.8 W launched power without observable nonlinear noise transfer.

**Th2A.56**
**Residual-Carrier-Filtering Based Co-Wavelength Integrated Sensing and Communication for 20 Tb/s WDM Transmission and Sub-Hertz Sensing,** Jing Li[1], Ke Ai[1], Chenghao Chay[1], Hao Li[1], Cunzheng Fan[1], Tian Qiu[1], Yang Zou[1], Yuming Zhao[1], Jian Xu[1], Shenmao Zhang[1], Xiaoxiao Dai[1], Chen Liu[1], Qizhen Sun[1], Qi Yang[1], Deming Liu[1]; *[1]Huazhong Univ of Science and Technology, China.* We demonstrate the first long-haul co-wavelength ISAC over a 190 km WDM fiber link, simultaneous achieving over 20 Tb/s transmission capacity and 0.01 Hz ultra-low-frequency sensing with 20 m spatial resolution for transoceanic monitoring.

**Th2A.57**
**Strain Demodulation Method Based on Cascaded ANN and GPU for Optical Frequency Domain Reflectometry,** Zhihao Wang[1], Keyuan Yang[1], Zikang Xv[1], Duojun Yin[1], Changjian Ke[1]; *[1]Huazhong Univ of Science and Technology, China.* This paper proposes a strain demodulation method based on cascaded ANN and GPU for OFDR. The strain measurement RMSE and demodulation time reach 1.19με and 12ms with keeping other indicators essentially unimpaired.

**Th2A.58**
**A Novel High-Speed Photonic Instantaneous Frequency Measurement Using Frequency Shifting Recirculating Loops,** PAVITRA V. DIDDI[1], Sreeraj S J[1], Joydip Dutta[1], Deepa Venkitesh[1]; *[1]Indian Inst. of Technology Madras, India.* We present a photonic instantaneous frequency measurement system where frequency-shifted optical tones beat with modulated unknown RF. Using a single laser and frequency-shifting loop, we identified RF frequencies within tens of microseconds.

## Th2A • Joint Poster Session II—Continued

**Th2A.59**
**Frequency-Domain Characterization of Deployed Fiber-Medium Coupling Using DAS,** Pierre Pruvost[1], Elie Awwad[1], Yves Jaouen[1], Heming Huang[1]; [1]*TelecomParis, France*. An optical cable is monitored using a DAS interrogator and an accelerometer. Frequency-domain analysis shows that, despite notable differences beyond 100Hz, DAS still provides valuable information on the media surrounding the cable.

**Th2A.60**
**Indoor Trial of a Distributed Coherent 2x2 MIMO Radar on Three Photonic Chips,** Federico Camponeschi[2], Filippo Scotti[1], Valentina Gemmato[2], Fawad Ahmad[2], Malik M. Amir[2], Arjun A. Kumar[2], Muhammad Imran[2], Claudio Porzi[2], Paolo Ghelfi[1], Antonella Bogoni[2], Mirco Scaffardi[1]; [1]*CNIT, Italy;* [2]*Scuola Superiore Sant'Anna, Italy.* The first distributed coherent radar network with three optically linked photonic integrated circuits realized in hybrid Silicon-Indium Phosphide (InP) technology is demonstrated. Characterization shows spatial resolution higher than 30 cm and capability of speed measurement.

**Th2A.61**
**A Novel Photonic Radar Jamming Technique Based on Gate-Controlled Dual Modulation,** Senyu Zhang[1], Wei Luo[1], Mengfan Cheng[1], Lei Deng[1], Shuang Zheng[1], Minming Zhang[1]; [1]*Huazhong Univ of Science and Technology, China*. A photonic-assisted jamming technique using gate-controlled dual modulation generates asymmetric false targets for enhanced deception. Experiments validate the approach, generating five effective false targets with a maximum centroid shift of 1.5 μs, corresponding to a 225-m range offset.

**Th2A.62**
**Tunable Microwave Photonic Radar Jamming System Based on Optical Frequency Comb,** Wei Luo[1], Senyu Zhang[1], Mengfan Cheng[1], Lei Deng[1], Shuang Zheng[1], Minming Zhang[1]; [1]*Huazhong Univ. of Science and Technology, China*. We demonstrate an optical-frequency-comb-based microwave-photonics-assisted radar jamming system that generates diverse false target clusters with irregular amplitude profiles by tailoring comb line amplitudes, experimentally validated through systematic measurements.

**Th2A.63**
**Demonstration of Frequency-Tunable Photonic-Aided D-Band km-Level Communications With High Reliability,** Xiongwei Yang[2], Yi Wei[2], Jingtian Liu[2], feng ZHAO[2], Jianjun Yu[1]; [1]*Fudan Univ., China;* [2]*School of Electronic Engineering, Xian Univ. of Posts and Telecommunications, China*. We experimentally demonstrated a kilometer-level and frequency flexible-tunable photonics-aided sub-THz high reliability transmission system over the D-band, with rate of 20 Gbits/s.

**Th2A.64**
**Monolithic Dual-Wavelength DFB Laser Source for High-Power and Tunable Terahertz Generation,** Yue Zhang[1], Zhenxing Sun[1], Rulei Xiao[1], Xiangfei Chen[1]; [1]*Nanjing Univ., China*. We proposed and demonstrated a high-power monolithic dual-wavelength DFB laser achieving 0.113–0.488 THz tunability and 170 mW output for compact, stable CW THz generation.

**Th2A.65**
**Agent-Controlled Hybrid Communication and Sensing Link for 6G-Compatible Industry 5.0 Networks,** Georgios Syriopoulos[1], Evridiki Kyriazi[1], panagiotis toumasis[1], Thenia Prousalidi[1], Argyris Ntanos[1], Panagiotis Kourelias[1], harry zervos[1], Giannis Giannoulis[1], Giannis Poulopoulos[1], Hercules Avramopoulos[1], Dimitris Apostolopoulos[1], Aris Stathis[1]; [1]*National Technical Univ. of Athens, Greece*. We demonstrate an agent-controlled hybrid fiber–FSO link equipped with a SiPh sensor enabling error-free 50 Gbaud transmission and precise temperature monitoring under ultra-dense WDM operation, achieving stable coexistence with a 17 dB power offset.

**Th2A.66**
**Demonstration of a 300-GHz 272-Gbps Hybrid THz/FSO Transmission System Based on 2×4 MIMO-PDM and a Shared Transmitter,** Qinyi Zhang[1], Jianjun Yu[1,2], Yifan Chen[1], Jiali Chen[1], Chengzhen Bian[1], Long Zhang[2], Junjie Ding[2], Ye Zhou[1], Xin Lu[1], Hansong Ma[1], Cai Yuancheng[2], Jianyu Long[1], feng ZHAO[3], Wen Zhou[1], yaoqiang xiao[4], Kaile Li[5], Weiping Li[1], Min Zhu[2], Jiao Zhang[2], Kaihui Wang[1]; [1]*Fudan Univ., China;* [2]*Purple Mountain Laboratories, China;* [3]*Xi'an Univ. of Posts and Telecommunications, China;* [4]*Hunan Univ., China;* [5]*Hangzhou Inst. of Technology, China*. We experimentally demonstrate, for the first time, a 300-GHz hybrid THz/FSO system transmitting a 34-GBaud DP-QPSK signal over a 15-meter distance. The THz/FSO system, which employs a shared transmitter and a 2×4 MIMO-PDM scheme, achieves a total bit rate of 272 Gbps.

**Th2A.67**
**Real-Time Photonic Down-Conversion for Fiber Fading-Free Dual-Sideband Conjugated-RoF Transmission,** Tomoya Suzuki[1], Yuma Kitaguchi[1], Takahide Sakamoto[1]; [1]*Tokyo Metropolitan Univ., Japan*. We propose and demonstrate real-time photonic down-converter based on photo-mixing in photodiode and harmonic sampling in ADC, for high RF-link gain dual-sideband conjugated-RoF (C-RoF). Fiber-fading-free transmission of 256-Mb/s QPSK C-RoF over 25-km SMF is demonstrated.

**Th2A.68**
**Optical Comb-Based Next-Generation FTTx Architecture for Seamless Residential and 5G-NR Service Provision,** Vicente Fito[1], Maria Morant[1], Roberto Llorente[1]; [1]*Nanophotonics Technology Center, Universitat Politecnica de Valencia, Spain*. A fiber-to-the-x (FTTx) architecture supporting 5G-NR based on optical combs is demonstrated characterizing the required PICs for filtering, switching and beamforming delay providing 0.15 nm spacing, 41 GHz frequency conversion, 87° beamsteering and video overlay.

**Th2A.69**
**Free-Space Same-Wavelength Transmission of Optical Frequency and Communication Signals,** Lei Liu[1], Zhicheng Jin[2], Feng Liu[1], Lai Yu[2], Youzhen You[2], William Shieh[1]; [1]*Westlake Univ., China;* [2]*Shanghai Inst. of Optics and Fine Mechanics Chinese Academy of Sciences, China*. We demonstrate a free-space co-transmission of optical frequency and communication signals at the same wavelength. The system achieves 100-Gb/s DP-QPSK signals over free-space link with the optical frequency instability of $1.47\times10^{-17}$@1s and $7.61\times10^{-19}$@1000s.

**Th2A.70**
**Cloud-Aware Reinforcement Learning-Based HAPS Trajectory Optimization in Hybrid FSO/RF Systems Using Rateless Coding,** Beibei Cui[1], Shanyong Cai[1], Liqian Wang[1], Zhiguo Zhang[1]; [1]*Beijing Univ. of Posts and Telecommunications Inst. of Information Photonics and Optical Communications, China*. This paper presents a DRL-based HAPS trajectory optimization framework integrating rateless coding. It enables seamless FSO/RF soft-switching and proactive cloud-avoidance, with reward shaping mitigating feedback sparsity. Simulations show significant throughput gains over hard-switching baselines.

**Th2A.71**
**Flat-Top Beam Transmission Mitigating Scintillation and BER Fluctuations in Underwater Optical Links Under Longitudinally Uniform Turbulence,** Kiichiro Kuwahara[1], Komei Maekawa[1], Takahiro Kodama[1]; [1]*Faculty of Engineering and Design, Kagawa Univ., Japan*. We experimentally compare Gaussian and flat-top beams for PAM-4 underwater optical transmission under longitudinally uniform turbulence. Flat-top beams mitigate scintillation, suppress BER variance, and extend reach, demonstrating effectiveness for turbulence-resilient, high-speed underwater optical communication links.

**Th2A.72**
**Impact of Antenna Misalignment on a 30-km D-Band Photonics-Assisted Wireless Link,** Xin Lu[1], Jianjun Yu[1,5], Ye Zhou[1], Hansong Ma[1], Jianyu Long[1], LUHAN JIANG[1], Yifan Chen[1], Weiping Li[1], Wen Zhou[1], Kaihui Wang[1], Xianming Zhao[2], feng ZHAO[3], Jianguo Yu[4]; [1]*Fudan Univ., China;* [2]*Harbin Inst. of Technology, China;* [3]*Xi'an Univ. of Posts and Telecommunications, China;* [4]*Beijing Univ. of Posts and Telecommunications, China;* [5]*Purple Mountain Laboratories, China*. We achieved 10-Gbps signal transmission in 30-km D-band photon-assisted wireless system with antenna misalignment tolerance of 0.65°, validating our theoretical model of long-range terahertz system, which provides quantitative alignment guidelines for long-range THz communication system.

**Th2A.73**
**Comparative Performance of DV- and CV-QKD in Co-Propagation With S+C+L-Band WDM Signals,** Hiroki Kawahara[1], Tetsuo Kawakami[1], Toshihiko Okamura[1], Nato Ishii[1]; [1]*NEC Corporation, Japan*. Using an ISRS/SpRS-aware model, we numerically compare decoy-state BB84 and four- state CV-QKD co-propagating with ultra-wideband WDM signals, showing CV-QKD achieves higher co-propagation efficiency defined by a normalized product of secret-key rate and WDM capacity.

**Th2A.74**
**Advanced Chip-Based QKD Systems,** Taofiq Paraiso[2], Yutaro Ishigaki[1], Ankur khurana[2], Yuen San Lo[2], Masashi Ito[1], Katsuyuki Kimura[1], Koji Kanazawa[1], Andrew J. Shields[2], Mark Stevenson[2]; [1]*Toshiba Corporate Laboratory, Japan;* [2]*Toshiba Europe Limited Cambridge Research Laboratory, UK*. In this work, we present an advanced research-grade chip-based QKD system that is fully self-contained and operates in real-time. A proof-of-concept route towards hardware accelerated key distillation is proposed. State-of-the-art QKD capabilities are achieved and stable operation over 35 h is demonstrated.

## Show Floor Programming

**MW5 • Deployment and Architectural Challenges in Metro, Access and Mobile X-Haul**
10:15–11:45, *Theater I*

**Technology Showcase: Designing for Density: Direct-to-Plug Liquid Cooling for Next-Generation Pluggable Optics**
ciena STÄUBLI
10:15-10:45, *Theater III*

**SF14 • From Access Fiber to Awareness Grid: Deploying DFOS for Security, Reliability and New Services**
10:30–11:30, *Theater II*

**Technology Showcase: Beyond SiPh, Game-changing InP Photonic Integration for Next Gen Pluggables in AI Data Centers**
SMART PHOTONICS
11:00-11:30, *Theater III*

**SF18 • How Will Optical Interconnects Meet AI Demand?**
11:45–12:45, *Theater III*

**SF15 • Operationalizing Open XR Optics – Enabling Improved Economics in the Optical Networks**
12:00–11:00, *Theater II*

**SF11 • AI Scale-up Opportunities with Short-Reach Optical Interconnects**
12:15–13:15, *Theater I*

## Room 403A

**14:00–16:00**
**Th3A • Subsystems for Novel Transmission Links**
*Presider: Bin Chen; Hefei Univ. of Technology, China*

**Th3A.1 • 14:00**
**Experimental Demonstration of Non-Data-Aided MIMO Equalization for Strongly Coupled SDM Transmission,** Pamir Oezsuna[1,2], Aymeric Arnould[1], Ruben S. Luis[3], Hideaki Furukawa[3], Ronald Freund[1,4], Georg Rademacher[2,1]; *[1]Fraunhofer Heinrich-Hertz-Institut, HHI, Germany; [2]Inst. of Electrical and Optical Communications, Universitat Stuttgart, Germany; [3]NICT, Japan; [4]Technische Universitat Berlin, Germany.* We experimentally demonstrate singularity-free, non-data-aided equalization for CC-MCF SDM transmission using subspace-constrained initialized (SCI)-CMA with temporal orthonormalization, achieving consistently singularity-free convergence while the conventional CMA failed in all 180 test cases.

**Th3A.2 • 14:15** ★ Top-Scored
**Real-Time 2.5-Pb/s Bidirectional Transmission Over 24-Core Single-Mode Fiber in S+C+L Bands,** Chao Yang[1], Shuchao Mi[2], Honglin Ji[2], Zhaopeng Xu[2], Xu Zhang[2], Hui Chen[2], Yao Lu[2], Shangcheng Wang[2], Siyue Jin[2], Xingfeng Li[2], Rongjun Xu[2], Chao Li[2], Zichen Liu[2], Qibing Wang[2], Jingbin Feng[2], Yuhan Gong[1], Qingyu He[1], Chuyu Peng[3], Ming Luo[1], Lei Wang[2], Zhixue He[2], Shaohua Yu[2]; *[1]State Key Laboratory of Optical Communication Technologies and Networks, China Information Communication Technologies Group Corporation, China; [2]Peng Cheng Laboratory, China; [3]Fiberhome Fujikura Optic Technology, China.* 2.5-Pb/s real-time bidirectional transmission leveraging commercial 400G coherent transponder is experimentally demonstrated over 10.3-km 24-core fiber at S+C+L bands, utilizing 6288 combined SDM/WDM channels with 75-GHz spacing across a 19.65-THz optical spectrum.

## Room 403B

**14:00–15:15**
**Th3B • AI Data Center Networks**
*Presider: Jesse Simsarian; Nokia Bell Labs, USA*

**Th3B.1 • 14:00**
**Field Operation Data Analysis of Optical Interconnects in AI Computing Networks,** Chunxiao Wang[1], Zhicheng Wang[1], Rui Lu[1], Qin Chen[1], Peng Wang[1], Liang Chen[1], Kun Qian[1], Zihan Zhao[1], Zhiping Yao[1]; *[1]Alibaba Cloud, China.* We analyze field-operation data of optical interconnects in AI computing networks, including impacts of failures, distribution of different failure types, and root causes of failures, to offer insights for improving the reliability of optical interconnects.

**Th3B.2 • 14:15**
**Systematic Fault Management of Million-Scale Field-Deployed Optical Transceivers in AI Data Centers,** Yidi Wang[1], Shengnan Li[1], Xiangtao Ding[2], juan wang[2], Wenbin Chen[1], Cheng Chen[2], Yufeng Jiang[2], Qing Liu[2], Yangmin Shao[2], Bowen Zhang[2], Yanli Liu[1], Min Zhang[1], Peilong Wang[2], Danshi Wang[1]; *[1]Beijing Univ. of Posts & Telecom, China; [2]Baidu, Systems Department, Kuike Technology Building, No.9 Shangdi Information Road, Haidian District, China.* A systematic fault management scheme is proposed for hyperscale optical transceivers in AI DCs, including fault prediction and RCL. Validated on Baidu production data, our approach achieves 0.894 F1 score and 92.5% accuracy.

## Room 408A

**14:00–15:30**
**Th3C • Co-packaged Optics and Advanced Packaging Techniques**
*Presider: Chen Ji; Celestial AI, USA*

**Th3C.1 • 14:00**
**Chiplet-to-Chiplet All-to-All Interconnecting Photonic Interposer Using AWGRs With 3D Ultrafast-Laser-Inscription,** Yiting Jin[1], Shun-Hung Lee[1], Siwei Li[1], Georgios Charalampous[1], Anirban Samanta[1], S. J. Ben Yoo[1]; *[1]UC Davis, USA.* We propose and demonstrate 3D photonic interposer with AWGRs designed for chiplet-to-chiplet all-to-all interconnection. 3D ultrafast laser inscription (ULI) technique achieves low loss coupling between silicon photonic chiplets through the photonic interposer with the AWGR.

**Th3C.2 • 14:15**
**Integrated Glass Waveguide Substrate With Surface Coupled Photonic Chips for Massive Scaling of CPO,** Lars Brusberg[1], Seong-ho Seok[2], Tim Grygiel[1], BoKyung Kong[2], Aramais Zakharian[3], Betsy Johnson[3], Janderson Rodrigues[3], Chad Terwilliger[3], Lucas Yeary[3], Jesus Cumana Morales[1], Marisol Gonzalez[1]; *[1]Corning Optical Communication GmbH & Co. KG, Germany; [2]Corning Technology Center Korea, Korea (the Democratic People's Republic of); [3]Corning Research and Development Corporation, USA.* Widescale CPO adoption relies on advanced glass substrates with embedded waveguides and electrical interconnects, enabling scalable silicon photonics assembly through sub-micron alignment, evanescent coupling, and gold bumps, achieving 2 dB fiber-to-chip loss in initial demonstrations.

## Room 408B

**14:00–16:00**
**Th3D • Microwave Photonics Systems**
*Presider: Abel Lorences-Riesgo, Huawei Technologies, China*

**Th3D.1 • 14:00** Invited
**Plasmonics for Microwave Photonic Systems,** Maurizio Burla[1]; *[1]Technische Universität Berlin, Germany.* The importance of low-loss integrated photonic platforms and the integration of plasmonic modulators are discussed as potential enablers for high-performance microwave photonics circuits to reach the THz range.

## Room 411

**14:00–16:00**
**Th3E • Access and Converged Network Architectures**
*Presider: Shikui Shen; China United Network Comm Group, China*

**Th3E.1 • 14:00** Invited
**Analysis and Demonstration of Future Coherent Metro PON Converged Networks,** Giuseppe Rizzelli[1], Safana Al Zoubi[1], Alessandro Galardini[2], Roberto Gaudino[1]; *[1]Politecnico di Torino, Italy; [2]TOP-IX, Italy.* We experimentally characterize a metro-PON converged optical network deployed on existing infrastructure carrying live traffic. Performance metrics in upstream and downstream direction demonstrate feasibility and highlight operational conditions for seamless metro-access integration in real-world environments.

## Room 501ABC

**14:00–16:00**
**Th3F • Photodetectors**
*Presider: Laura Giovane; Broadcom Corporation, USA*

**Th3F.1 • 14:00**
**Germanium Photodetectors With >100 GHz Bandwidth and >1.1 a/W Responsivity on 200-mm Silicon Photonics Platform,** Xudong Jia[1,4], Jiawei Sun[1,4], Xuan Sang Nguyen[3,4], Roger Tern[3,4], Xingwen Hong[1,3], Rui Shao[1,4], Tanmay Ghosh[4], Ruo Qi Goh[3,4], Wing Wai Chung[3,4], Suan Neng Foo[3,4], Wen Qi Tan[3,4], Jae Ok Yoo[3,4], Yiwen Zhang[3,4], Landobasa Tobing[3,4], Eng Soon Tok[2,4], Kah-Wee Ang[1,4], Navab Singh[3,4], Xianshu Luo[3,4], Xiao Gong[1,4], Leh Woon Lim[3,4], Yee-Chia Yeo[4]; *[1]Department of Electrical and Computer Engineering, National Univ. of Singapore, Singapore; [2]Department of Physics, National Univ. of Singapore, Singapore; [3]Inst. of Microelectronics, Agency for Science Technology and Research, Singapore; [4]National Semiconductor Translation and Innovation Centre, Singapore.* We demonstrate Ge photodetector with high-quality Ge growth in silicon recess and optimized lateral P-i-N diode, enabling uniform wafer-scale performance with >100 GHz bandwidth, >1.1 A/W responsivity, and <25 nA dark current at -2 V.

**Th3F.2 • 14:15**
**360 Gbps Ge-on-Si Avalanche Photodiodes Operating in the O- and C-Band,** Amir K. Shaheen[1,2], Conor Coughlan[1], Cedric Bruynsteen[3], Mathias Berciano[1], Didit Yudistira[1], Roger Loo[1,4], Hakim Kobbi[1], Leandro DaSilva[3], Nishant Singh[3], Peter Verheyen[1], Maumita Chakrabarti[1], Xin Yin[3], Yoojin Ban[1], Dimitrios Velenis[1], Filippo Ferraro[1], Dries Van Thourhout[1,2], Peter Ossieur[3], Joris Van Campenhout[1]; *[1]Interuniversitair Micro-Elektronica Centrum, Belgium; [2]PRG, Universiteit Gent, Belgium; [3]IDLab, Belgium; [4]Solid State Sciences, Universiteit Gent, Belgium.* We demonstrate up to 180 GBaud PAM4 data transmission below the HD-FEC BER threshold in the O- and C-band using Ge-on-Si APDs with respectively 70 and 100 GHz BW, and 2 and 1.5 A/W responsivity.

## Room 502A

**14:00–16:00**
**Th3G • Panel: Optical Sensing as a Service on Transceiver and Fiber Systems: Catering to More than just Telecom Industry**

**Organizers:**
Annika Dochhan, *Christian-Albrechts Universität zu Kiel, Germany*
Ming-Fang Huang, *NEC Laboratories America Inc., USA*
Tomoyuki Kato, *1Finity Inc., Japan*
Cen Wang, *KDDI Research Inc., Japan*

**Speakers:**
Takeshi Hoshida, *1Finity Inc., Japan*
Yue-Kai Huang, *NEC Laboratories America Inc., USA*
Patricia Layec, *Nokia, France*
Takeo Sasai, *NTT, Japan*
Vincent Sleiffer, *Adtrain Networks SE, Sweden*
Jun Shan Wey, *Verizon, USA*

Joint optical sensing and communication technologies have received extensive attention due to fiber utilization maximization and cost-effectiveness enhancement. However, several challenges remain in realizing Optical Sensing as a Service (OSaaS), including the translation of technologies into practical applications, the need for standardization, and the alignment of interests between operators and vendors.

OSaaS facilitates the intelligent operation of optical networks, thereby improving network resilience and availability. The standardization organizations are also actively promoting fiber-optic systems with sensor capabilities, such as SMART CABLE. In addition, the emerging DSP-based sensing eliminates the range limitation of backscattering-based technologies. This technology provides opportunities for device vendors to develop innovative products and expand market reach. Beyond telecommunication applications, OSaaS can expedite intensive acquisition of sensor data and foster innovation of new applications in diverse fields, such as environmental and civil infrastructure monitoring. This effectively revitalizes existing optical fiber assets by creating a revenue stream.

Therefore, this panel aims to show the OSaaS prospects of a) transformations from technologies into applications or products, b) deployments and verifications, and c) standardization activities.

## Room 502B

**14:00–16:00**
**Th3H • Programmable Photonics**
*Presider: Nikos Pleros; Aristoteleio Panepistimio Thessalonikis, Greece*

**Th3H.1 • 14:00** **Tutorial**
**Programmable Photonics,** Jose Capmany[1]; [1]*Universitat Politècnica de València, Spain.* This tutorial provides a comprehensive introduction to the basic operation principles, architectures and applications of programmable integrated photonic circuits. It will contemplate both photonic and electronic hardware as well as software aspects.

Dr. Dr. José Capmany is a Full Professor in Photonics and leader of the Photonics Research Labs (www.prl.upv.es) at the institute of Telecommunications and Multimedia Applications (www.iteam.upv.es), Universitat Politècnica de Valencia, Spain. He holds BSc+MSc degrees and doctorates in Electrical Engineering and Physics.

He has published over 650 papers in international refereed journals and conferences and has been a member of the Technical Program Committees of the European Conference on Optical Communications (ECOC), the Optical Fiber Conference (OFC). He is a Fellow of the Optica and the Institute of Electrical and Electronics Engineers (IEEE. He is also a founder and chief scientific officer of the spin-off companies VLC Photonics (acquired by Hitachi in 2020) dedicated to the design of photonic integrated circuits and iPronics (www.ipronics.com) dedicated to programmable photonics.

## Room 515A

**14:00–16:00**
**Th3I • Special Session: Rethinking Networking Convergence from Operational Perspective: Towards a Data and AI-centric Operational Future**
*Presider: Andreas Gladisch, Deutesche Telekom AG Laboratories,, Germany; Daniel Kilper, Univ. of Dublin Trinity College, Ireland; Fritz-Joachim Westphal, Deutsche Telekom Innovation Laboratories, Germany*

**Th3I.1 • 14:00** **Invited**
**From Operating Networks to Operating Autonomy: The Operational Shift to the AI-Native Internet,** Malik Tatipamula[1]; [1]*Ericsson, USA.* Network operations historically assured delivery and execution. AI-native systems require assuring autonomous behavior. This talk explains the operational transition from packet and workload management to intent, policy, and accountability enforcement using the Participation–Abstraction–Correctness model.

**Th3I.2 • 14:15** **Invited**
**The Integrated Ecosystem: AI-capable Multi-Domain Orchestration and Cross-Layer Operations,** Inder Monga[1]; [1]*ESNet, USA.* ESnet's transition to AI-managed infrastructure will highlight how cross-layer and AIOps create an autonomous network fabric capable of accelerating global scientific workflows. We explore building new integration frameworks within the American Science Cloud Genesis Mission.

## Room 515B

**14:00–16:00**
**Th3J • Coherent for Data Center**
*Presider: Kang Ping Zhong; Hong Kong Polytechnic Univ., Hong Kong*

**Th3J.1 • 14:00** **Tutorial**
**Analog Coherent Optics Inside the Data Center,** Clint Schow[1]; [1]*Univ. of California Santa Barbara, USA.* Energy-efficient coherent links offer a path to minimizing power consumption and latency while enabling bandwidth scaling and expanded optical link budgets that can enable reconfigurable photonic networks tailored to the demands of AI workloads.

Clint Schow received B.S., M.S. and Ph.D. degrees from the University of Texas at Austin. After positions at IBM and Agility Communications, Dr. Schow spent more than a decade at the IBM T.J. Watson Research Center in Yorktown Heights, NY, as a research staff member and manager. Since 2015 he has been a professor in the Electrical and Computer Engineering Department at the University of California Santa Barbara. He is a fellow of the IEEE and Optica, has published more than 250 journal and conference articles, and has 33 issued patents.

## Room 518

## Show Floor Programming

**SF16 • Driving Optical Interconnect Specs for AI**
13:30–14:30, *Theater II*

**SF12 • Fiber Broadband Progress and New Horizons**
13:45–14:45, *Theater I*

**SF12 • Fiber Broadband Progress and New Horizons**
13:45–14:45, *Theater I*

**Technology Showcase: Near-Package Optics: The Practical Path Beyond CPO**
LIGHTSPEED PHOTONICS
13:45–14:45, *Theater III*

**SF19 • From Connectivity to Intelligence: Evolving Toward a Converged Multi-Access Optical PON Network**
14:30-15:30, *Theater III*

**SF17 • Standards Update on Multicore Fibre and the Impact of AI on Access and Transport Networks**
14:45–15:45, *Theater II*

**SF13 • Silicon Photonics and Co-Packaged Optics Standardized Ecosystem**
15:00–16:00, *Theater I*

## Room 403A

### Th3A • Subsystems for Novel Transmission Links—Continued

**Th3A.3 • 14:30** Invited

**Advanced SMART Techniques for the Hollow-Core Fiber Submarine ISAC,** Lin Sun[1], Jiaqi Cai[1], Weiye Wang[1], Rendong Xu[2], Lipeng Feng[3], Anxu Zhang[3], Peng Li[4], Lei Zhang[4], Jie Luo[4], Gordon Ning Liu[1], Gangxiang Shen[1]; [1]*Soochow Univ., China;* [2]*Zhejiang Univ., China;* [3]*China Telecom Research Inst. Beijing, China;* [4]*Yangtze Optical Fibre and Cable Joint Stock Limited Company, China.* Hollow-core fibers (HCFs) providing characters of low loss and nonlinearity meet the demands of long-haul submarine communications. New solutions of subsea monitoring by integrated sensing and communications on HCF cables need to be developed.

## Room 403B

### Th3B • AI Data Center Networks—Continued

**Th3B.3 • 14:30**

**Robust Brownfield Topology Design for Data Centre Interconnection,** Giovanni S. Sticca[1,2], Robin Matzner[2], Memedhe Ibrahimi[1], Massimo Tornatore[1], Polina Bayvel[2]; [1]*Politecnico di Milano, Italy;* [2]*Univ. College London, UK.* We propose a robust topology design framework for data centre interconnection networks that maximises throughput under traffic distribution variations, achieving up to 57% higher throughput compared to conventional methods that assume a single traffic distribution.

**Th3B.4 • 14:45** Invited

**In-Network Optical Computing,** Zhizhen Zhong[1]; [1]*Netpreme Corporation, USA.* This presentation will discuss in-network optical computing.

## Room 408A

### Th3C • Co-packaged Optics and Advanced Packaging Techniques—Continued

**Th3C.3 • 14:30**

**Vertical Optical Coupling Tapers for Co-Packaged Optics With Multimode Fiber and High-Speed Photodetectors,** Jean-Luc Polleux[1], Benjamin Boisnard[1], Mayte Gomez Castano[1], Ronghua Zhou[1], Carlos Viana[1], Keizo Kinoshita[2], Michiyo Kubo[2], Kazuhiro Shiba[2], Shigeru Kobayashi[2], Kazuhiko Kurata[2]; [1]*ICON Photonics, France;* [2]*AIO Core, Japan.* This paper presents co-packaging-optics (CPO) coupling of multimode fiber arrays to high-speed photodetectors with low aperture size down to 10 µm. Coupling efficiencies exceeding 95% have been achieved with alignment tolerances above ±25 µm.

**Th3C.4 • 14:45** Invited

**High Performing Photonics Systems - CPO, Towards Photonics Chiplets,** Tolga Tekin[1]; [1]*Fraunhofer IZM, Germany.* This paper focuses on the efforts in developing low-latency, high-bandwidth, and high-density off-chip, chiplet, and core optical interconnect technologies to meet the demands of next-generation European data centers.

## Room 408B

### Th3D • Microwave Photonics Systems—Continued

**Th3D.2 • 14:30** ★ Top-Scored

**Integrated Diffractive Recirculating Microring Mesh for Picometer-Resolution Spectroscopy,** Wenzhang Tian[1], Xianyi Feng[1], Hao Chen[1], Baohua Wen[1], Yeyu Tong[1]; [1]*Hong Kong Univ of Sci & Tech (Guangzhou), China.* We demonstrated a single-shot reconstructive spectrometer with 2.5 pm resolution and 160 nm bandwidth, achieved through a fully passive silicon photonic recirculating microring mesh integrated with a diffractive nano-antenna array.

**Th3D.3 • 14:45**

**Wideband, Low-Loss, Multi-Wavelength-Channel, Continuously Tunable Optical True Time Delay Processor,** Yoav Dana[1], Idan Shefer[1], David Sinefeld[2], Dan M. Marom[1]; [1]*Applied Physics, Hebrew Univ. of Jerusalem Faculty of Science, Israel;* [2]*Applied Physics and Electro-Optical Engineering, Jerusalem College of Technology, Israel.* An optical true-time delay free-space spectral processor supporting 32 independently/continuously tunable delays on wavelength channels with >40GHz bandwidth and >1ns delay is realized, utilizing fast MEMS tilting mirrors and exhibiting only 6 dB loss.

## Room 411

### Th3E • Access and Converged Network Architectures—Continued

**Th3E.2 • 14:30**

**Demonstration of High Accuracy Timing Transport Over Optical WDM Network Alongside 200G Wavelength Traffic,** Yu Rong Zhou[1], Mike Gilson[1], Russell Davey[1], Alan Stranc[1], Cheng Chen[1], Ardel Iddin[2], Thomas Gemmer[2], Marc Degieux[2], Pavan Matcha[2]; [1]*BT Group plc, UK;* [2]*Nokia Group, Finland.* We report successful demonstration of accurate timing transport over WDM network alongside 200G wavelengths achieving timing accuracy within ±15 ns across a chain of four boundary clocks, different WDM system configurations are investigated.

**Th3E.3 • 14:45**

**Dynamic Control of Multi-Technology Optical Access Networks With PON and Coherent P2MP,** Roberto Morro[2], Roberto Marcinelli[2], Annachiara Pagano[2], Anna Chiado Piat[2], Emilio Riccardi[2], Andrea Marotta[3], Carlo Centofanti[3], Ramon Casellas[4], Filippo Cugini[1], Andrea Sgambelluri[5]; [1]*CNIT, Italy;* [2]*FiberCop, Italy;* [3]*Universita degli Studi dell'Aquila, Italy;* [4]*Centre Tecn`ologic de Telecomunicacions de Catalunya, Spain;* [5]*Scuola Superiore Sant'Anna, Italy.* We demonstrate a multi-technology optical access architecture integrating PON and P2MP coherent optics through a programmable matrix with SDN orchestration, enabling dynamic coexistence, on-demand service provisioning, and unified management across heterogeneous optical domains.

## Room 501ABC

### Th3F • Photodetectors—Continued

**Th3F.3 • 14:30**

**A Ge/Si Photodiode Exceeding 110 GHz With 0.9 a/W, low Capacitance and Operating at -0.5 v for O and C-Band Applications,** Conor Coughlan[1], Amir Shahin[1,2], Mathias Berciano[1], Hakim Kobbi[1], Shalini Jakanadan[1], Roger Loo[1,2], Cedric Bruynsteen[1,2], Jakob Declercq[1,2], Minkyu Kim[1], Swetanshu Bipul[1], Peter Verheyen[1], Dimitrios Velenis[1], Maumita Chakrabarti[1], Filippo Ferraro[1], Imene Jadli[1], Dries Van Thourhout[2,1], Xin Yin[2,1], Peter Ossieur[1,2], Joris Van Campenhout[1]; [1]*Interuniversitair Micro-Elektronica Centrum, Belgium;* [2]*Universiteit Gent, Belgium.* Ge photodiodes deeply recessed into highly doped Si are fabricated, reducing series resistance, transit time and diffusion. Bandwidths exceeding 110 GHz with 0.9 A/W responsivity were measured, with ≤ 6fF capacitance at -0.5 V bias.

**Th3F.4 • 14:45**

**92 GHz Bandwidth and High Power Ge PD With Distributed Absorption Regions and Interdigitated Electrode,** Wenxin Deng[1], Tao Chu[1]; [1]*Zhejiang Univ., China.* We demonstrate a compact Ge photodetector (PD) with a high bandwidth of 92 GHz and 69 GHz when photocurrent is 0.1 mA and 8 mA by utilizing distributed absorption regions and an interdigitated electrode. Furthermore, the proposed PD has a low dark current of 5.67 nA and a high responsivity of 1 A/W for optical power of 40 mW.

## Room 502A

### Th3G • Panel: Optical Sensing as a Service on Transceiver and Fiber Systems: Catering to More than just Telecom Industry—Continued

The key questions to address in this panel are:

- What are the key application areas that suit a particular sensing technique?
- Can hybridization of sensing technologies help address blind spots or trade-offs?
- What are the challenges, opportunities and valuable use cases of deploying OSaaS?
- How to coordinate sensing paradigms with AI-assisted operations (e.g., digital twins, LLM, autonomous driving networks, etc.), incl. data interpretations and system requirements?
- What role will standards and interoperability play in adoption and deployment?
- Who will primarily invest in OSaaS, and what will the landscape look like in 5-10 years?

## Room 502B

### Th3H • Programmable Photonics—Continued

Professor Capmany is the 2012 King James I Prize Laureate on novel technologies and the National Research award in Engineering 2020, the two highest scientific distinctions in Spain, for his outstanding contributions to the field of microwave photonics. He has also received the Engineering achievement award from the IEEE Photonics Society in 2021 and the Innovation prize from the Royal Society of Physics in Spain in 2022. He is an ERC Advanced and Proof of concept double grantee and was a distinguished lecturer of the IEEE Photonics Society for the 2013-14 term. He has been associate editor of IEEE Photonics Technology Letters (2010-2016) and the IEEE Journal of Lightwave Technology (2016-2018). He served as Editor in Chief of the IEEE Journal of Selected Topics in Quantum Electronics from 2018 to 2022.

## Room 515A

### Th3I • Special Session: Rethinking Networking Convergence from Operational Perspective: Towards a Data and AI-centric Operational Future—Continued

**Th3I.3 • 14:30** Invited

**Cloud-native Optical Network in the Era of AI: Requirement and Architecture,** Hideki Nishizawa[1]; [1]*NTT Network Innovation Laboratories, Japan.* This talk discusses requirements and architectures for cloud-native optical networks leveraging digital twins as key enablers, emphasizing telcos' transition to data center operators and system integrators to enable AI-driven operations.

**Th3I.4 • 14:45** Invited

**Better Making Phone Calls in Isaac Azimov's Utopia,** Sebastian Bigo[1], Patricia Layec[1], Camille Delezoide[1]; [1]*Nokia Bell Labs, Murray Hill, NJ, United States.* Built for human communications, networks are increasingly burdened by machine traffic for AI, yet AI can also help operate and robotize them. We discuss automation challenges, focusing on reliability and scalability of data collection and processing.

## Room 515B

### Th3J • Coherent for Data Center—Continued

## Room 518

## Show Floor Programming

**SF12 • Fiber Broadband Progress and New Horizons**
13:45–14:45, *Theater I*

**SF12 • Fiber Broadband Progress and New Horizons**
13:45–14:45, *Theater I*

**Technology Showcase: Near-Package Optics: The Practical Path Beyond CPO**
LIGHTSPEED PHOTONICS
13:45–14:45, *Theater III*

**SF19 • From Connectivity to Intelligence: Evolving Toward a Converged Multi-Access Optical PON Network**
14:30-15:30, *Theater III*

**SF17 • Standards Update on Multicore Fibre and the Impact of AI on Access and Transport Networks**
14:45–15:45, *Theater II*

**SF13 • Silicon Photonics and Co-Packaged Optics Standardized Ecosystem**
15:00–16:00, *Theater I*

## Room 403A

### Th3A • Subsystems for Novel Transmission Links—Continued

**Th3A.4 • 15:00**
**QR-Decomposition Based Recursive Least Squares Low-Complexity MDL-Tolerant MIMO Equalization for High-Symbol-Rate Coupled SDM Channel Transmissions,** Kohki Shibahara[1], Akira Kawai[1], Megumi Hoshi[1], Takayuki Kobayashi[1], Yutaka Miyamoto[1]; [1]*Network Innovation Laboratories, NTT Inc., Japan.* We propose numerically-stable and fast-converging QR-decomposition-based recursive-least-squares MIMO equalization for high-MDL SDM transmission, achieving up to 67% lower computational complexity. It simultaneously provides IQ-imbalance compensation and twofold-faster filter-coefficient learning in 12-coupled 140-GBd 3317-km signal transmission.

**Th3A.5 • 15:15** ★ Top-Scored
**A Monolithic CMOS 28Gb/s PAM-4 Optical Receiver Front-End With Lateral-Enhanced P-Well/N-Well APD for VCSEL-Based Links,** Dongshen Zhan[1], Hemiao Wang[1], Xiongshi Luo[1], Yangyi Zhang[1], Zhenyu Yao[1], Wentao Zhou[1], Zhenghao Li[1], Hongzhi Wu[1], De Zhou[1], Quan Pan[1]; [1]*State Key Laboratory of Quantum Functional Materials, School of Microelectronics, Southern Univ. of Science and Technology, China.* A 28Gb/s PAM-4 monolithic optical receiver front-end is designed in 28nm CMOS with the proposed lateral-enhanced PW/NW APD. It demonstrates a cost-efficient optical link solution, achieving the highest data rate with an SER of 6E–5 and a power efficiency of 0.66pJ/bit.

## Room 403B

### Th3B • AI Data Center Networks—Continued

## Room 408A

### Th3C • Co-packaged Optics and Advanced Packaging Techniques—Continued

**Th3C.5 • 15:15**
**Ultra-Low Loss Compact SiP Polarization Compensator for CPO With an ELS,** Aleksandar Nikic[1], Weijia Li[1], Charles St-Arnault[1], Santiago Bernal[1], Benton Qiu[1], Deng Mao[1], Essam Berikaa[1], Kaibo Zhang[1], Codey Nacke[1], Luhua Xu[1], Max Zhang[1], Ian Plant[1], Alessandra Bigongiari[2], Fabio Cavaliere[2], Antonio D'Errico[2], Luca Giorgi[2], Stephane Lessard[2], Roberto Sabella[2], Stefano Stracca[2], David V. Plant[1]; [1]*McGill Univ., Canada;* [2]*Ericsson, Italy.* We demonstrate a novel semi-deterministic SiP O-Band device, capable of compensating any ELS SOP from 1km distances, with an IL of 1.9-dB and PDL of 0.77-dB, enabling the ubiquitous use of ELS in CPO transceivers.

## Room 408B

### Th3D • Microwave Photonics Systems—Continued

**Th3D.4 • 15:00**
**2.4 Tbit/s Random Bit Generation With Programmable Massively Parallel Chaos Source,** Qiuzhuo Deng[1], Can Wang[1], Yuxin Liang[2], Hanmeng Li[2], Kangpeng Ye[1], Oskars Ozolins[3,4], Naidi Cui[2], Xin Yin[5], Xiaodan Pang[1,3], Lu Zhang[1], Xianbin Yu[1,3]; [1]*Zhejiang Univ., China;* [2]*Chongqing United Microelectronics Center, China;* [3]*Rigas Tehniska universitate, Latvia;* [4]*RISE Research Inst. of Sweden, Sweden;* [5]*Universiteit Gent, Belgium.* We demonstrate a low-complexity and a programmable massively parallel chaos source with 40 channels and wide bandwidth of ~34 GHz/channel, which breaks conventional scaling trade-offs, thereby enabling ultrafast random bit generation with 2.4 Tbit/s.

**Th3D.5 • 15:15**
**Wide-Bandwidth and High-Precision Silicon Microwave Frequency Measurement System,** Zexu Wang[1], Zuozhou He[1], Hongzhi Xiong[1], Yiwei Xie[1], Daoxin Dai[1]; [1]*Zhejiang Univ., China.* We demonstrate a channelized-instantaneous frequency measurement (CIFM) system, using wavelength-division multiplexing and programmable frequency measurement technique, achieving high-precision measurements with an error of 24.02 MHz across a 1-40 GHz range.

## Room 411

### Th3E • Access and Converged Network Architectures—Continued

**Th3E.4 • 15:00**
**End-to-End Orchestration Across MCF Infrastructure: Field Trial of Spatial PON and Metro Convergence With O-RAN for AR/VR Services With Edge Offload,** Andrea Marotta[1,2], Pablo A. Robles[3], Pol Gonzalez[4], Leonardo D'Errico[2], Ibrahim Babiker[5], Carlo Centofanti[1,2], Giammarco Di Sciullo[1], Cristian Antonelli[1], Luis Velasco[4], Stefano Tennina[2], Stephen Parker[5], Marco Quagliotti[6], Emilio Riccardi[7], Oscar G. De Dios[3], Filippo Cugini[8], Andrea Sgambelluri[9]; [1]*Universita degli Studi dell'Aquila, Italy;* [2]*WEST Aquila SRL, Italy;* [3]*Telefonica de Espana, Spain;* [4]*Universitat Politecnica de Catalunya, Spain;* [5]*Accelleran, Belgium;* [6]*Telecom Italia, Italy;* [7]*Fibercop, Italy;* [8]*Consorzio Nazionale Interuniversitario per le Telecomunicazioni, Italy;* [9]*Scuola Superiore Sant'Anna, Italy.* First field trial demonstrating energy-aware convergence of spatial PON with 5G O-RAN for AR/VR services. Traffic-driven orchestration dynamically activates/deactivates spatial lanes and radio units, achieving 8\% energy reduction while maintaining service quality.

**Th3E.5 • 15:15**
**Decoupling Equalization From Network Complexity: an Interpretable Kolmogorov-Arnold Network-Based Equalizer for Real-Time Low-Latency 6G Links,** Tianqi Zheng[1], Kaihui Wang[1], Sheng Hu[1], Xiongwei Yang[1], Ye Zhou[1], Chengzhen Bian[1], Jianjun Yu[1]; [1]*Fudan Univ., China.* This work demonstrates a Kolmogorov–Arnold Network (KAN)-based equalizer for terahertz-over-fiber systems, achieving a 1.2 dB sensitivity gain with only 6 forward computation units. By decoupling forward-backward propagation and deploying via lookup tables on FPGA, it enables ultra-low-latency, resource-efficient 6G links.

## Room 501ABC

### Th3F • Photodetectors—Continued

**Th3F.5 • 15:00**
**Uniformly Absorbed Waveguide-Integrated Germanium Photodetector for High-Power and High-Speed Receiver,** Jinwen Song[1], TING XIA[2,1], Fangchen Hu[1], Xu Wang[2,1], Fengxin Yu[1], Wei Chu[1], Haiwen Cai[1], Xiao Hu[1]; [1]*Zhangjiang Laboratory, China;* [2]*Fudan Univ., China.* We demonstrate a lateral waveguide coupled Ge-Si photodetector enabling uniform absorption with 67 GHz bandwidth under 4 mA photocurrent, in which 112 Gbps NRZ and 224 Gbps PAM4 clear openings of eye diagrams are experimentally attained.

**Th3F.6 • 15:15**
**Low-Voltage Microring-Assisted Ge Avalanche Photodiodes With 56 Gbaud on a 300-mm Wafer,** Bongkwon Son[1], Jung-Tack Yang[1], Seungjun Han[1], Jongwoo Park[1], Seong-Hwan Kim[1], SeungHun Lee[1], Youngzoon Yoon[1], Kyung-Sang Cho[1], Changbum Lee[1], Yeonjae Park[1], Seyoon Kim[1], Sihan Kim[1], Duhyun Lee[1], Chan-Wook Baik[1], Dongjun Seo[1], Doojun Eom[1], Jaeho Choi[1], Junghoon Chey[1], Junyeung Kim[1], Changgyun Shin[1], Hyunil Byun[1], Seok-Hee Hwang[1], Hyochul Kim[1], Hyundai Park[1], Kangho Lee[1]; [1]*Samsung Electronics Co., Ltd., Korea (the Republic of).* We present microring-assisted Ge avalanche photodiodes (MRA-Ge APDs) fabricated on a 300-mm platform. The MRA-Ge APD exhibits an on-resonance responsivity of 0.82 A/W at −1.0 V. In addition, an avalanche gain of 7.5 is achieved at −6.1 V with the good uniformity across the 300-mm wafer. The MRA-Ge APD supports 56 Gbaud (NRZ and PAM4) operation.

## Room 502A

### Th3G • Panel: Optical Sensing as a Service on Transceiver and Fiber Systems: Catering to More than just Telecom Industry—Continued

## Room 502B

### Th3H • Programmable Photonics—Continued

**Th3H.2 • 15:00**
**Multi-Output all-Optical Nonlinear Element for Photonic Neural Networks With Super-Efficient Activation Reshaping,** Petar Atanasijevic[1], Mladen Banović[1], Jasna Crnjanski[1], Marko Krstić[1], Dejan Gvozdić[1]; [1]*Univerzitet u Beogradu, Serbia*. We experimentally demonstrate reshaping-enabled all-optical adaptive activation functions with non-increasing, non-decreasing, and non-monotonic trends, establishing in hardware the core structure for advanced photonic neural network architectures.

**Th3H.3 • 15:15** ★ Top-Scored
**In-Network Analog AllReduce for ML With Programmable Integrated Photonics,** Arjun Devraj[1], Bill Owens[2], Daniel Pérez-López[3], Rachee Singh[1]; [1]*Cornell Univ., USA;* [2]*NYSERNet, USA;* [3]*iPronics Programmable Photonics, Spain*. We demonstrate in-network analog AllReduce using programmable integrated photonics. Our design enables simultaneous analog computation and circuit routing within a silicon photonic mesh, validated in hardware and end-to-end ML training, yielding 2× faster communication.

## Room 515A

### Th3I • Special Session: Rethinking Networking Convergence from Operational Perspective: Towards a Data and AI-centric Operational Future—Continued

## Room 515B

### Th3J • Coherent for Data Center—Continued

**Th3J.2 • 15:00**
**A Linear MRM-Based Coherent Optical Link Architecture With Integrated Closed-Loop Carrier Phase Recovery,** Dan Sturm[1], Marziyeh Rezaei[1], Pengyu Zeng[1], Asha Rashmi Nayak[1], Scott Li[1], Sajjad Moazeni[1]; [1]*Electrical and Computer Engineering, Univ. of Washington, USA*. To meet the continued scaling demands of AI infrastructure, we demonstrate the next generation of coherent optical links using an MRM-based transmitter and continuous analog DSP-free carrier-phase recovery in GlobalFoundries 45 nm silicon photonics.

**Th3J.3 • 15:15**
**Practical Considerations for Laser Selection in DSP-Free Coherent Systems Employing a Pilot-Tone-Assisted Optical Phase-Locked Loop,** Jingchuan WANG[1], Mohamad Hossein Idjadi[1], Xi Chen[1], Gregory Raybon[1], Callum Deakin[1], Brian Stern[1], Di Che[1]; [1]*Nokia Bell Labs, USA*. We implement a framework to evaluate the laser phase noise-induced penalty and verify it in a DSP-free system with up to 130-GBaud 16-QAM over 10-km hollow-core fiber. It bridges laser and system modeling aiming for practical guidelines to select lasers.

## Room 518

## Show Floor Programming

**SF19 • From Connectivity to Intelligence: Evolving Toward a Converged Multi-Access Optical PON Network**
14:30-15:30, *Theater III*

**SF17 • Standards Update on Multicore Fibre and the Impact of AI on Access and Transport Networks**
14:45–15:45, *Theater II*

**SF13 • Silicon Photonics and Co-Packaged Optics Standardized Ecosystem**
15:00–16:00, *Theater I*

## Th3A • Subsystems for Novel Transmission Links—Continued

**Th3A.6 • 15:30**
**Ultra-Fast and Multi-Point Microwave Photonics Frequency Hopping With Integrated Decoy Tones for Secure Millimeter-Wave Communication,** Xiaoyang Liu[1], Kai Xu[1], Mengfan Cheng[1], Qi Yang[1], Ming Tang[1], Deming Liu[1], Lei Deng[1]; [1]*Huazhong Univ. of Science and Technology, China*. We propose an ultra-fast frequency-hopping scheme incorporating decoy tones. Multi-point frequency-hopping is achieved with a band of 70GHz and a hopping period of 5ns. The decoy signals show 99.6% constellation-quality similarity yet a ~50% BER.

**Th3A.7 • 15:45**
**Square-Root-Processed and Optical Carrier-Suppressed DSB Modulation for Simple Analog Radio-Over-Fiber Transmission Systems,** Takaki Sugiyama[1], Ryoji Ito[1], Daisuke Hisano[1], Hirofumi Sasaki[2], Akihiro Maruta[1], Ken Mishina[1]; [1]*The Univ. of Osaka, Japan;* [2]*NTT, Inc., Japan*. We propose a novel modulation scheme of square-root-processed and optical carrier-suppressed DSB modulation to facilitate simple analog radio-over-fiber transmission systems. We demonstrate the validity of the proposed method through numerical simulations and experiments.

## Th3B • AI Data Center Networks—Continued

## Th3C • Co-packaged Optics and Advanced Packaging Techniques—Continued

## Th3D • Microwave Photonics Systems—Continued

**Th3D.6 • 15:30** Invited
**Integrated Microwave Photonics Inside Radar Systems: Potential and Current Issues,** Paolo Ghelfi[1]; [1]*CNIT, Italy.* The rush of integrated photonics technologies is fueling the interest in microwave photonics solutions within radar systems, improving their performance while reducing SWaP. We review the latest application opportunities and discuss their current limitations.

## Th3E • Access and Converged Network Architectures—Continued

**Th3E.6 • 15:30** Invited
**Interoperability in Optical Space Networks,** Ramon Mata Calvo[1]; [1]*European Space Agency, Netherlands*. Optical space networks are a key infrastructure for global communications. HydRON targets the demonstration of the required technologies and operational concepts, and ESTOL sets a specification to reach interoperability among communication terminals from different vendors.

## Th3F • Photodetectors—Continued

**Th3F.7 • 15:30**
**260 Gbit/s PAM-4 Waveguide-Integrated Graphene Photodetector With >110 GHz Bandwidth Based on Hybrid Plasmonic Slot Structure,** Hejie Peng[1], Zhiqiang Quan[1], Lidong Zhang[1], Yuwei Zhuang[1], Yibo Feng[1], Ruiqi Liu[1], jing du[1], Wenyu Zhao[1], Jian Wang[1]; [1]*Wuhan National Laboratory for Optoelectr, China*. We propose and demonstrate a waveguide-integrated graphene photodetector based on a hybrid plasmonic slot structure, achieving 0.583 A/W responsivity, >110 GHz bandwidth, and 260 Gbit/s PAM-4 detection through enhanced light-graphene interaction.

**Th3F.8 • 15:45**
**61-Port Fan-Shaped Ge-on-Si Photodetector for Waveguide-Multiplexed Photonic Matrix-Vector Multiplication,** Rui Tang[1], Makoto Okano[2], Kasidit Toprasertpong[1], Mitsuru Takenaka[1]; [1]*The Univ. of Tokyo, Japan;* [2]*National Inst. of Advanced Industrial Science and Technology, Japan*. We successfully scale a multiport Ge-on-Si photodetector to 61 ports with 16.4 GHz bandwidth through Ge-area optimization. The compact fan-shaped design with proper Ge length enables scalable, high-speed photonic matrix–vector multiplication using waveguide multiplexing.

## Room 502A

### Th3G • Panel: Optical Sensing as a Service on Transceiver and Fiber Systems: Catering to More than just Telecom Industry—Continued

## Room 502B

### Th3H • Programmable Photonics—Continued

**Th3H.4 • 15:30**
**Hyperspectral Photonic Tensor Core Driven by III-v/Si Membrane Laser Modulators and Programmable Photonics,** Mitsumasa Nakajima[1], Hidetaka Nishi[1], Taishi Sumiya[1], Takuro Fujii[1], Nikolaos-Panteleimon Diamantopoulos[1], Koji Takeda[1], Toshikazu Hashimoto[1], Takasumi Tanabe[2], Shinji Matsuo[1]; *[1]Device Technology Labs., NTT, Inc., Japan; [2]Department of Electronics and Electrical Engineering, Faculty of Science and Technology, Keio Gijuku Daigaku, Japan*. We demonstrated a scalable photonic tensor processor based on time-space-wavelength division incoherent matrix-matrix multiplication on integrated InP/Si directly modulated lasers and programmable interferometer mesh. We confirmed successful operation through an image-classification benchmark.

**Th3H.5 • 15:45**
**Energy Optimization in Programmable Integrated Photonic Unitary Circuits Based on Euler Rotations,** Jose Capmany[1], Pablo Martinez-Carrasco[1], Raul Lopez[1]; *[1]Universitat Politècnica de València, Spain*. We experimentally demonstrate energy-efficient arbitrary unitary operations in programmable integrated photonic circuits using Euler rotations and selecting the shorter path in each rotation, achieving systematic energy savings up to 1.64 mW per tunable basic unit.

## Room 515A

### Th3I • Special Session: Rethinking Networking Convergence from Operational Perspective: Towards a Data and AI-centric Operational Future—Continued

A discussion will follow the presentations.

## Room 515B

### Th3J • Coherent for Data Center—Continued

**Th3J.4 • 15:30**
**Barium Titanate DP-IQM Enabling Net 1 Tbps/λ ZR and Coherent-Lite Data Center Networks,** Benton Qiu[1], Charles St-Arnault[1], Santiago Bernal[1], Aleksandar Nikic[1], Kaibo Zhang[1], Yixiang Hu[1], Pascal Stark[2], Wouter Diels[2], Felix Eltes[2], David V. Plant[1]; *[1]McGill Univ., Canada; [2]Lumiphase, Switzerland*. We present a barium titanate (BTO) dual polarization in-phase quadrature modulator (DP-IQM) enabling a record net 1 Tbps/λ over 80 km in a ZR modeled system and over 2 km in a coherent-lite system.

**Th3J.5 • 15:45** ★ Top-Scored
**Silicon-Organic Hybrid (SOH) IQ Modulators With Sub-1 v π-Voltages Operating at 200 GBd 16QAM and 144 GBd 64QAM,** Alexander Kotz[4], Mohamed Kelany[4], Adrian Schwarzenberger[4], Hend Kholeif[4,5], Christoph Wilhelm[4,2], Stefan Singer[4,2], Carsten Eschenbaum[2], Adrian Mertens[2], Malte Martens[2], Sidra Sarwar[2,3], Peter Erk[4,2], Artem Kuzmin[4,5], Stefan Bräse[3], Sebastian Randel[4], Wolfgang Freude[4], 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 GmbH, Germany; [3]Inst. of Biological and Chemical Systems – Functional Molecular Systems (IBCS-FMS), Karlsruhe Inst. of Technology (KIT), Germany; [4]Inst. of Photonics and Quantum Electronics (IPQ), Karlsruhe Inst. of Technology (KIT), Germany; [5]Inst. of Microstructure Technology (IMT), Karlsruhe Inst. of Technology (KIT), Germany*. We demonstrate compact high-speed silicon-organic hybrid (SOH) IQ modulators offering π-voltages below 800 mV. Our devices reach symbol rates of 200 GBd for 16QAM and of 144 GBd for 64QAM transmission over 85 km – record-high values for IQ modulators on the silicon photonic platform.

## Room 518

## Show Floor Programming

**SF17 • Standards Update on Multicore Fibre and the Impact of AI on Access and Transport Networks**
14:45–15:45, *Theater II*

**SF13 • Silicon Photonics and Co-Packaged Optics Standardized Ecosystem**
15:00–16:00, *Theater I*

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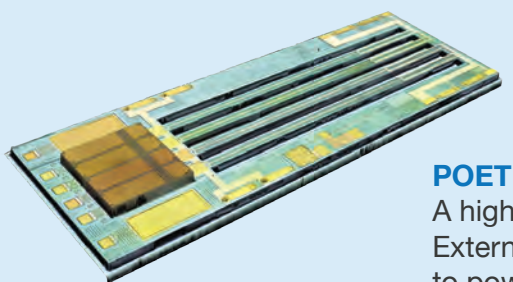

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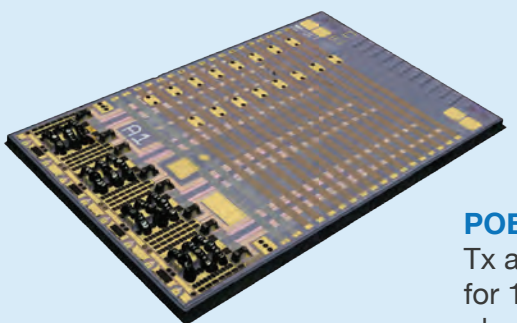

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