

Ballroom A

8:00 a.m.–10:00 a.m.
OThA • Microstructured Fibers

Ming-Jun Li; Corning Inc., USA, Presider

OThA1 • 8:00 a.m.

Large-Mode-Area Single-Mode Holey Fiber with Low Bending Losses: Towards High Power Beam Delivery Systems, *Yukihiro Tsuchida, Kunimasa Saitoh, Masanori Koshihara; Hokkaido Univ., Japan.* We propose a novel design method for large-mode-area single-mode holey fiber with effective mode area of 1400 μm^2 , small allowable bending radius of 5 cm, and good beam quality factor of 1.15 at 1.064- μm wavelength.

OThA2 • 8:15 a.m.

Bending Properties of Hole-Assisted Single Polarization Fibers, *Xin Chen, Ming-Jun Li, Joohyun Koh, Anthony Artuso, Daniel A. Nolan; Corning Inc., USA.* We study effects of bending on single polarization fiber performance. Good qualitative agreement between numerical and experimental results is found, which helps to understand fiber deployment conditions and facilitate new design.

Ballroom B

8:00 a.m.–10:00 a.m.
OThB • Optical Processing I

David Boertjes; Nortel Networks, Canada, Presider

OThB1 • 8:00 a.m. Invited

NEDO Project on Photonic Network Technologies-Development of an OBS Node Prototype and Key Devices, *Yoshiaki Nakano; Univ. of Tokyo, Japan.* We present a summary of the optical burst switching (OBS) node prototype and major components achieved in NEDO-funded Photonic Network Project. Advanced devices such as matrix switch, wavelength converter and tunable lasers are reported.

Ballroom C

8:00 a.m.–9:45 a.m.
OThC • Resonant Optical Devices

David Moss; Univ. of Sydney, Australia, Presider

OThC1 • 8:00 a.m. Tutorial

Coupled Resonator Optical Devices, *Amnon Yariv; Caltech, USA.* No abstract available.

Ballroom D

8:00 a.m.–10:00 a.m.
OThD • Modulation Techniques

Michel W. Chbat; Siemens Communications, Inc., USA, Presider

OThD1 • 8:00 a.m.

Offset Sideband Modulation at 2.5 GSym/s, *Jamie D. Gaudette¹, David J. Krause¹, John C. Cartledge¹, Kim Roberts²; ¹Queen's Univ., Canada, ²Nortel Networks, Canada.* The generation of an optical carrier and 2.5-GSym/s offset modulated sideband is demonstrated using arbitrary optical waveform generation and a single laser and modulator. In this demonstration, the sideband is modulated using QPSK and 16-QAM.

OThD2 • 8:15 a.m.

System Performance of DPSK Signals Transmitted through Broadband SBS-Based Slow Light Element and Reduction of Slow-Light-Induced Data-Pattern Dependence, *Bo Zhang¹, Irfan Fazal¹, Lianshan Yan², Lin Zhang¹, Alan E. Willner¹, Zhaoming Zhu³, Daniel J. Gauthier³; ¹Univ. of Southern California, USA, ²General Photonics, USA, ³Duke Univ., USA.* We demonstrate 42 ps delay on 10.7-Gb/s DPSK signals via SBS-based slow light. Slow-light-induced DPSK-data-pattern dependence is analyzed and its reduction results in 3-dB Q factor improvement. NRZ-DPSK and RZ-DPSK system performances are compared.

Ballroom E

8:00 a.m.–10:00 a.m.
OThE • Service and Network Management

Hans-Martin Foisel; T-Systems Technology Ctr., Germany, Presider

OThE1 • 8:00 a.m. Tutorial

Service Oriented Architectures with User Controlled Light Paths, *Bill St. Arnaud; Canarie Inc., Canada.* An innovative optical network paradigm is described where all network elements, including switches, routers and links are represented as web services, which can be bound into a network instantiation using web services workflow.



Bill St. Arnaud is Senior Director Advanced Networks for Canarie Inc., where he has been responsible for the coordination and implementation of Canada's next generation optical Internet initiative called CA*net 4. He has been the principal architect of the User Controlled LightPath concept of applying Service Oriented Architecture to network elements to allow users to orchestrate their own Internet network topologies and architectures fully integrated with their specific application needs. Bill St. Arnaud is an author of numerous papers and is a frequent guest speaker at various conferences on the Internet and optical networking. He is a graduate of Carleton University School of Engineering.

Room 304 A/B

8:00 a.m.–10:00 a.m.
OThF • Optical Packet Switching Networks

Liam-Kuan Chen; Chinese Univ. of Hong Kong, China, *Presider*

OThF1 • 8:00 a.m. Invited
Technologies for Building Fast Reconfigurable WDM Optical Networks, Daniel Blumenthal; Univ. of California at Santa Barbara, USA. No abstract available.

Room 303 A

8:00 a.m.–10:00 a.m.
OThG • Photodetectors, Terabits and Terahertz

Joe Campbell; Univ. of Virginia, USA, *Presider*

OThG1 • 8:00 a.m.
High-Speed and High-Power Performance of a Dual-Step Evanescently-Coupled Uni-Travelling-Carrier Photodiode at a 1.55 μm Wavelength, Y.-S. Wu, P.-H. Chiu, Jin-Wei Shi; Dept. of EE, Natl. Central Univ., Taiwan. We demonstrate a dual-step evanescently-coupled uni-travelling-carrier photodiode to minimize the dependence of responsivity on cleaved-length. High responsivity (0.9A/W), wide electrical bandwidth (~60GHz), and high saturation current-bandwidth product (>780mA-GHz) have been achieved simultaneously under 50 Ω load.

OThG2 • 8:15 a.m. Invited
Recent Advances in AlInAs Avalanche Photodiodes, Eiji Yagyu, E. Ishimura, M. Nakaji, H. Itamoto, T. Aoyagi, K. Yoshiara, Y. Tokuda; Mitsubishi Electric Corp., Japan. We present practical planar AlInAs APDs, which have large gain-bandwidth products, low noise, and high reliability. The APD receivers had a sensitivity of -28.6 dBm at 10 Gb/s and -37.0 dBm at 2.5 Gb/s.

Room 303 B

8:00 a.m.–10:00 a.m.
NThA • Optical Fiber Connectorization: Problems and Solutions

Jin Hong; Oplink Communications, USA, *Presider*

NThA1 • 8:00 a.m.
Managing Fiber Connections in NGN and Applications, Michael F. Lane¹, David Z. Chen¹, Dimitrios Kokkinos²; ¹Verizon Labs, USA, ²CUNY, USA. Increasing fiber applications such as DWDM, Ultra Long Haul and FTTH are rapidly taxing manually managed fiber infrastructure. New fiber management technologies and architectures are evaluated to meet the growth of emerging networks and applications.

NThA2 • 8:20 a.m.
Field Installable Connector Optimized for Holey Fiber, Yoshihisa Kato¹, K. Suzuki¹, K. Ohsono¹, M. Wakasa², Y. Nakatani², T. Nishio², M. Tachikura²; ¹Hitachi Cable, Ltd., Japan, ²Advanced Cable Systems Corp., Japan. To realize easy field installation of connectors for holey fibers, we developed a novel mechanical splicing technique that utilizes a curing-type material for refractive-index matching instead of conventional liquid-type materials.

Room 303 C

8:00 a.m.–10:00 a.m.
NThB • Optical/Wireless Access Architecture

Petar K. Pepeljugoski; IBM Res., USA, *Presider*

NThB1 • 8:00 a.m.
QoS-Aware Scheduling over Hybrid Optical Wireless Networks, Yuanqiu Luo¹, Si Yin¹, Ting Wang¹, Yoshihiko Suemura², Shinya Nakamura³, Nirwan Ansari³, Milorad Cvijetic⁴; ¹NEC Labs America, USA, ²NEC Corp., Japan, ³New Jersey Inst. of Technology, USA, ⁴NEC America, USA. Purposing to increase throughput in the hybrid optical wireless networks, we propose a scheduling scheme to deliver services by taking the QoS requirement into consideration. Simulations demonstrate that the centralized process facilitates transmission overhead reduction.

NThB2 • 8:20 a.m. Invited
Optical/Wireless Access Architecture and Field Trials, Peter Magill; AT&T, USA. No abstract available.

Notes

Ballroom A

OThA • Microstructured Fibers—Continued**OThA3 • 8:30 a.m.**

Mechanical Strength and Fatigue of Microstructured Optical Fibers, *Alexey F. Kosolapov, Sergei L. Semjonov, Alexandr N. Denisov, Evgeny M. Dianov; Fiber Optics Res. Ctr., Russian Acad. of Sciences, Russian Federation*. The response of the strength and fatigue parameters of strong microstructured fiber to environmental factors in holes was studied. It was similar to that for usual hole-free strong fibers without a protective coating.

OThA4 • 8:45 a.m.

Fracture Strength of Air-Clad Microstructured Fibers, *François Véronique, Seyed Sadreddin Aboutorabi; Ecole de Technologie Supérieure, Canada*. Measurement of microstructured fiber (MSF) bending strength is reported for the first time. Both coated and chemically stripped MSF are found to exhibit fracture bending strengths comparable to standard communications fiber.

Ballroom B

OThB • Optical Processing I—Continued**OThB2 • 8:30 a.m.**

DPSK Signal Regeneration Using a Non-linear Amplifying Loop Mirror, *Klaus Sponzel¹, Christian Stephan¹, Kristian Cvecek¹, Georgy Onishchukov¹, Bernhard Schmauss², Gerd Leuchs¹; ¹Inst. of Optics, Information and Photonics (Max Planck Res. Group) Univ. of Erlangen-Nuremberg, Germany, ²Inst. for Microwave Technology, Univ. of Erlangen-Nuremberg, Germany*. Power characteristics and phase functions of a NALM are investigated in simulations and experimentally, showing a phase-preserving nonlinear characteristics suitable for amplitude regeneration of phase-encoded signals. A negative power penalty of 1.5 dB was obtained.

OThB3 • 8:45 a.m.

All-Optical Amplitude Noise Suppression of 160-Gb/s OOK and DPSK Data Signals Using a Parametric Fiber Switch, *Fumio Futami¹, R. Okabe¹, S. Ono¹, S. Watanabe¹, R. Ludwig², C. Schmidt-Langhorts², C. Schubert²; ¹Fujitsu Labs Ltd., Japan, ²Fraunhofer Inst. for Telecommunications, Heinrich-Hertz Inst., Germany*. We demonstrate the noise limiting performance of a fiber switch based on parametric gain saturation in highly nonlinear fiber. Bit-error-rate measurements were performed at 160Gb/s for on-off keying and differential phase shift keying data signals.

Ballroom C

OThC • Resonant Optical Devices—Continued

Ballroom D

OThD • Modulation Techniques—Continued**OThD3 • 8:30 a.m.**

High-Sensitivity Demodulation of Multiple-Data-Rate WDM-DPSK Signals Using a Single Interferometer, *David Caplan, Mark Stevens, John Carney; MIT Lincoln Lab, USA*. We demonstrate simultaneous reception of multiple-rate wavelength-division-multiplexed optical-DPSK signals using a single interferometer. The demodulation approach provides rate-flexibility and scalability, enabling penalty-free performance and compliance with existing channel-rate and channel-spacing standards.

OThD4 • 8:45 a.m.

Ultimate Linewidth-Tolerant 20-Gbps QPSK-Homodyne Transmission Using a Spectrum-Sliced ASE Light Source, *Moriya Nakamura, Yukiyoshi Kamio, Guo-Wei Lu, Tetsuya Miyazaki; Natl. Inst. of Information and Communications Technology (NICT), Japan*. We demonstrated ultimate linewidth-tolerant 20-Gbps QPSK-homodyne using a 3-nm spectrum-sliced ASE light source by an optical phase noise cancellation, attained BER less than 1×10^{-6} after 160-km transmission. We also characterized DGD and dispersion tolerances.

Ballroom E

OThE • Service and Network Management—Continued

Room 304 A/B

OThF • Optical Packet Switching Networks—Continued**OThF2 • 8:30 a.m.**

Multi-Stage SOA Switch Fabrics: 4x40Gb/s Packet Switching and Fault Tolerance, *Eng Tin Aw¹, Tao Lin¹, Adrian Wonfor¹, Richard V. Penty¹, Ian H. White^{1,2}, Madeleine Glick²*; ¹Univ. of Cambridge, UK, ²Intel Res., UK. Performance of packet switching at 4x40Gb/s through a multi-stage SOA is evaluated. Fault identification and rerouting in the multi-stage switch is demonstrated.

OThF3 • 8:45 a.m.

Petabit-per-Second Routers: Case for All-Optical over Electronic Implementation, *S. J. Ben Yoo, Haijun Yang*; Univ. of California at Davis, USA. This paper investigates merits and challenges of all-optical routers. All-optical routers can exploit the wavelength domain not available in electronic routers to overcome the lack of optical buffers, and to realize compact ultralow power systems.

Room 303 A

OThG • Photodetectors, Terabits and Terahertz—Continued**OThG3 • 8:45 a.m.**

Ge Photodetectors Integrated with Waveguides for Electronic-Photonic Integrated Circuits on CMOS Platform, *Donghwan Ahn, Ching-yin Hong, Jifeng Liu, Mark Beals, Jian Chen, Franz Kaertner, Lionel C. Kimerling, Jurgen Michel*; MIT, USA. Ge photodetectors monolithically integrated with silicon oxynitride and silicon nitride waveguides on Si CMOS platform are presented. The devices demonstrated high efficiency ($\sim 1.08\text{A/W}$) and high-speed ($> 14\text{ Gbit/s}$) performances at low bias.

Room 303 B

NThA • Optical Fiber Connectorization: Problems and Solutions—Continued**NThA3 • 8:40 a.m.**

Elimination of Manual Cleaving and De-nubbing in the Polishing of Connectorized Fiber End-Faces, *Cuneyt Erdogan*; Krell Technologies, Inc., USA. We demonstrate an automated process for connectorized optical fibers encompassing tip de-nubbing through final polish. The automated process is compatible with both single and multi-fiber connectors, and compliant to applicable optical and end-face geometry criteria.

Room 303 C

NThB • Optical/Wireless Access Architecture—Continued

Notes

Ballroom A

OThA • Microstructured Fibers—Continued

OThA5 • 9:00 a.m.
Practical Design of Microstructured Optical Fibers for Surface Plasmon Resonance Sensing, *Alireza Hassani, Maksim Skorobogatiy; Ecole Polytechnique de Montreal, Canada.* Plasmons on the surface of large metallized holes containing analyte are excited by the fundamental mode of a microstructured fiber. Phase matching between plasmon and core modes is facilitated by the perforation of fiber core.

OThA6 • 9:15 a.m.
Experimental Demonstration of Very High Negative Chromatic Dispersion Dual-Core Photonic Crystal Fiber, *Sigang Yang¹, Yejin Zhang¹, Lina He¹, Shizhong Xie¹, Jinyan Li², Wei Chen², Zuowen Jiang², Jinggong Peng², Haiqing Li²; ¹Tsinghua Univ., China, ²FiberHome Telecommunication Technologies Co. Ltd., China.* This paper reports the experimental drawing fabrication of very large negative chromatic dispersion dual-core photonic crystal fiber. The fabricated fiber has a peak chromatic dispersion of -820 ps/(nm km).

OThA7 • 9:30 a.m.
Controllability of Guided Acoustic-Wave Brillouin Scattering Spectra in Hole-Assisted Fibers, *Takashi Matsui, Kazuhide Nakajima, Taiji Sakamoto, Kazuyuki Shiraki, Izumi Sankawa; NTT Corp., Japan.* We clarify that GAWBS gain for a particular acoustic torsional/radial mode is observed in hole-assisted fiber. It is revealed that the acoustic mode can be controlled by simply designing the air-hole position and size.

Ballroom B

OThB • Optical Processing I—Continued

OThB4 • 9:00 a.m.
All-Optical Signal Reshaping of a 40 Gb/s RZ Signal by Dual-Stage Pump Modulated Four-Wave-Mixing, *C. H. Kwok, Chimlon Lin; Dept. of Electronic Engineering, Chinese Univ. of Hong Kong, Hong Kong.* All-optical signal reshaping is demonstrated with a 40 Gb/s RZ signal by using two cascaded pump modulated four-wave-mixing processes. A 5 dB improvement in the receiver sensitivity is reported for a degraded signal input.

OThB5 • 9:15 a.m.
Polarization Independent All-Optical Retiming Based on Cross-Phase Modulation and Spectral Slicing, *Chris Ito, Sung Han Chung, Iannick Monfils, John C. Cartledge; Queen's Univ., Canada.* Polarization independent all-optical retiming is demonstrated using a self-pulsating DFB laser and cross-phase modulation in a highly nonlinear fiber. Regardless of its state-of-polarization, the timing jitter of retimed data signal is less than 2 ps.

OThB6 • 9:30 a.m.
Generalisation and Experimental Validation of Design Rules for Self-Phase Modulation-based 2R-Regenerators, *Lionel Provost, Christophe Finot, Kazumori Mukasa, Periklis Petropoulos, David J. Richardson; Optoelectronics Res. Ctr., Univ. of Southampton, UK.* We report the design of 2R-regenerators based on Self-Phase Modulation in lossy fibers. We experimentally demonstrate the applicability of the proposed scaling rules and present detailed characterization of the pulse characteristics at the regenerator output.

Ballroom C

OThC • Resonant Optical Devices—Continued

OThC2 • 9:00 a.m. Invited
Strategies for Fabricating Strong-Confinement Microring Filters and Circuits, *Henry Smith¹, Tymon Barwicz¹, Charles W. Holzwarth¹, Milos A. Popovic¹, Michael R. Watts², Peter T. Rakich¹, Minghao Qi³, Raul Barreto¹, Franz X. Kärtner¹, Erich P. Ippen¹; ¹MIT, USA, ²Sandia Natl. Labs, USA, ³Purdue Univ., USA.* We describe strategies for fabricating strong-confinement microring filters and circuits, and assert that techniques specifically tailored to microphotonic requirements provide a more efficient path to commercialization than techniques developed for semiconductor electronics.

OThC3 • 9:30 a.m.
A Tunable Dispersion Compensator with Highly Refractive Silicon Etalons, *Toshiaki Sugawara¹, Satoshi Makio², Makoto Takahashi¹, Hirohisa Sano², Masato Shishikura¹, Nobuhiko Kikuchi¹; ¹Hitachi, Ltd., Central Res. Lab, Japan, ²Hitachi Metals, Ltd., Advanced Electronics Res. Lab, Japan.* We used highly refractive silicon etalons to develop a tunable dispersion compensator with ± 250 -ps/nm tunable range and low <2.3-dB loss (2.1-dB improvement). We demonstrated 40-Gbps-NRZ transmissions with 1000-ps/nm tunable range in a double-pass configuration.

Ballroom D

OThD • Modulation Techniques—Continued

OThD5 • 9:00 a.m. Invited
100 Gigabit Ethernet Transmission—Physical Layer Issues, *Gottfried Lehmann¹, Rainer H. Derksen¹, Colja Schubert², Marcus Winter³; ¹Siemens Networks, Germany, ²Fraunhofer Inst. for Telecommunications, HHI, Germany, ³Technical Univ. of Berlin, Germany.* Solutions to transmit 100 Gigabit Ethernet Signals (GbE) over hundred or more kilometers are discussed. An overview of experimental ≥ 100 Gb/s ETDM approaches is given and the suitability of various modulation formats is evaluated.

OThD6 • 9:30 a.m.
CPFSK/MSK Modulation with a Monolithic Integrated LiNbO₃ Modulator, *Takahide Sakamoto, Akito Chiba, Tetsuya Kawaniishi, Masayuki Izutsu; NICT, Japan.* We propose a high-speed CPFSK/MSK modulation technique using a single-stage monolithic-integrated dual-arm driven FSK modulator. By measuring phase trajectory, we directly confirmed that the externally modulated lightwave was truly continuous in phase to form CPFSK/MSK.

Ballroom E

OThE • Service and Network Management—Continued

OThE2 • 9:00 a.m.
Network Management Solution for PS/PON, WDM/PON and Hybrid PS/WDM/PON Using DS-OCDFM, *Habib Fathallah, Leslie A. Rusch; Ctr. d'Optique Photonique et Laser, Laval Univ., Canada.* A novel network management solution for PS/PON, WDM/PON and PS/WDM/PON is proposed and developed. Modified DS-OCDFM overcomes OTDR shortcomings and capacity limitation of known PON management techniques for standard and advanced PON architectures.

OThE3 • 9:15 a.m.
Novel Fault Monitoring and Localization Scheme in WDM-PONs with Upstream VCSEL Transmitters, *Elaine Wong^{1,2}, Xiaoxue Zhao¹, Connie J. Chang-Hasnain¹; ¹Dept of Electrical Engineering and Computer Science, Univ. of California at Berkeley, USA, ²ARC Special Res. Ctr. on Ultra-Broadband Information Networks, Dept of EEE, Univ. of Melbourne, Australia.* A highly-sensitive (-67 dBm) fault monitoring and localization scheme is achieved without modifications to the ONU, by utilizing a low bandwidth (2kHz) and power (-7dBm) fault monitor, and the high reflectivity mirror of VCSEL transmitters.

OThE4 • 9:30 a.m.
A Novel Technique for Low-Cost Embedded Non-Intrusive Fiber Monitoring of P2MP Optical Access Networks, *Wei Chen, Bert De Mulder, Jan Vandewege, Xingzhi Qiu, Johan Bauwelinck, Bart Baekelandt; Ghent Univ., Belgium.* A low cost embedded OTDR method is presented for monitoring the fiber plant of TDM optical networks without extra optical components nor performance penalty. It localizes abrupt changes in link attenuation without disturbing network operation.

OThF • Optical Packet Switching Networks—Continued**OThF4 • 9:00 a.m.**

Experimental Demonstration of a Label-Switched and 50GHz Channel Spacing DWDM Network with 50Gbit/s DQPSK Payload and 3.125Gb/s Inversion-RZ OOK Label, Jianjun Yu¹, Xiang Zhou², Lei Xu¹, Philip Nan Ji¹, Yong-Kee Ye³, Ting Wang¹, Gee Kung Chang³; ¹NEC Lab America, USA, ²AT&T Labs, USA, ³Georgia Tech, USA. We have successfully demonstrated that an inversion-RZ pulse signal can be employed in a 50Gbit/s RZ-DQPSK payload per channel and 50GHz channel spacing optical packet switching network as an orthogonal modulation optical label.

OThF5 • 9:15 a.m.

Low-Cost, Scalable Optical Packet Switching Networks with Multi-Wavelength Labels, Pegah Seddighian¹, José Bernardo Rosas-Fernández¹, Simon Ayotte¹, Leslie Ann Rusch¹, Sophie LaRochelle¹, Alberto Leon-García²; ¹Laval Univ., Canada, ²Univ. of Toronto, Canada. We propose a self-forwarding packet-switched optical network with bit-parallel multi-wavelength labels. We experimentally demonstrate transmission of variable-length optical packets over 80 km of fiber and switching over a 1x4 multistage switch with two stages.

OThF6 • 9:30 a.m.

Experimental Demonstration of an Optical-Label-Switching Router Architecture Supporting Selective 3R Regeneration, Zujing Zhu, Bo Xiang, Haijun Yang, S. J. Ben Yoo; Univ. of California at Davis, USA. We propose an optical-label-switching router architecture that utilizes selective-3R to offer regeneration in a smart and efficient way with only limited 3R capability. The experiment demonstrates error-free operation of selective-3R with all-optical burst-mode clock recovery.

OThG • Photodetectors, Terabits and Terahertz—Continued**OThG4 • 9:00 a.m.**

Invited

160-Gb/s, 16-Channel Full-Duplex, Single-Chip CMOS Optical Transceiver, Clint L. Schow, Fuad E. Doany, Odile Liboiron-Ladouceur, Christian Baks, Daniel M. Kuchta, Laurent Schares, Richard John, Jeff A. Kash; IBM T. J. Watson Res. Ctr., USA. We report a single-chip CMOS optical transceiver incorporating sixteen 10-Gb/s transmitter and receiver channels for a 160 Gb/s aggregate bit rate. The transceiver consumes 15.6 mW/Gb/s with an area efficiency of 9.4 Gb/s/mm² per link.

OThG5 • 9:30 a.m.

Invited

Terahertz Applications and Techniques, Martin Koch; TU Braunschweig, Germany. We briefly review techniques for optoelectronic generation and detection of THz waves and give examples for industrial applications of THz imaging systems. As an outlook we discuss the potential of future wireless THz communication systems.

NThA • Optical Fiber Connectorization: Problems and Solutions—Continued**NThA4 • 9:00 a.m.**

Multi-Fiber, MT Ferrule Endface Fiber Tip Displacement Model for Physical Contact Interconnects, Michael Gurreri¹, James Kevern¹, Michael Kadar-Kallen¹, Lou Castagna¹, Darrell Childers², Mike Hughes²; ¹Tyco Electronics, USA, ²US Conec, USA. This paper describes a simplified model linking MT ferrule and connector attributes to positive contact performance. Validation with FEA, experimental apparatus and empirical results are described, along with topics for future study.

NThA5 • 9:20 a.m.

Field Installable LC Connector and Mechanical Splice, Khee Yen Serin Tan¹, Terutake Kobayashi², Daigo Saito², Kazuhiro Takizawa², Kazuya Ogata²; ¹Fujikura Technology Singapore Pte Ltd, Singapore, ²Fujikura Ltd., Japan. This paper describes the development of the field installable LC connector and the mechanical splice. Both developments are an improvement over existing techniques in terms of operation, reliability and costs.

NThB • Optical/Wireless Access Architecture—Continued**NThB3 • 9:00 a.m.**

Experimental Validation of an Access Evolution Strategy: Smooth FTTP Service Migration Path, Kent McCammon¹, Shing-Wa Wong²; ¹AT&T, USA, ²Stanford Univ., USA. We examine a cost-effective upgrade path using WDM over deployed FTTP infrastructures with capability to co-exist with a working G-PON system. We demonstrate overlay of five Gigabit signals operating between 1531nm~1611nm over a working G-PON.

NThB4 • 9:20 a.m.

Engineering a Scalable and Bandwidth Elastic Next Generation PON, Stamatios Kartalopoulos, Andres Sierra; Univ. of Oklahoma, USA. We engineer and simulate the scalability and bandwidth elasticity of a next generation PON. Our scalable PON hierarchically combines WDM and TDM, and it connects 16,000 end-users with elastic bandwidth on demand with high performance.

Ballroom A**OThA • Microstructured Fibers—Continued****OThA8 • 9:45 a.m.**

Evaluation of Rayleigh Scattering Loss in Photonic Crystal Fibers by Using Bi-Directional OTDR Measurement, *Kyozo Tsujikawa, Katsusuke Tajima, Koji Ieda, Kazuhide Nakajima, Kenji Kurokawa, Kazuyuki Shiraki, Izumi Sankawa; NTT Access Network Service Systems Labs, Japan.* We investigate the scattering loss in photonic crystal fibers with different structures by using bi-directional OTDR measurement. Their intrinsic Rayleigh scattering coefficient is slightly less than that of conventional pure silica core single-mode fiber.

Ballroom B**OThB • Optical Processing I—Continued****OThB7 • 9:45 a.m.**

All-Optical Clock Recovery Using the Temporal Talbot Effect, *Dominik Pudo, Michal Depa, Lawrence R. Chen; McGill Univ., Canada.* We demonstrate novel all-optical clock recovery for short pulse communication systems based on the temporal Talbot effect. By simply propagating a data stream through 80 km of single-mode fiber, we generate a periodic pulse train.

Ballroom C**Ballroom D****OThD • Modulation Techniques—Continued****OThD7 • 9:45 a.m.**

Demonstration and Design of High Spectral Efficiency 4Gb/s OFDM System in Passive Optical Networks, *Yu-Min Lin; Industrial Technology Res. Inst., Taiwan.* With OFDM's spectral efficiency and electrical signal processing power, we have demonstrated that a 4Gb/s OFDM-16QAM signal can be transmitted error free in 20km passive optical networks using cost-effective optical devices.

Ballroom E**OThE • Service and Network Management—Continued****OThE5 • 9:45 a.m.**

Damage to Optical Networks by Wildlife and Methods for Protecting Existing Optical Fiber Cables in the FTTH Era, *Hiroshi Tanaka, Tomoyuki Iwata, Tetsuya Kaiden, Toshiyuki Neno, Hisashi Izumita; NTT East Technical Assistance & Support Ctr., Japan.* This paper describes a 1999-2005 analysis of damage to optical networks by wildlife and proposes methods for protecting existing optical fiber cables. These methods enable us to improve network reliability and reduce maintenance costs.

10:00 a.m.–4:00 p.m. Exhibit Open

10:00 a.m.–10:30 a.m. Coffee Break, Exhibit Hall

OThF • Optical Packet Switching Networks—Continued

OThF7 • 9:45 a.m.

Experimental Demonstration of a Complete SPINet Optical Packet Switched Interconnection Network, *Assaf Shacham, Howard Wang, Keren Bergman; Columbia Univ., USA*. A 4x4 fully implemented photonic interconnection network is experimentally demonstrated. The network routes 60 Gb/s wavelength-striped packets (6x10 Gb/s) error-free in the optical domain, resolves contentions, and detects dropped packets via a unique acknowledgement protocol.

NThA • Optical Fiber Connectorization: Problems and Solutions—Continued

NThA6 • 9:40 a.m.

Accumulation of Particles Near the Core During Repetitive Fiber Connector Matings and De-Matings, *Tatiana Berdinskikh¹, Jeno Chen¹, John M. Culbert², David Fisher³, Sun-Yuan Huang⁴, Brian J. Roche⁵, Heather Tkalec⁶, Douglas H. Wilson⁷, Steven B. Ainley²; ¹Celestica Intl. Inc, Canada, ²Megladon Manufacturing Group Ltd, USA, ³Tyco Electronics, USA, ⁴Intel Corp., USA, ⁵Cisco Systems Inc., USA, ⁶Alcatel Corp., Canada, ⁷PVI Systems Inc., USA*. The increased accumulation of particles near the core during a series of mating/de-mating operations was investigated. One cause for this accumulation was ESD (electrostatic discharge) effects from cleaning. Methods to prevent this phenomenon were studied.

NThB • Optical/Wireless Access Architecture—Continued

NThB5 • 9:40 a.m.

Super-Broadband Access Services Delivery in Optical-Wireless Networks, *Zhensheng Jia¹, Jianjun Yu², Georgios Ellinas³, Gee-Kung Chang⁴; ¹Georgia Tech, USA, ²NEC Labs, America, USA, ³Univ. of Cyprus, Cyprus*. We demonstrate the overall architecture design for delivering future super-broadband dual services over optical fiber network. Several enabling technologies for system integration and transmission of optical mm-wave over both fiber and air are discussed.

10:00 a.m.–4:00 p.m. Exhibit Open

10:00 a.m.–10:30 a.m. Coffee Break, Exhibit Hall

Ballroom A

10:30 a.m.–12:30 p.m.
OThH • Optical Waveguide Devices

Hiroshi Takahashi; NTT Photonics Labs, Japan, President

OThH1 • 10:30 a.m. Tutorial
High Density Integration of Functional Optical Circuits with Higher Index Difference, Brent Little; Little Optics, USA. High index contrast waveguides allow for miniaturization of optical building blocks resulting in densely integrated optical circuits. We review the state of the art in commercialization of high index contrast circuits focusing on materials and fabrication, optical building block designs, and compact optical circuits.



Dr. Little received his Ph.D. in electrical engineering from the University of Waterloo, Canada in 1994. Subsequently, Dr. Little served as a Research Scientist at the Massachusetts Institute of Technology working with Prof. Haus, a Research Faculty member at the University of Maryland College Park, and has held research positions at Nortel Networks Canada and Fujitsu Labs in Japan. In 2000 he co-founded Little Optics Inc., and served as President and Chief Technology Officer until the company was acquired by Nomadics in December of 2004 and subsequently by Infinera in 2006. At Nomadics he served as Vice President of Planar Lightwave Circuits, and currently with Infinera he is Director of PLC Design.

Ballroom B

10:30 a.m.–12:30 p.m.
OThI • Optical Processing II

Luc Boivin; Verizon Business, USA, President

OThI1 • 10:30 a.m.
The Photonic Bottleneck, Kerry J. Hinton¹, Peter M. Farrell², Rodney S. Tucker³; ¹ARC Special Ctr. for Ultra-Broadband Information Networks, Australia, ²Natl. ICT Australia, Australia. By analyzing the basic physics of all-optical processes, we show that all-optical networks will suffer a “photonic bottleneck” due to the fundamental properties of photons.

OThI2 • 10:45 a.m.
Ultrafast All-Optical Differentiators for Generation of Orthogonal (Sub-)Pico-second Hermite-Gaussian Waveforms, Yongwoo Park¹, Radan Slavik², José Azaña¹; ¹INRS-EMT, Canada, ²Inst. of Radio Engineering and Electronics, Acad. of Sciences of the Czech Republic, Czech Republic. A novel reconfigurable technique for higher-order temporal differentiation of ultrafast optical waveforms is proposed. Using this method, we experimentally demonstrate efficient generation of temporally orthogonal second and third-order Hermite-Gaussian waveforms in the (sub-)picosecond regime.

Ballroom C

10:30 a.m.–12:30 p.m.
OThJ • Optical Network Survivability

Dominic A. Schupke; Siemens, Germany, President

OThJ1 • 10:30 a.m. Invited
Service Availability in Optical Network Design, Monika Jaeger; T-Systems, Germany. The paper explores survivability concepts for the migration to carrier class next generation IP services over optical transport networks. Design criteria for highly available optical networks are proposed and tradeoffs of different approaches are analyzed.

Ballroom D

10:30 a.m.–12:30 p.m.
OThK • Receiver Design

Herbert F. Haunstein; Univ. Erlangen-Nürnberg, Germany, President

OThK1 • 10:30 a.m.
DPSK Receiver Design—Optical Filtering Considerations, Christian Malouin, Jon Bennike, Ted Schmidt; StrataLight Communications, USA. We study via simulation the influence of the DPSK decoder free spectral range (FSR) when strong optical filtering is considered for the NRZ and RZ modulation formats and show that larger FSR can improve performance.

OThK2 • 10:45 a.m.
IMDD Transmission over 1,040 km of Standard Single-Mode Fiber at 10Gbit/s Using a One-Sample-per-Bit Reduced-Complexity MLSE Receiver, Sebastian J. Savory¹, Y. Benlachtar¹, Robert I. Killey¹, Polina Bayvel¹, Gabriella Bosco², Pierluigi Poggiolini², Josep Prat³, Mireia Omella Cancer³; ¹Univ. College of London, UK, ²Politecnico di Torino, Italy, ³Univ. Politecnica de Catalunya, Spain. We demonstrate 1,040km NRZ-IMDD transmission at 10Gbit/s over G.652 fibre, without any optical dispersion compensation, using a reduced-complexity MLSE receiver employing, for the first time at this distance, one sample per bit only.

Ballroom E

10:30 a.m.–12:30 p.m.
OThL • Transmission Experiments

Harshad P. Sardesai; Ciena Corp., USA, President

OThL1 • 10:30 a.m.
Fully Transparent Multiplexing and Transport of 10GbE-LANPHY Signals in 44.6-Gbit/s-Based RZ-DQPSK WDM Transmission, Yoshiaki Kisaka¹, Shigeaki Aisawa¹, Masahito Tomizawa¹, Yutaka Miyamoto¹, Kazuhiko Terada², Noboru Iwasaki², Akihide Sano¹, Hiroji Masuda¹, Masafumi Koga¹; ¹NTT Network Innovation Labs, NTT Corp., Japan, ²NTT Microsystem Integration Labs, NTT Corp., Japan. We successfully demonstrate transparent 10GbE-LANPHY transport in 44.6-Gbit/s RZ-DQPSK WDM transmission for the first time. A single-chip 43/44-Gbit/s OTN framer LSI that supports fully transparent STM-64/10GbE multiplexing and DQPSK precoding are adopted.

OThL2 • 10:45 a.m.
42.8 Gbit/s, 4 Bits per Symbol 16-ary Inverse-RZ-QASK-DQPSK Transmission Experiment without Polmux, Murat Serbay¹, Torger Tøkle², Palle Jeppesen², Werner Rosenkranz¹; ¹Univ. of Kiel, Germany, ²COM DTU, Denmark. We present an experimental implementation of 16-ary 42.8 Gbit/s Inverse-RZ-QASK-DQPSK, using four-level inverse return-to-zero amplitude modulation with four-level differential phase modulation. We demonstrate transmission over a 75 km fibre span with only minor degradation.

Room 304 A/B

10:30 a.m.–12:30 p.m.
**OThM • Hybrid Optical
Wireless**

Milorad Cvijetic; NEC Corp.,
USA, *Presider*

OThM1 • 10:30 a.m. **Invited**
Hybrid Optical-Wireless Networks,
Sudhir Dixit; Nokia Res., USA. In this talk
we explore why, what, and how of the
optical-wireless convergence, identify how
the industry viewpoints align, and discuss
the key barriers and solutions to achieving
true convergence.

Room 303 A

10:30 a.m.–12:30 p.m.
**OThN • Signal Measurement
and Equalization**

Gregory Raybon; Lucent
Technologies, USA, *Presider*

OThN1 • 10:30 a.m.
**Simultaneous Measurement of Dispersion
Parameter and Length of an Optical
Fiber by Using a Direct Lasing Mode
Detection Technique,** *Ki-hong Yoon¹,
Young Cheol Kim², Jae-Won Song², Hyun
Deok Kim²; ¹Electronics and Telecommuni-
cations Res. Inst., Republic of Korea,
²Kyungpook Natl. Univ., Republic of Korea.*
A simultaneous measurement technique
of the dispersion parameter and the length
of an optical fiber has been demonstrated.
The measurement errors were less than
0.14% for the length and 1.7% for the
dispersion parameter.

OThN2 • 10:45 a.m.
**Simultaneous and Independent Monitor-
ing of OSNR, Chromatic and Polariza-
tion Mode Dispersion for NRZ-OOK,
DPSK and Duobinary,** *Yannick Keith
Lizé^{1,2,3}, Jeng-Yuan Yang², Louis C. Chris-
ten², Xiaoxia Wu², Scott Nuccio², Teng Wu²,
Alan E. Willner², Raman Kashyap¹, François
Séguin³; ¹École Polytechnique de Montréal,
Canada, ²Univ. of Southern California,
USA, ³ITF Labs, Canada.* We demonstrate
experimentally and through simulations a
simultaneous and independent monitor-
ing of CD, PMD and OSNR using a 1/4-
bit delay Mach-Zehnder interferometer
for NRZ-OOK, DPSK and Duobinary
modulation formats.

Room 303 B

10:30 a.m.–12:30 p.m.
**NThC • Intelligent Optical
Networks**

Mark Allen; Infinera, USA,
Presider

NThC1 • 10:30 a.m. **Invited**
**Optical Meshed Networks: From Con-
cept to Deployment,** *Hans-Jürgen
Schmidtke, Michel Chbat; Siemens Com-
munications, USA.* The paper discusses the
fundamental conceptual work and the
design building blocks of a meshed optical
networks and gives a future outlook of the
next generation optical platforms.

Room 303 C

10:30 a.m.–12:30 p.m.
**NThD • Ethernet and Video
Service Architectures**

Stevan E. Plote, Sr.; Infinera, USA,
Presider

NThD1 • 10:30 a.m. **Invited**
Carrier Ethernet: A Reality Check, *Stuart
D. Elby, Haidar A. Chamas, William A.
Bjorkman, Vincent A. Alesi; Verizon Com-
munications, USA.* This paper provides a
current assessment of Carrier Ethernet
from a service provider perspective. It
highlights the drivers and key attributes of
Carrier Ethernet and discusses some re-
maining gaps and challenges.

Notes

Ballroom A

OThH • Optical Waveguide Devices—Continued

OThH2 • 11:30 a.m.
Waveguide Technology Development Based on Temperature- and Humidity-Resistant Low-Loss Silsesquioxane Polymer for Optical Interconnects, Roger Dangel¹, Rene Beyeler¹, Folkert Horst¹, Norbert Meier¹, Bert J. Offrein¹, Bruno Sicard², Matt Moymihar², Philip Knudsen², Ed Anzures²; ¹IBM Res. Div., Switzerland, ²Rohm and Haas Electronic Materials LLC, USA. We have jointly developed the material and processes to integrate silsesquioxane optical waveguides on printed circuit boards for high-speed datacom applications, using a low-loss, reliable and commercially available polymer designed for 850 nm.

Ballroom B

OThI • Optical Processing II—Continued

OThI3 • 11:00 a.m. **Invited**
Optical Signal Processing Based on All-Optical Analog-to-Digital Conversion, Akihiro Maruta, Sho-ichira Oda; *Osaka Univ., Japan*. Fiber nonlinearities provide us attractive functions for optical signal processing. In this paper, we focus our attention on all-optical analog-to-digital and digital-to-analog conversion schemes which be applied for wide variety of signal processing.

OThI4 • 11:30 a.m.
A Reconfigurable All-Optical AND/OR Logic Gate Using Multilevel Modulation and Self-Phase Modulation, Li Huo, Chinlon Lin, Chun-Kit Chan, Lian-Kuan Chen; *Dept. of Information Engineering, Chinese Univ. of Hong Kong, Hong Kong*. We demonstrated a reconfigurable and polarization-independent all-optical logic gate based on multilevel modulation. Reconfigurable logic AND and OR operations were realized by simply adjusting the center frequency of an optical band-pass filter.

Ballroom C

OThJ • Optical Network Survivability—Continued

OThJ2 • 11:00 a.m.
Meeting SLAs by Design: A Protection Scheme with Memory, Ori Gerstel¹, Galen H. Sasaki²; ¹Cisco Systems, USA, ²Univ. of Hawaii, USA. A protection scheme is introduced that insures connections meet their SLAs with limited protection bandwidth. The network keeps track of the amount of outage each connection experiences, and protects them before they violate their SLAs.

OThJ3 • 11:15 a.m.
Impacts of Multiple Backups and Multi-Link Sharing among Primary and Backups for Dynamic Service Provisioning in Survivable Mesh Networks, Lei Song, Biswanath Mukherjee; *Univ. of California at Davis, USA*. We propose a reliability analysis for connections with 1+N protection and primary-backup k-link sharing. We develop a cost-effective dynamic provisioning scheme to carry connections which have stringent SLA requirements with availability guarantee and resource efficiency.

OThJ4 • 11:30 a.m.
Backup Reprovisioning after Shared Risk Link Group (SRLG) Failures in Survivable WDM Mesh Networks, Xu Shao, Luying Zhou, Yixin Wang; *Inst. for Infocomm Res., Singapore*. Compared to single-link failures, SRLG failures will leave much more connections vulnerable to next failures. We investigate benefits of backup reprovisioning after SRLG failures and evaluate different policies for backup reprovisioning.

Ballroom D

OThK • Receiver Design—Continued

OThK3 • 11:00 a.m.
Nonlinear Equalizers in Narrowband Filter Receiver Achieving 950 ps/nm Residual Dispersion Tolerance for 40Gb/s Optical MSK Transmission Systems, Thirukkumaran Sivahumaran, Thanh L. Huynh, Khee Khok Pang, Le Nguyen Binh; *Dept. of Electrical and Computer Systems Engineering, Monash Univ., Australia*. We propose nonlinear equalizers that extend the reach of dispersion tolerance of 40Gb/s optical MSK systems to ± 952 ps/nm and ± 884 ps/nm at BER = $1e^{-9}$ with required OSNR of 23.5dB and 19dB respectively.

OThK4 • 11:15 a.m. **Invited**
Coherent Receivers for Practical Optical Communication Systems, Andreas Leven, Noriaki Kaneda, Ut-Va Koch, Young-kai Chen; *Lucent Technologies, USA*. Coherent receivers that utilize electrical signal processing techniques have attracted increased attention over the last couple of years. In this paper, we will discuss some practical aspects of these receivers and present some recent results.

Ballroom E

OThL • Transmission Experiments—Continued

OThL3 • 11:00 a.m. **Invited**
Modulation/Demodulation Schemes for Optical Multi-Level Transmission, Nobuhiko Kikuchi, Kenro Sekine, Shinya Sasaki; *Central Res. Lab, Hitachi Ltd., Japan*. The optical multilevel signaling is a promising candidate to realize next-generation high-speed transceivers beyond 40 Gbit/s, or ultimate-capacity DWDM system. This paper discusses advanced modulation/demodulation schemes toward the practical implementation of more than 16-level signaling.

OThL4 • 11:30 a.m.
Inline Pump Sharing Architecture for Remotely-Pumped Pre- and Post-Amplifiers, Serguei Papernyi; *MPB Communications Inc, Canada*. A new transmission link configuration with remote Er post- and pre-amplifiers where pump power is shared between a pair of fibers carrying traffic in opposite directions is proposed. A budget increase of >4dB is demonstrated.

OThM • Hybrid Optical Wireless—Continued**OThM2 • 11:00 a.m.**

A Novel Full-Duplex Wavelength-Reuse Optical-Wireless Architecture with Directly Modulated SOA as Upstream Colorless Amplified Modulator, *Zhensheng Jia¹, Jianjun Yu², Georgios Ellinas³, Geekung Chang¹*; ¹Georgia Tech, USA, ²NEC Labs America, USA, ³Univ. of Cyprus, Cyprus. We demonstrate full-duplex optical-wireless architecture using optical phase modulator and interleaver for downstream optical mm-wave generation and wavelength reuse for upstream. Directly modulated SOA is employed to eliminate amplifiers and external modulators at base station.

OThM3 • 11:15 a.m.

MARIN Hybrid Optical-Wireless Access Network, *Wei-Tao Shaw, Shing-Wa Wong, Ning Cheng, Leonid Kazovsky*; *Photonics & Networking Res. Lab, Stanford Univ., USA*. A novel hybrid optical-wireless access network is proposed for metropolitan area. This novel architecture consists of wireless mesh networks and a reconfigurable optical backhaul and aggregation network based on TDM-PON technology.

OThM4 • 11:30 a.m.

RADAR: Risk-and-Delay Aware Routing Algorithm in a Hybrid Wireless-Optical Broadband Access Network (WOBAN), *Suman Sarkar¹, Hong-Hsu Yen², Sudhir Dixit¹, Biswanath Mukherjee¹*; ¹Univ. of California at Davis, USA, ²Dept. of Information Management, Shih Hsin Univ., Taiwan, ³Nokia Res. Ctr., USA. We propose "Risk-and-Delay Aware Routing Algorithm" (RADAR) for WOBAN. RADAR minimizes packet delay in the wireless front end of WOBAN and reduces packet loss for multiple failure scenarios: gateway failure, ONU failure, and OLT failure.

OThN • Signal Measurement and Equalization—Continued**OThN3 • 11:00 a.m.**

Invited

High Resolution Optical Waveform and Eye Diagram Monitoring, *Peter Andrekson*; *Chalmers Univ. of Technology, Sweden*. Techniques to analyze optical waveforms with high resolution are discussed. Emphasis is on all-optical sampling offering high resolution with excellent sensitivity. We also discuss techniques to analyze the complete optical field of high bit-rate signals.

OThN4 • 11:30 a.m.

Optical Equalization of 42.7-Gbaud Band-Limited NRZ-DQPSK Signals for High-Spectral-Efficiency Transmission, *Alan H. Gnauck¹, Chris Doerr¹, Peter Winzer¹, Steven Cabor¹, Mark Cappuzzo¹, Evans Chen¹, Annjoe Wong-Foy¹, Louis Gomez², Mike Santo¹, Tetsuya Kawanishi², Takahide Sakamoto²*; ¹Bell Labs, Lucent Technologies, USA, ²Natl. Inst. of Info. and Comm., Japan. We demonstrate the use of an optical equalizer to allow a 42.7-Gbaud (85.4-Gb/s) NRZ-DQPSK signal to tolerate the narrow optical filtering required in high-spectral-efficiency systems. The equalizer passbands are repetitive, enabling equalization of multiple channels.

NThC • Intelligent Optical Networks—Continued**NThC2 • 11:10 a.m.**

Cost vs. Capacity Tradeoff with Shared Mesh Protection in Optical-Bypass-Enabled Backbone Networks, *Jane M. Simmons*; *Monarch Network Architects, USA*. Shared mesh protection based on cross-connecting pre-deployed protection subconnections is well suited for the optical-bypass-enabled networks currently being deployed. This scheme poses a cost-versus-capacity tradeoff, which is investigated through studies on several realistic backbone networks.

NThC3 • 11:30 a.m.

Deployment of Carrier-Grade Bandwidth-on-Demand Services over Optical Transport Networks: A Verizon Experience, *Stephen S. Liu, Lily F. Chen*; *Verizon Technology Organization, USA*. In 2006, Verizon launched the Bandwidth-on-Demand trial in New York City, as a precursor to the formal rollout of Just-in-Time Provisioning service in 2007. The service features reduced provisioning intervals achieved by a GMPLS control plane.

NThD • Ethernet and Video Service Architectures—Continued**NThD2 • 11:10 a.m.**

Video Transport and Distribution for IPTV Networks, *Matt Hallam, Tom Rarick*; *Tellabs, USA*. An end to end architecture is needed to help carriers cost effectively meet emerging video demands. An architecture containing ROADM based transport and flexible access provides the scale for video while affording significant CapEx savings.

NThD3 • 11:30 a.m.

Digital Terrestrial Broadcasting Transport System in SDH Network, *Ayako Murakami¹, Akira Agata¹, Yukio Horiuchi^{1,2}, Jun Miura², Nobuo Furuya²*; ¹KDDI R&D Labs, Japan, ²KDDI Corp., Japan. We have developed a digital terrestrial broadcasting transport system to realize the broadcast infrastructure based on a SDH network, and confirmed a high accurate frequency transmission of OFDM sample clock in a SDH network.

Ballroom A

OThH • Optical Waveguide Devices—Continued**OThH3 • 11:45 a.m.**

Ultra-Wide-Band Low Loss and PDL 1x32 Splitter Polymer Optical Waveguide Chip and Module, *Shotaro Takenobu, Yasuhiro Kuwana, Kousuke Takayama, Yoshitomi Morizawa; Asahi Glass Co., Ltd., Japan.* Comparable optical properties to silica were shown by our 1x32 splitter polymer optical waveguide with dopant-free perfluoropolymer core. Insertion losses and polarization dependent losses at 1.31, 1.55, and even 1.65 μ m were <16.3dB, <0.15dB, respectively.

OThH4 • 12:00 p.m. Invited

Light-Induced Self-Written Three-Dimensional Polymer Optical Waveguide for Module Fabrication and Interconnection, *Manabu Kagami, Tatsuya Yamashita, Masatoshi Yonemura, Akari Kawasaki, Masaaki Tsuchimori, Takayuki Matsui; Toyota Central R&D Labs, Japan.* Light-induced self-written (LISW) technology is a unique and simple method of forming low-loss 3-dimensional optical circuits in a photopolymer solution. By using this technology, we fabricated and tested a WDM optical module.

Ballroom B

OThI • Optical Processing II—Continued**OThI5 • 11:45 a.m.**

All-Optical Combination of DPSK and OOK to 160 Gbit/s DQPSK Data Signals, *Michael Galili¹, Bernd Huettl², Carsten Schmidt-Langhorst², Reinhold Ludwig², Fumio Futami³, Shigeki Watanabe³, Colja Schubert²; ¹COM-DTU, Denmark, ²Fraunhofer Inst. for Telecommunications, Heinrich-Hertz-Inst., Germany, ³Fujitsu Labs Ltd., Japan.* All-optical combination of a DPSK and an OOK data signal to 160 Gbit/s DQPSK is proposed and demonstrated using highly nonlinear fibre. Error-free operation of the combiner is shown mid-span in a 320km transmission link.

OThI6 • 12:00 p.m. Invited

Digitization of Microwave Signals with Spatial Spectral Holography, *Wm. Randall Babbitt; Montana State Univ., USA.* A new optical approach to broadband analog-to-digital conversion is discussed, which directly records signals in the frequency domain. This frequency-domain stretch processor can achieve 10-bit performance at 20GSPS and is extendable to signals over 100GHz.

Ballroom C

OThJ • Optical Network Survivability—Continued**OThJ5 • 11:45 a.m.**

Survivable Differential Delay Aware Multi-Service Over SONET/SDH Networks with Virtual Concatenation, *Sheng Huang^{1,2}, Smita Rai³, Biswanath Mukherjee³; ¹Dept. of Electrical and Computer Engineering, Univ. of California at Davis, USA, ²Optical Networking Component Group, Intel Corp., USA, ³Dept. of Computer Science, Univ. of California at Davis, USA.* We propose a model for differential-delay compensation and two approaches for provisioning survivable service on Data-over-SONET/SDH networks with virtual concatenation. Our approaches optimize the resource subject to the constraint of differential-delay compensation.

OThJ6 • 12:00 p.m.

Novel Redundancy Design Methodology for an Optimal PON Protection Architecture, *Young Min Kim¹, Mi Sun Ryu¹, Hong Shik Park¹, Jeong Ju Yoo²; ¹Information and Communication Univ., Republic of Korea, ²ETRI, Republic of Korea.* We present novel redundancy methodology to design a survivable PON and demonstrate the efficiency of our redundancy methodology by analyzing the performance of derived protection architecture in terms of availability and cost perspective.

OThJ7 • 12:15 p.m.

Towards a Cryptanalysis of Spectral-Phase Encoded Optical CDMA with Phase-Scrambling, *Sharon Goldberg¹, Ronald C. Menendez², Paul R. Prucnal¹; ¹Dept. of Electrical Engineering, Princeton Univ., USA, ²Telcordia Technologies, Applied Res., USA.* We show how an eavesdropper with a small amount of knowledge about the traffic sent via a spectral-phase optical CDMA system with phase-scrambling can break the confidentiality of certain systems within a few bit intervals.

Ballroom D

OThK • Receiver Design—Continued**OThK5 • 11:45 a.m.**

10 Gb/s AC-Coupled Digital Burst-Mode Optical Receiver, *Benn C. Thomsen, Benjamin J. Puttnam, Polina Bayvel; Univ. College London, UK.* A 10Gb/s NRZ digital burst-mode optical receiver without any line-coding has been realized using an AC-coupled photodiode and asynchronous 20GS/s ADC. Symbol timing, amplitude and baseline wander corrections are implemented with digital signal processing.

OThK6 • 12:00 p.m.

A 2.5 Gb/s Edge-Detecting Burst-Mode Receiver for GPON Access Networks, *Emilio Hugues-Salas, Rouzbeh Razavi, Terence Quinlan, Manoj Thakur, Stuart Walker; Univ. of Essex, UK.* We describe a 2.5 Gb/s burst-mode receiver featuring edge-detecting data recovery. A high-performance SiGe comparator and standard optical front-end combination removed all burst-format issues. Error-free performance was achieved in a 32 km radius GPON test-bed.

OThK7 • 12:15 p.m.

Adaptive Polarization Tracking and Equalization for Polarization-Diverse Intraday Receiver of On-Off Keying (OOK), *Ut-Va Koc; Bell Labs, Lucent Technologies, USA.* We propose using on-off-keying with an adaptive algorithm to resolve issues in coherent communication to track fast polarization without phase synchronization. This allows polarization-multiplexed transmission and compensation of impairments, making coherent detection feasible for implementation.

Ballroom E

OThL • Transmission Experiments—Continued**OThL5 • 11:45 a.m.**

Local Dispersion Map Deviations in Metro-Regional Transmission Investigated Using a Dynamically Re-Configurable Re-Circulating Loop, *Daniel C. Kilper, Sethumadhavan Chandrasekhar, Ellsworth Burrows, Larry Buhl, Joe Centanni; Bell Labs, Lucent Technologies, USA.* The performance of 40x10.7 Gb/s NRZ-OOK signals is measured in a dynamically re-configurable re-circulating loop experiment with local dispersion map variations up to +/-120 ps/nm and mean residual-dispersion per-span between 10.3-54.0 ps/nm over 28x27dB spans.

OThL6 • 12:00 p.m.

IFWM Suppression in NRZ Transmission Experiment at 40 Gb/s Using Asynchronous Phase Modulation, *Marco Forzati, Anders Berntson, Jonas Mårtensson, Anders Djupsjöbacka; Acreo, Sweden.* Asynchronous Phase Modulation (APM) scheme is experimentally studied for the first time. APM is shown to increase the power tolerance of NRZ-OOK over a 3x75-km link.

OThL7 • 12:15 p.m.

Evaluation of Chirp-Managed Lasers in a Dispersion Managed DWDM Transmission over 24 Spans, *Sethumadhavan Chandrasekhar¹, Daniel C. Kilper¹, Xueyan Zheng², Daniel Mahgerefteh², Y. Matsui², K. McCallion², Z. Fan², P. Tayebati²; ¹Bell Labs, Lucent Technologies, USA, ²AZNA LLC, USA.* We report the first long-haul DWDM transmission using three chirp-managed lasers spaced 50-GHz apart in SSMF at 10-Gb/s. Transmission penalties less than 0.7dB over a dispersion-managed 1980-km link was measured with performance comparable to NRZ-OOK.

12:30 p.m.–3:00 p.m. Lunch (on your own)

OThM • Hybrid Optical Wireless—Continued**OThM5 • 11:45 a.m.**

Demonstration of a Novel WDM-PON Access Network Compatible with ROF System to Provide 2.5Gb/s per Channel Symmetric Data Services, Jianjun Yu¹, Zhensheng Jia², Ting Wang⁴, Gee-Kung Chang³, Georgios Ellinas⁵; ¹NEC Labs America, USA, ²Georgia Tech, USA, ³Univ. of Cyprus, Cyprus. We present the first demonstration of an agile WDM-PON architecture compatible with radio-over-fiber system to provide 2.5Gbit/s symmetric data services. Several enabling techniques are employed to increase transmission capacity while keeping low cost.

OThM6 • 12:00 p.m.

1.92 Gbit/s MB-OFDM Ultra Wide Band Radio Transmission over Low Bandwidth Multimode Fiber, Anna Pizzinat, Pierre Urvoas, Benoît Charbonnier; France Telecom Res. and Development, France. We demonstrate the feasibility of using low bandwidth multimode fiber to transmit 3x640Mbit/s MB-OFDM UWB radio signals with pre-distortion over a distance of 500 m by means of a low cost VCSEL.

OThM7 • 12:15 p.m.

Simultaneous Modulation and Transmission of FTTH Baseband and Radio Signals on a Single Wavelength, Chun-Ting Lin¹, Cheng-Feng Peng¹, Peng-Chun Peng², Jyehong Chen¹, Wei-Ren Peng¹, Bi-Shiou Chiou¹, Sien Chi^{1,3}; ¹Natl. Chiao-Tung Univ., Taiwan, ²Natl. Chi Nan Univ., Taiwan, ³Yuan-Ze Univ., Taiwan. We propose a hybrid optical access network integrating wired-line FTTH baseband and wireless RF signals sharing a single distributed infrastructure. After transmitted over 50km optical fiber, power penalties for both signals are less than 0.2dB.

OThN • Signal Measurement and Equalization—Continued**OThN5 • 11:45 a.m.**

Electronic Dispersion Compensation of 40-Gb/s Multimode Fiber Links Using IIR Equalization, George Ng, Anthony C. Carusone; Univ. of Toronto, Canada. Simulations demonstrate a 3rd order IIR equalizer compensates for modal dispersion in over 90% of the 5% worst-case 50-m multimode fiber links at 40Gbps with less than 2.5dB ISI penalty and 0.15 UI of jitter.

OThN6 • 12:00 p.m.

Advances in 40G Electronic Equalizers, Makoto Nakamura, Koichi Murata, Masami Tokumitsu; NTT Photonics Labs, Japan. Progress in LSI technologies and circuit techniques has led to 40-Gbit/s electronic equalizers. A new InP-HBT decision-feedback-equalizer IC using a circuit technique that boosts speed exhibits good performance at 40 Gbit/s.

NThC • Intelligent Optical Networks—Continued**NThC4 • 11:50 a.m.**

On Using Fast Signalling to Improve Restoration in Multilayer Networks, Américo F. Muchanga¹, Antoine B. Bagula^{1,2}, Lena Wosinska¹; ¹Royal Inst. of Technology KTH, Sweden, ²Univ. of Stellenbosch, South Africa. We present a fast signalling scheme where intra-layer signalling and inter-layer communication are used to reduce the recovery operation time. Simulation reveals the efficiency of the scheme compared to normal signalling strategies.

NThC5 • 12:10 p.m.

Robust Timely Scheduled Optical Burst Switching, Oliver Yu, Huan Xu, Leping Yin; Univ. of Illinois at Chicago, USA. The two-way reservation based optical-burst-switching scheme is implemented over existing distributed-control optical-circuit-switching networks through the novel robust timely scheduled reservation protocol to guarantee data delivery and minimize burst blocking while maximizing wavelength utilization.

NThD • Ethernet and Video Service Architectures—Continued**NThD4 • 11:50 a.m.**

Digital Protection for Ethernet and Video Transport Oriented Metro Optical Networks, Vijay Vusirikala, Serge Melle; Infinera, USA. We describe a digital protection scheme based on integrated sub-wavelength switching that is optimized for Ethernet and video-transport oriented metro optical networks. Results from a quantitative analysis illustrate the significant benefits over traditional protection methods.

NThD5 • 12:10 p.m.

Cost-Effective Optical Access Upgrades Using Wavelength Shared Hybrid Passive Optical Network Architecture, Martin Bouda, Paparao Palacharla, Youichi Akasaka, Alexander Umnov, Cechan Tian, Takao Naito; Fujitsu Labs of America, USA. We propose and demonstrate a novel Wavelength Shared Hybrid Passive Optical Network (WS-HPON) architecture for symmetric Gigabit PON capacity upgrades with installed equipment re-use, to bridge the technology gap between Gigabit- and WDM-PON systems cost-effectively.

12:30 p.m.–3:00 p.m. Lunch (on your own)

12:30 p.m.–3:00 p.m.
JThA • Joint Poster Session II

JThA1

Fabrication of Helicoidal Long-Period Fiber Gratings by Twisting a Standard Single Mode Fiber, Woojin Shin, B.-A. Yu, T.J. Eom, Y.L. Lee, Y.C. Noh, J.M. Lee, D. K. Ko; *Advanced Photonics Res. Inst., Republic of Korea*. We report a new method of fabrication of helicoidal long-period fiber gratings by twisting a single mode fiber with CO₂ laser beam. The transmission characteristics of helicoidal long-period fiber gratings were experimentally demonstrated.

JThA2

Quasi Single-Mode Fiber for the Cost-Effective Implementation of Broadband Access Networks, Seung Pil Jung¹, Kyung Goo Lee², Chang Hyun Jung², Jun Haeng Lee¹, Eui Seung Son¹, Jang Won Chae¹, Yun C. Chung¹; ¹KAIST, Republic of Korea, ²Optomagic, Republic of Korea. We designed and fabricated quasi single-mode fiber (QSMF) for the cost-effective implementation of broadband access networks. The core diameter of QSMF was 20- μ m. Using this fiber, we demonstrated the transmission of 10-Gb/s signal over 2-km.

JThA3

Application of Coherent Anti-Stokes Raman Scattering Microscopy Using Photonic Crystal Fiber with Two Zero-Dispersion Wavelengths, Bassam Mansour¹, Craig Brideau², Sangeeta Murugkar¹, Andrew Ridsdale², Shawkyl El Mougy¹, Hanan Anis¹, Peter Stys²; ¹School of Information Technology and Engineering (SITE), Univ. of Ottawa, Canada, ²Div. of Neuroscience, Ottawa Health Res. Inst., Univ. of Ottawa, Canada. We demonstrate spectral multiplex CARS microscopy based on a broadband source and a two zero-dispersion wavelength PCF. The quality of the images is similar to those obtained from technically more complex and expensive sources.

JThA4

Collectively Fabricated Spherical Lensed Fiber Array Based on Chemical Etching and Polishing Techniques, Akinori Sugimura, Masaru Sasaki, Masahiro Saito, Tadashi Sonobe, Nobuo Imaizumi; *Namiki Precision Jewel Co., Ltd., Japan*. A simple fabrication method for spherical lensed fiber array (SLFA) is developed. All fibers of SLFA are handled collectively through the etching and polishing processes. Far-field patterns were measured. Tip radii of curvature were 10 \pm 1 μ m.

JThA5

Novel Local Liquid-Core Single-Mode Fiber for Dispersion Engineering Using Submicron Tapered Fiber, Nan-Kuang Chen¹, Sien Chi^{1,2}; ¹Dept. of Photonics & Inst. of Electro-Optical Engineering/Natl. Chiao Tung Univ., Taiwan, ²Dept. of Electrical Engineering, Yuan Ze Univ., Taiwan. A capillary is threaded with a submicron-tapered-fiber and then stretched. The stretched capillary, serving as a new cladding, with submicron-tapered-fiber inside is infiltrated with optical liquid, acting as a new core, for novel dispersion engineering.

JThA6

Enhancement of the Stimulated Brillouin Scattering of Higher-Order Acoustic Modes in Hole-Assisted Fibers, Kunimasa Saitoh, Hironori Nagano, Nikolaos Florous, Masanori Koshiba; *Hokkaido Univ., Japan*. By using an accurate numerical method we show that both the higher-order peaks and main peak of the SBS in hole-assisted-fibers can be enhanced by more than 3-dB, by appropriate selection of the design parameters.

JThA7

Over 5-Months Long-Term PMD Continuous Measurement in Installed Fiber Cables with an Exposed Fiber Section, Takeshi Kawasaki, Wataru Ichihara, Tomoyoshi Kataoka, Shinji Matsuoka; *NTT Corp., Japan*. We report continuous PMD measurements (> 5-months) of installed fiber cables with exposed fiber section. Standard deviations of measured mean DGD with large daily fluctuations lie within theoretical uncertainties. Accuracy is related to measurement intervals.

JThA8

Compact All-Fiber Mach-Zehnder Interferometers Formed in Photonic Crystal Fiber, HaeYoung Choi, Myoung Jin Kim, Byeong Ha Lee; *Gwangju Inst. of Science and Technology, Republic of Korea*. We propose simple but very effective methods for implementing all-PCF Mach-Zehnder interferometers. The interference properties between the core and cladding modes of a PCF are investigated with respect to the interferometer length.

JThA9

S Band Erbium-Doped Fiber Ring Laser Tunable through the Active Fiber Bending Losses, Matteo Foroni¹, Federica Poli¹, Annamaria Cucinotta¹, Stefano Selleri¹, Paolo Vavassori²; ¹Univ. of Parma, Italy, ²Petroceramics S.r.l., Italy. A S band single-frequency depressed-cladding erbium-doped fiber ring laser which can be tuned through the active fiber bending losses is presented. A tuning range of 44 nm, between 1491 and 1535 nm, has been demonstrated.

JThA10

40 GHz Actively Mode-Locked Erbium-Doped Fiber Ring Laser Using an Electro-Absorption Modulator and a Linear Optical Amplifier, Lixin Xu^{1,2}, L. F. K. Lui¹, P. K. A. Wai¹, H. Y. Tam¹, C. Lu¹; ¹Hong Kong Polytechnic Univ., China, ²Univ. of Science and Technology of China, China. We demonstrated a 40-GHz actively mode-locked erbium-doped fiber laser that incorporates an EAM and a LOA. Stable pulses with peak power of 46-mW and pulsewidth of 2.8-ps are obtained when pumped with 100-mw.

JThA11

Tunable Ultrafast and Ultraslow Light in Erbium Doped Waveguide at Room Temperature, Peng-Chun Peng¹, Chun-Chen Chiang², Jyehong Chen², Chun-Ting Lin², Sien Chi²; ¹Natl. Chi Nan Univ., Taiwan, ²Natl. Chiao-Tung Univ., Taiwan. This investigation experimentally demonstrates tunable ultrafast and ultraslow light in an erbium doped waveguide for the first time. Group velocity of about -67.5 m/s (fast light) and 12.4 m/s (slow light) are reported.

JThA12

Pump-to-Stokes Transfer of Relative Intensity Noise in Brillouin Fiber Ring Lasers, Jihong Geng, Shibin Jiang; *NP Photonics, USA*. Pump-to-Stokes RIN transfer function in Brillouin ring lasers is studied experimentally in frequency and time domain, indicating 40-60dB RIN reduction at anti-resonant frequencies. At resonant frequencies the transfer function is still much lower than unity.

JThA13

Design Optimization of High Power and Low RIN Lasers for Efficient Raman Co-Pumping, Stefano Faralli, Gabriele Bolognini, Fabrizio Di Pasquale; *Scuola Superiore Sant'Anna, Italy*. We experimentally characterize high-power (up to 2W) and low-noise lasers, based on counter-pumped DRA, for efficient first- and higher-order distributed Raman co-pumping. We show that an optimization of the active fiber parameters minimizes the pump RIN.

JThA14

Power Transients in Second Order Pumped Lumped Raman Fiber Amplifier, Miroslav Karasek¹, Jan Radil¹, Josef Vojtech^{1,2}, David Krcmarik²; ¹CESNET, Czech Republic, ²IREAS CR, Czech Republic. We present experimental and theoretical results on power transients in an all-optical gain-clamped second order pumped lumped Raman fiber amplifier. Channel addition/removal was simulated by transmitting 10 signals, light of eight lasers was square-wave modulated.

JThA15

Dynamic Compensation of Raman Tilt in a Fiber Link by EDFA during Transient Events, Maxim Bolshtyansky, Nicholas King, Gregory Cowle; *JDSU, USA*. The tilt in channel power distribution due to Raman induced channel-to-channel interaction can be accurately estimated by relatively simple means. Simulations show that the tilt can be dynamically compensated by adjusting an EDFA tilt.

12:30 p.m.–3:00 p.m.

JThA • Joint Poster Session II—Continued

JThA16

Multi-Edge-Written Long-Period Fiber Gratings with Low PDL By Using High-Frequency CO₂ Laser Pulses, Yunjiang Rao^{1,2}, Tao Zhu^{1,2}, Ruokun Wang¹; ¹Dept. of Optoelectronics Eng., Chongqing Univ., China, ²Univ. of Electronic Science & Technology of China, China. An asymmetric LPFG with low PDL is fabricated by multi-edge exposure method with CO₂ laser. The experimental results show the PDL of a triple-edge-written LPFG with an attenuation of -16.5dB can be reduced to 0.18dB.

JThA17

Single-Reflection-Band Fiber Bragg Gratings with Channelized Linear and Nonlinear Dispersion and Their Applications, Xuewen Shu, Elena Turitsyna, Ian Bennion; Aston Univ., UK. We present a new class of multi-channel Fiber Bragg grating, which provides channelized dispersion with only a single reflection band. Such gratings can provide pure phase control of optical pulses without introducing any deleterious insertion-loss-variation.

JThA18

Characterization of Cladding Modes for the Design of Long-Period Fiber Gratings, Qing Liu, Kin Seng Chiang, Yunqi Liu; Dept. of Electronic Engineering, City Univ. of Hong Kong, Hong Kong. We propose a method to measure the dispersion characteristics of the cladding modes of a single-mode fiber for the design of long-period gratings. The phase-matching curves for the first 19 symmetric cladding modes are obtained.

JThA19

Low Loss Wavelength Monitor with Sub-Picometer Resolution Based on Tilted Fiber Gratings, Yann Tissot, Hans G. Limberger, René P. Salathé; EPFL-APL, Switzerland. A wavelength monitor based on a pair of tilted fiber Bragg gratings with low insertion loss (<1 dB) and sub-picometer wavelength resolution is reported.

JThA20

Single-End Spectral Resolved Measurement of Polarization Mode Dispersion in Optical Fibers, Hui Dong, Ping Shum, Junqiang Zhou, Yandong Gong; Network Technology Res. Ctr., Singapore. An improved single-end backreflection technique is proposed to perform the spectral resolved measurement of polarization mode dispersion in optical fibers. The agreement between the results of single-end and forward measurements is very good.

JThA21

Modal Control of a 50µm Core Diameter Multimode Fiber Using a Spatial Light Modulator, Poh Ling Neo, Jon P. Freeman, Timothy D. Wilkinson; Univ. of Cambridge, UK. An iterative, self-correcting system for doing modal control using adaptive optics in a 50µm core diameter multimode fiber (MMF) is designed. It is shown experimentally to reduce the number of modes generated by 300%.

JThA22

Automatic EDFA Gain Spectrum Equalization Using LPFGs on Divided Coil Heaters, Jun Kye Bae^{1,2}, Dongyeon Koh¹, Sang Hyuck Kim¹, Namkyoo Park², Sang Bae Lee¹; ¹Photonic Res. Ctr., Korea Inst. of Science and Technology, Republic of Korea, ²Optical Communication Systems Lab, School of EECS, Seoul Natl. Univ., Republic of Korea. We describe a dynamic EDFA based on automatic feedback control of LPFG based active gain equalizing filters. With LPFGs mounted on a divided coil heater array, wide dynamic-range gain control for an EDFA was achieved.

JThA23

Proposal of a Novel MMI-Based NxN Non-Blocking Optical Ring Switch, Nan Xie, Katsuyuki Utaka; Waseda Univ., Japan. Novel MMI-based optical NxN switch network with nested rings topology reduces as much as 20% of switches compared with the Beneš configuration.

JThA24

Loop-Back AWG Router with Non-Uniform Transmission Capacity, Osamu Moriwaki¹, Kenya Suzuki¹, Hiroshi Takahashi¹, Yoshihisa Sakai¹, Ken-ichi Sato², Shoji Kakehashi²; ¹NTT Photonics Labs, NTT Corp., Japan, ²Nagoya Univ., Japan. We developed an AWG-based wavelength router with a loop-back structure for a system with non-uniformly distributed traffic. We describe the design of the loop-back waveguides and the transmission characteristics of the developed device.

JThA25

Compact 2x2 Couplers for Unequal Splitting of Power Obtained by Cascading of Short MMI Sections, David J. Y. Feng, T. S. Lay, T. Y. Chang; Inst. of Electro-Optical Engineering/Natl. Sun Yat-Sen Univ., Taiwan. More than 32% length reduction for 0%, 15%, and 28% cross-coupling multimode-interference couplers is obtained by cascading two short MMI sections. Previously unavailable cross coupling ratios of 7% and 64% are also obtained.

JThA26

Fabrication of Cascaded Perpendicular Up Tapers for Si-Wire Waveguides, Hidehiko Yoda¹, Hideki Ikeda¹, Haruhiko Tsuchiya¹, Kazuo Shiraishi¹, Chen S. Tsai^{2,3}; ¹Utsunomiya Univ., Japan, ²Univ. of California, USA, ³Natl. Taiwan Univ., Taiwan. A new type of spot-size converter (SSC) is proposed for efficient coupling between a single-mode fiber and a silicon wire waveguide with cross section of 0.3x0.3µm². Desirable mode expansion was confirmed numerically and experimentally.

JThA27

Synchronized Coherent OCDM System Using 128-Chip Orthogonal Sequence SSFBG Encoder/Decoder, Saeko Oshiba¹, Yasuhiro Kotani¹, Renichi Moritomo¹, Kensuke Sasaki², Shukou Kobayashi²; ¹Kyoto Inst. of Technology, Japan, ²Oki Electric Industry Co., Ltd., Japan. Synchronized optical code division multiplexing system using 128-chip orthogonal sequence SSFBG en/decoder was experimentally demonstrated. Multiplexing for more than 17 users is experimentally achieved with changing interference levels using orthogonal codes for reducing cross-correlation noise.

JThA28

Integration of Dual-Code Optical CDMA Encoder and Decoder by Holographic Bragg Reflectors, Yue-Kai Huang¹, Konstantin Kravtsov¹, Ivan Glesk¹, Paul R. Prucnal¹, Christoph M. Greiner², Dmitri Lazikov², Thomas W. Mossberg²; ¹Princeton Univ., USA, ²LightSmyth Technologies Inc., USA. A matching integrated OCDMA encoder-decoder pair based on holographic Bragg reflector technology was fabricated. Simultaneous en/decoding operation of two wavelength-hopping time-spreading codes was successfully performed at OC-24. A double-pass scheme was employed for longer code-length.

JThA29

A Novel Two-Section Tunable Slotted Fabry-Pérot Laser Exhibiting ns Wavelength Switching, Richard Phelan¹, Diarmuid Byrne¹, Wei-Huo Guo¹, Qiaoyin Lu¹, Brendan Roycroft², Frank Smyth³, Liam Barry³, John F. Donegan¹; ¹Semiconductor Photonics Group, Ireland, ²Tyndall Inst., Ireland, ³Dublin City Univ., Ireland. A novel two-section tunable laser diode is demonstrated by etching slots into the laser ridge. A discontinuous tuning-range of 30nm was achieved with a SMSR of 38dB. A wavelength switching time of 1.5ns is demonstrated.

JThA30

High-Speed Wavelength-Swept Semiconductor Laser Using a Diffraction Grating and a Polygon Scanner in Littrow Configuration, Seyed Mohammad Reza Motaghian Nezam, Guillermo J. Tearney, Brett E. Bouma; Harvard Medical School and Massachusetts General Hospital, USA. High-speed tuning of an extended-cavity-semiconductor-laser is demonstrated using a scanning-polygon filter. We achieved a tuning rate of 7714nm/ms with 65mW of power over a wavelength range of 135nm and with an instantaneous linewidth ~ 0.13nm.

JThA31

Multi-Wavelength Light Source for OCDMA Using a Directly Sinusoidally Modulated Laser Diode, Manabu Yoshino, Shin Kaneko, Noriki Miki; NTT Corp., Japan. For OCDMA, a novel flattened multi-wavelength light source scheme that is based on a directly sinusoidally modulated laser diode technique is proposed. Its performance is confirmed experimentally; its support of OCDMA is demonstrated.

JThA32

Synchronization Dynamics of Optical Injection Locking in Self-Pulsation Laser Diode without a Saturable Absorber, Min Yong Jeon¹, Young Ahn Leem², Dae-Su Yee¹, Eundeok Sim², Dong Churl Kim², Hyunsung Ko², Kwang-Seong Choi², Kyung Hyun Park²; ¹ChungNam Natl. Univ., Republic of Korea, ²Electronics and Telecommunications Res. Inst., Republic of Korea, ³Korea Res. Inst. of Standards and Science, Republic of Korea. We report, for the first time to our knowledge, the observation of the synchronization dynamics of optical injection locking in the passively mode-locked laser diode without a saturable absorber.

Exhibit Hall

12:30 p.m.–3:00 p.m.

JThA • Joint Poster Session II—Continued

JThA33

Ultra-Broadband Quantum-Dot Semiconductor Optical Amplifier and Its Applications, Z.G. Lu¹, J.R. Liu¹, S. Raymond¹, P.J. Poole¹, P.J. Barrios¹, G. Pakulski¹, D. Poitras¹, F.G. Sun¹, S. Taebi¹, T. Hall²; ¹Inst. for Microstructural Sciences, Natl. Res. Council Canada, Canada, ²Ctr. for Res. in Photonics, Univ. of Ottawa, Canada. We have developed an ultra-broadband InAs/InGaAsP quantum-dot semiconductor optical amplifier around 1520 nm with the 3-dB bandwidth of 150 nm. The four-wave mixing process and multi-wavelength lasers have been demonstrated by using our QD-SOAs.

JThA34

Widely Tunable Wavelength Conversion 10 Gb/s Using a Modulated Grating Y-Branch Laser Integrated with an Optical Amplifier, Marek G. Chacinski¹, Wouter D'Oosterlinck², Mats Isaksson¹, Geert Morthier², Richard Schatz²; ¹Royal Inst. of Technology (KTH), Sweden, ²Ghent Univ., Belgium. A simple integrated tunable wavelength converter is presented. 10Gb/s XGM conversion of signals at wavelength 1530-1560nm to 1531-1556nm and transmission at 2.5Gb/s over 25km SSMF of the converted signals were achieved.

JThA35

Synchronous Clock Pumping to Improve Performance of All-Optical Wavelength Conversion for RZ-DPSK Based on Four-Wave Mixing in SOA, He Wen, Huan Jiang, Xiaoping Zheng, Hanyi Zhang, Yili Guo; Tsinghua Univ., China. Synchronous clock pumping is proposed to improve the performance of all optical wavelength conversion based on four-wave mixing effect in semiconductor optical amplifier. About 3dB improvement in output power is achieved for RZ-DPSK format.

JThA36

All-Optical Wavelength Conversion at 40 Gb/s Data Rate in Silicon Waveguides, Ying-Hao Kuo¹, Haisheng Rong¹, Vanessa Sih¹, Shengbo Xu¹, Mario Paniccia¹, Oded Cohen²; ¹Intel, USA, ²Intel, Israel. We report efficient wavelength conversion of a high speed signal at 40 Gb/s via four-wave mixing in silicon-on-insulator rib waveguides. Results give an efficiency of -8.6 dB, and the converted signal shows good signal integrity.

JThA37

High-Speed Phase-Correlated Signal Generation by Phase-Reconstruction of OTDM Signals through Differential Cross-Phase Modulation in an SOA-MZI, Saurabh Kumar, Alan E. Willner; Univ. of Southern California, USA. We propose a method to generate high-speed coherent phase-modulated signals using DXPM in an SOA-MZI. Results include generation of 80-Gb/s RZ-DPSK, CSRZ, GAP-CSRZ, PAP-CSRZ, and AMI modulation formats. The technique also enables output pulse-width control.

JThA38

1550nm Optical Interconnect Transceiver with Low Voltage Electro-absorption Modulators Flip-Chip Bonded to 90nm CMOS, Jonathan E. Roth¹, Samuel Palermo², Noah C. Helman³, David P. Bour⁴, David A. B. Miller¹, Mark Horowitz¹; ¹Stanford Univ., USA, ²Intel Corp., USA, ³Univ. of California at San Francisco, USA, ⁴BridgeLux, Inc., USA. A low-voltage 90nm CMOS optical interconnect transceiver operating at 1550nm is presented. This is the first system demonstrated using the recent Quasi-Waveguide Angled Facet Electro-absorption Modulator (QWAFEM), featuring simple electronic and optical packaging.

JThA39

Long-Haul Raman-Assisted EDFA Systems with Ultra-Long Spans, Alan J. Lucero, Dmitri G. Foursa, Dmitry Kovsh, Morten Nissov, Alexei N. Pilipetskii; Tyco Telecommunications, USA. We present a methodology to optimize a Raman assisted EDFA transmission system. We analyzed span lengths from 120 km to 210 km and then give in-depth numerical and experimental results for 150 km spans.

JThA40

Impact of Polarization Hole Burning in Lightly Loaded Ultra Long-Haul WDM Systems, Bamdad Golshahi, Lutfur Rahman, Katya Golovchenko; Tyco Telecommunications, USA. In lightly loaded ultra-long WDM systems, which use idlers for power management, we show experimentally that a higher inline EDFA output power can significantly reduce the PHB-induced performance fluctuations, with enhanced system margin in result.

JThA41

A New Dispersion Map for Undersea Optical Communication Systems, Georg Mohs, William T. Anderson, Ekaterina A. Golovchenko; Tyco Telecommunications, USA. We present a new type of dispersion map for undersea WDM transmission based on non slope-matched fiber. 64x10 Gb/s were transmitted over transatlantic distance with more than 1.5 dB performance advantage over previous conventional maps.

JThA42

A Novel Scheme to Generate 100Gbit/s DQPSK Signal with Large PMD Tolerance, Jianjun Yu¹, Xiang Zhou², Lei Xu¹, Philip Ji¹, Ting Wang¹; ¹NEC Labs America, USA, ²AT&T Labs, USA. A novel 100Gbit/s transmitter has been proposed and experimentally demonstrated. It can tolerate over 20ps DGD. After transmission over 300km conventional SMF, the power penalty is 0.7dB.

JThA43

Mitigation of Patterning Effects at 40 Gb/s by Skewed Channel Pre-Encoding, Brendan Slater¹, Sonia Boscolo¹, Alexander Shafarenko², Sergei K. Turitsyn¹; ¹Photonics Res. Group, School of Engineering and Applied Science, Aston Univ., UK, ²Dept. of Computer Science, Univ. of Hertfordshire, UK. Through direct error computation, reduction of pattern-dependent errors in a standard-fiber-based transmission link at 40Gb/s-rate is demonstrated by application of a skewed data pre-encoding. The trade-off between bit-error-rate improvement and data rate loss is examined.

JThA44

Cross Comparison of the Nonlinear Impairments Caused by 10Gbit/s Neighboring Channels on a 40Gbit/s Channel Modulated with Various Formats and over Various Fiber Types, Mathieu Lefrançois, François Houndoungbo, Thibaut Fauconnier, Gabriel Charlet, Sébastien Bigo; Alcatel Res. and Innovation, France. We evaluate the impact of 10Gbit/s NRZ channels on the performance of one 40Gbit/s PSBT, DQPSK or DPSK channel over two fiber types. DPSK and PSBT are much less affected by 10Gbit/s neighbors than DQPSK.

JThA45

Field Transmission by Using a Commercially-Ready 43 Gbit/s DWDM System Employing RZ-DQPSK Transponders in High PMD Installed Fiber, Tomoyoshi Kataoka, Shinji Matsuoka, Toshiya Matsuda, Hideki Maeda, Norio Sakaida, Tsutomu Kubo, Takashi Kotanigawa, Takeshi Kawasaki; NTT Network Service Systems Labs, Japan. Using a commercially-ready 40- λ DWDM system, RZ-DQPSK is confirmed to offer excellent DGD tolerance, up to 25 ps, through high PMD installed DSFs.

JThA46

Power Efficient LDPC-Coded Modulation for Free-Space Optical Communication over the Atmospheric Turbulence Channel, Ivan B. Djordjevic, Bane Vasic, Mark A. Neifeld; Univ. of Arizona, USA. We describe a power efficient transmission scheme based on LDPC-coded modulation. This technique is suitable for use in hybrid RF/microwave-free-space optical communications operating under the strong atmospheric turbulence, and provides an excellent coding gain.

JThA47

Optimum Design for Coherent Optical OFDM Transmitter, Yan Tang, Xing Wen Yi, William Shieh, Rob Evans; Univ. of Melbourne, Australia. Optimum design for coherent optical OFDM transmitter has been analyzed. In contrast to the direct-detection system, the optimal modulator bias point for the coherent system is π where the nonlinearity and excessive loss are minimized.

JThA48

Experimental Demonstration of Optically Phase-Shifted SSB Modulation with Fiber-Based Optical Hilbert Transformers, Katsumi Takano, Nobutomo Hanzawa, Sadayuki Tanji, Kiyoshi Nakagawa; Yamagata Univ., Japan. Optically phase-shifted SSB modulation is demonstrated using the third-order optical Hilbert transformer of Mach-Zehnder interferometers. The results verify the principle of the optically phase-shifted SSB scheme which is applicable for high-speed transmission with bandwidth efficiency.

12:30 p.m.–3:00 p.m.

JThA • Joint Poster Session II—Continued

JThA49

Comparison of Methods for Monitoring PMD-Induced Penalty, *Kate E. Cornick¹, Kerry Hinton², Sarah D. Dods¹, Peter M. Farrell¹*; ¹Natl. ICT Australia, Australia, ²Univ. of Melbourne, Australia. We present and verify theoretical models relating PMD-induced penalty with four different monitoring techniques, and show they interrelate through system specific constants. We then assess the robustness of each monitoring technique to various optical impairments.

JThA50

DPSK Error Correction Using Multi-Bit Detection for Enhanced Sensitivity and Compensation of Impairments, *Louis C. Christen^{1,2}, Yannick K. Lize¹, Scott R. Nuccio¹, Xiang Liu³, Moshe Nazarathy⁴, Alan E. Willner¹*; ¹Univ. of Southern California, USA, ²Northrop Grumman Space Technology, USA, ³Bell Labs, Lucent Technologies, USA, ⁴Israel Inst. of Technology, Israel. We demonstrate a new technique for correcting common errors in DPSK transmission due to impairments using delay-line-interferometers of multiple-bit-delays. We show large improvements for 10-GB/s DPSK data using one and two-bit delay interferometers.

JThA51

Receiver-Side, Adaptive, Opto-Electronic Chromatic Dispersion Compensation of Single-Mode Fiber, *Arup Polley, Stephen E. Ralph*; *Georgia Tech*, USA. We present the theoretical and simulation results of a receiver-side, adaptive, opto-electronic chromatic dispersion compensation technique.

JThA52

Dual-Pump Four-Wave Mixing in Bismuth-Oxide Highly Nonlinear Fiber for Wide-Band DPSK Wavelength Conversion, *Mable P. Fok¹, Chester Shu¹, Daniel J. Blumenthal²*; ¹Chinese Univ. of Hong Kong, Hong Kong, ²Univ. of California at Santa Barbara, USA. Wide-band wavelength conversion is obtained in a 32-cm highly nonlinear bismuth oxide fiber using dual-pump four-wave mixing. The conversion for a 10-Gb/s NRZ-DPSK signal shows a power penalty below 4 dB over a 30-nm range.

JThA53

All-Optical Re-Phasing, Re-Shaping, and Re-Amplification of RZ-DPSK Data, *Ehab Awad, Pak Cho, Julius Goldhar*; *Univ. of Maryland at College Park*, USA. We demonstrate novel technique for RZ-DPSK regeneration based on converting phase-noise into amplitude-noise and eliminating it using SOA. The system was tested using degraded 223-1 PRBS. BER shows removal of error-floor with 4dB power-penalty improvement.

JThA54

Asynchronous Digital Optical Regenerator by an EAM-Loop for 4 x 40Gb/s WDM to 160Gb/s OTDM Conversion, *C. W. Chow, A. D. Ellis*; *Photonic Systems Group, Tyndall Natl. Inst., Ireland*. We propose a novel configuration for asynchronous digital optical regeneration requiring only one electroabsorption modulator. This regenerates signals with high amplitude fluctuation, and re-shapes/re-times pulses for 4 x 40Gb/s WDM to 160Gb/s OTDM conversion.

JThA55

Ultra-Fast Clock Recovery Based on Pre-Embedded Sub-Harmonic Clock in Optical Burst/Package Networks, *S. B. Jun¹, Paul K. J. Park², Hoon Kim², Yun C. Chung¹*; ¹Korea Advanced Inst. of Science and Technology, Republic of Korea, ²Samsung Electronics, Republic of Korea. We propose an ultra-fast clock recovery technique for the use in the optical burst/packet networks, and evaluated its performance by using 40-Gb/s burst-mode NRZ and DPSK signals.

JThA56

A Synchronous All-Optical 160 Gb/s Photonic Interconnection Network, *Antonella Bogoni¹, Nicola Andriolli², Mirco Scaffardi², Gianluca Berrettini², Gianluca Meloni², Antonio Malacarne², Francesco Fresi², Claudio Porzi², Piero Castoldi², Luca Poti¹*; ¹CNIT, Italy, ²Scuola Superiore Sant'Anna, Italy. A modular photonic interconnection network based on a combination of basic 2x2 all-optical nodes is presented. The proposed architecture is synchronous, can operate up to 160Gb/s and exhibits self-routing capability and very low switching latency.

JThA57

All-Optical Reconfigurable Bipolar Tap Microwave Filter Using Photonic Bandgap Fiber and DGD Module, *Xianbin Yu, Xiaoping Zheng, Hanyi Zhang, Yili Guo*; *Dept. of Electronic Engineering, Tsinghua Univ., China*. An all-optical bipolar tap microwave filter based on photonic bandgap fiber and DGD module is proposed and experimentally demonstrated. The filter provides tunability and reconfigurability along with immunity to optical coherence interference.

JThA58

Coherence Free All Optical Microwave Notch Filter with Negative Coefficient Based on Polarization Modulation in an Electro-Optic Phase Modulator, *Choong Keun Oh¹, Tae-Young Kim¹, Sun-Jong Kim², Chang-Soo Park¹*; ¹GIST, Republic of Korea, ²TTA, Republic of Korea. We propose a coherence-free all-optical microwave notch filter with negative and positive coefficients from single optical source based on polarization modulation. The experimental result shows the stable notch filter characteristics with FSR of 3.97 GHz.

JThA59

Millimeter-Wave Signal Generation Using Four-Wave Mixing Effect in SOA, *Tianliang Wang, Minghua Chen, Hongwei Chen, Shizhong Xie*; *Tsinghua Univ., China*. Optical generation millimeter-wave signals employing FWM effect in SOA is proposed. Sextuple fundamental frequency millimeter-wave of 42GHz with 3dB linewidth 20Hz and phase noise less than -75dBc/Hz at 1.6 kHz offset is obtained.

JThA60

Simultaneous Base-Band and mm-Wave Delivery of Gbps Data Employing Photonic Vector Modulators, *Miguel Angel Piqueras¹, Valentin Polo², Javier Marti²*; ¹DAS Photonics, S.L., Spain, ²Nanophotonics Technology Ctr., Spain. A highly scalable photonic vector modulation architecture that allows the simultaneous transmission of the digital base-band data is experimentally demonstrated generating up to 3 Gbps 8QAM signals directly at 39 GHz.

JThA61

Evaluation of the Performance of SCM-Based Access Networks Using the Spectrally-Sliced ASE from a Semiconductor Optical Amplifier, *Agustin Pérez¹, Geert Mortier², Salvador Sales¹, Juan Manuel Temprado¹, Joaquin Vague¹*; ¹Univ. Politecnica de Valencia, Spain, ²Ghent Univ., Belgium. We report on the distribution of SCM signals using the spectrally-sliced Amplified Spontaneous Emission (ASE) from a SOA. Also, we have developed a model for the ASE, and have obtained good agreement with the measurements.

JThA62

Experimental Investigation of Adaptive Ethernet Forwarding and Optical Cut-through for Metro Optical Ethernet Networks, *Xu Shao, Luying Zhou, Chava Vijaya Saradhi, Teck Yoong Chai, Yixin Wang*; *Inst. for Infocomm Res., Singapore*. We present a system design for hybrid Ethernet and WDM employing commercial Ethernet hardware platform, and experimentally evaluate various schemes to achieve switching between Ethernet lightpaths.

JThA63

New High-Speed Optical Routing Architecture Based on First-Come-First-Serve Principle, *Takashi Yamada, Shunji Kimura, Katsumi Iwatsuki, Takamasa Imai*; *NTT Access Network Service Systems Labs, Japan*. We propose a new high-speed routing architecture using the first-come-first-served basis with a partial-mesh topology. This architecture can solve the optimal-path problem within 200ms over 200 node networks. The prototype-boards implemented the architecture showed high-speed performance.

12:30 p.m.–3:00 p.m.

JThA • Joint Poster Session II—Continued

JThA64

Cross Layer Routing in Transparent Optical Networks, *Christina (Tanya) Politi¹, Chris Matrakidis¹, Alexandros Stavdas¹, Vasilis Anagnostopoulos², Matthias Gunke³*; ¹Univ. of Peloponnese, Greece, ²Natl. Technical Univ. of Athens, Greece, ³T-Systems Enterprise Services GmbH, Germany. New algorithmically simplified WRA that incorporate physical layer criteria in the path establishment procedure are suggested and applied in the Deutsche Telecom network. Their blocking performance superiority and physical performance guarantee is discussed.

JThA65

Quasi-Dynamic Network Design Considering Different Service Holding/Contract Terms, *Koichi Kanie, Hiroshi Hasegawa, Ken-ichi Sato; Nagoya Univ., Japan*. We present a quasi-dynamic multi-layered photonic network design algorithm that achieves cost-effective incremental network expansion to accommodate future broadband services. It is demonstrated that service holding/contract times are key parameters in developing cost-effective networks.

JThA66

Multilayer Routing on Restricted Path for Traffic in IP over DWDM Networks, *Xinyou Cui, Xiaoping Zheng, Yanhe Li, Yili Guo, Hanyi Zhang; Tsinghua Univ., China*. Multilayer Routing on Restricted Path (MRRP) was proposed, which confines the traffic only choose network resource on the restricted path. Discrete Event Simulation (DES) shows that MRRP has lower blocking probability and resource occupation.

JThA67

Minimizing Vulnerability with End-to-End Protection Schemes for Optical Networks, *Sun-il Kim, Xiaolan J. Zhang, Steven S. Lumetta; Univ. of Illinois at Urbana-Champaign, USA*. In this paper, we present techniques that allow network end-to-end protection reconfiguration algorithms to achieve maximum robustness under multiple failures. With the presented approach, maximum robustness can be achieved for a given topology.

JThA68

Multiple Failure Recovery of Optical Paths Using GMPLS Based Restoration Scheme Escalation, *Yoshiaki Sone, Wataru Imajuku, Masahiko Jimno; NTT Labs, Japan*. This paper proposes a GMPLS based restoration scheme escalation against multiple failures. The proposed scheme automatically evolves from a pre-planned restoration scheme to a LSP rerouting scheme following the failure state in a network.

JThA69

Survivable Routing for Segment Protection under Multiple Failures, *Qingya She, Xiaodong Huang, Jason Jue; Univ. of Texas at Dallas, USA*. This paper considers the problem of survivable routing for segment protection under multiple failures. We propose an efficient algorithm to select working routes and backup segments to maximize the end-to-end survivability. Corresponding cost are investigated.

JThA70

Coordinated Resource Scheduling in High-Performance Optical Grids, *Sun-il Kim¹, Admela Jukan², Steven S. Lumetta¹*; ¹Univ. of Illinois at Urbana-Champaign, USA, ²INRS/ Univ. du Quebec, Canada. This paper investigates coordinated resource scheduling algorithms for high performance optical grids. We introduce a simple scheduling algorithm and study its impact on grid performance.

JThA71

Output-Aware Buffering with Variable Delay Buffers in Optical Packet Switching Networks, *Ming Xin, Minghua Chen, Hongwei Chen, Shizhong Xie; Tsinghua Univ., China*. A new buffer structure with output-aware buffering and variable delay buffer is proposed. This structure can realize optical RAM buffering in OPS contention resolution, so that it can significantly improve the performance of OPS networks.

JThA72

First Demonstration of Clockless Serial Optical Code Label Switching with SSFBGs Label Recognizer, *Hideaki Tamai¹, Masahiro Sarashina¹, Kensuke Sasaki², Masayuki Kashima²*; ¹OITDA, Japan, ²Ok Electric Industry. Co., Ltd., Japan. We proposed and demonstrated 40Gbps, 256-label optical packet switching employing a clockless serial optical code label processing. Eight different SSFBGs label recognizers with high auto- to cross-correlation peak ratio were used for optical label correlation.

JThA73

Increasing the Number of Users in an Optical CDMA System by Pulse-Position Modulation, *Poorya Saghari, Reza Omrani, Vahid R. Arbab, Alan E. Willner, Vijay P. Kumar; Univ. of Southern California, USA*. We analytically show that using PPM-OCDMA can increase the spectral efficiency of an OCDMA system up to factor of 3. Utilizing our results we generate the performance trends of PPM-OCDMA systems for varying code-sets.

JThA74

Multi-Rate Spectral Phase-Encoded Time-Spreading Optical CDMA System Using OVVSF Code Sequences, *Takaya Miyazawa¹, Iwao Sasase¹, S. J. Ben Yoo²*; ¹Keio Univ., Japan, ²Univ. of California at Davis, USA. We propose a multi-rate SPECTS-O-CDMA system using OVVSF code sequences. The proposed multi-rate system achieves a distinct differentiation on bit-rate/BER requirements and improves the BER performances of higher-rate users compared to the conventional single-rate system.

JThA75

In-Field WDM-DPSK 8x10 Gb/s Transmission over 300 km Using Four Common SOAs, *Ernesto Ciaramella¹, Antonio D'Errico¹, Valentina Donzella¹, Giampiero Contestabile¹, Silvello Betti², Valeria Carrozzo², Franco Curti², Michele Guglielmucci³*; ¹Scuola Superiore Sant'Anna, Italy, ²Tor Vergata Univ., Italy, ³Inst. Superiore Comunicazioni e Tecnologie dell'Informazione, Italy. Field-trial transmission demonstrates the feasibility of WDM-DPSK systems exploiting semiconductor optical amplifiers, with practical amplifier spacing (100 km) for the first time.

JThA76

A Protection Method for Ring-Type TDM-PONs against Fiber Fault, *Chien-Hung Yeh¹, C.-S. Lee¹, S. Chi^{2,3}*; ¹Information & Communications Res. Labs, Industrial Technology Res. Inst., Taiwan, ²NCTU, Taiwan, ³Yuan Ze Univ., Taiwan. A new self-protected ring-based time-division-multiplexed passive optical network (TDM-PON) with dual-fiber path against the fiber-fault in the fiber access system is proposed and investigated experimentally.

JThA77

Flexibility in Access Networks : A Novel WDMA/TDMA Scheme for Passive Optical Networks, *Roman Glatty, Philippe Guignard, Philippe Chanclou; France Telecom Res. and Development, France*. We propose a new access network scheme introducing WDM based flexibility, with dynamic rearrangement of customer connections. We focus on physical layer issues, simulation and experimental results are provided for a network without optical amplification.

JThA78

A Bidirectional RSOA Based WDM-PON Utilizing a SCM Signal for Down-Link and a Baseband Signal for Up-Link, *Seunghyun Jang¹, Byoung Whi Kim¹, Chul-Soo Lee¹, Eui-Suk Jung¹, Dong-Min Seo²*; ¹Electronics and Telecommunications Res. Inst., Republic of Korea, ²Univ. of Science and Technology, Republic of Korea. We propose and demonstrate WDM-PON utilizing SCM technique for down-link and baseband technique for up-link with RSOA for re-modulation. The BER performances were shown to be as good as those of CW light injected RSOA.

JThA79

In-Service Fault Localization in WDM Passive Optical Networks, *Xiao Fei Cheng¹, Yang Jing Wen¹, Zhaowen Xu¹, Yixin Wang¹, Jaya Shankar O/S Pathmasuntharam¹, Ping Shum²*; ¹Inst. for Infocomm Res., Singapore, ²Nanyang Technological Univ., Singapore. We propose a novel in-service fault localization scheme in WDM-PON. Two PONs are combined and monitored simultaneously. Fiber fault and automatic protection switching in ONUs are monitored real-time at central office(CO) without interrupting customer service.

12:30 p.m.–3:00 p.m.

JThA • Joint Poster Session II—Continued

JThA80

A FSR-Interleaved, Self-Wrapping, Multiple-Cascaded AWG-Based WDM Access Network, Stuart Walker¹, Mehmet Toygan¹, Ioannis Tsalamani¹, Michael Parker²; ¹Univ. of Essex, UK, ²Fujitsu Labs of Europe Ltd., UK. We describe a WDM:TDM-swapped access network architecture, featuring AWG-based double-cascade downstream and triple-cascade upstream operation. Cyclical Latin-routing protocols allow FSR-interleaving for capacity-multiplication via self-wrapping 16x16 and 1x32 central office AWGs. 2.5Gb/s/wavelength performance was experimentally verified.

JThA81

Demonstration of Radio over Fibre Distributed Antenna Network for Combined In-Building WLAN and 3G Coverage, Michael J. Crisp, Sheng Li, Adrian Wonfor, Richard V. Penty, Ian H. White; Univ. of Cambridge, UK. A RF-over-fibre distributed multi-antenna network is demonstrated to improve coverage and reduce the required dynamic range of co-existing IEEE 802.11g WLAN and 3G services by using overlapping cells, fed from a single signal source.

JThA82

Efficient BER Estimation for Radio-over-Fiber Systems, Ghislain Mouil Sil, Hadrien Louchet, André Richter; VPLsystems, Germany. We present a novel BER estimation method for sub-carrier multiplexed signals using QAM modulation that accounts for noise and intermodulation distortions. It is of particular interest for the design and optimization of radio-over-fiber systems.

JThA83

Using Signal Processing Technologies from the Radio Frequency Domain in Optics, Harald Rohde, Sebastian Randel, Changsong Xie; Siemens AG, Germany. The possibilities of bandwidth-efficiency improvements of optical communication systems by adoption of signal processing technologies such as Multiple-Subcarrier Modulation, Equalization, CDMA and MIMO, from radio frequency domain into optics is discussed.

JThA84

CSMA/CD-Based Fiber-to-the-Desk System with Remote Repeater, An V. Tran¹, Chang-Ioon Chae², Thisara Jayasinghe², Rodney S. Tucker¹; ¹Univ. of Melbourne, Australia, ²Natl. ICT Australia, Australia. We report a fiber-to-the-desk system using carrier-sense multiple access with collision detection (CSMA/CD) and a remote repeater. The CSMA/CD is performed at the repeater to enable high channel efficiency and low-cost implementation of optical LAN.

JThA85

Carrier Ethernet Services Preserving SONET and Migrating to the MPLS Network, Joseph V. Mocerino; Fujitsu Network Communications, USA. Service providers maintain network investment while offering Carrier Ethernet services and migrating to MPLS. VCAT and LCAS mapping, plus leaky bucket and dual leaky bucket policing methods, are described along with various flow encapsulation techniques.

JThA86

Broadband Access Technologies for FTTx Deployment, William Yue, Joseph V. Mocerino; Fujitsu Network Communications, USA. This paper describes GPON applications using both all fiber and fiber/DSL mix for cost savings. Transporting Multiple Broadband Services over the Metro and Core Network is described for differentiated services.

JThA87

Techno-Economic Evaluation of Optical Access and Metropolitan Area Networks: The Influence of the Status of Maturity of the Photonics Component Industry, Dimitris Varoutas¹, Thomas Kamalakis¹, Dimitris Katsianis¹, Thomas Sphicopoulos¹, Thomas Monath²; ¹Univ. of Athens, Greece, ²T-Systems Nova GmbH, Germany. A techno-economic evaluation of the business aspects of optical networks in the access/metro optical networks is given and its relation to the evolution of the photonic component industry is highlighted.

JThA88

Dynamic Attenuator: A New Passive Device to Control Optical Power Levels in Networks, A. N. M. Masum Choudhury¹, Barbara Grzegorzewska¹, Timothy Hanrahan¹, Tom Marrapode¹, Ariela Donva², Moshe Oron², Ram Oron², Regina Shvartzer²; ¹Molex Inc., USA, ²Kilolambda Technologies Ltd., Israel. Dynamic attenuator, a new passive optical device limits output power level by light scattering mechanism and protects the network from permanent damage. This paper shows its assembly and performance under normal and extreme environmental conditions.

JThA89

40-Channel Transmitter and Receiver Photonic Integrated Circuits Operating at a per Channel Data Rate 12.5Gbit/s, Masaki Kato, Radhakrishnan Nagarajan, Jacco Pleumeekers, Peter Evans, Arnold Chen, Atul Mathur, Andrew Dentai, Sheila Hurtt, Damien Lambert, Prashant Chavarkar, Mark Missey, Johan Bäck, Ranjani Muthiah, Sanjeev Murthy, Randal Salvatore, Charles Joyner, Jon Rossi, Richard Schneider, Mehrdad Ziari, Fred Kish, David Welch; Infinera, USA. We demonstrate 40 channel transmitter and receiver large scale photonic integrated circuits operating as a pair at 12.5Gbit/s.

JThA90

The Next Frontier in Testing: 40 Gb/s Transmission, Francis Audet; EXFO, Canada. 40 Gb/s transmission is now commercially available, and many tier 1 operators may deploy it shortly. New modulation formats, tighter sensitivity specifications, dispersion issues, and Raman amplification—what does this involve in terms of testing?

JThA91

Decagonal Photonic Crystal Fibers with Ultra-Flattened Dispersion and Low Confinement Loss, S. M. Abdur Razzak, Yoshinori Namihira, Feroza Begum, Shubi Kaijage, Tatsuya Kinjo, Jitsuryo Nakahodo, Kazuya Miyagi, Nianyu Zou; Univ. of the Ryukyus, Japan. Decagonal PCFs with extremely low dispersion of 0 ± 0.26 ps/(nm-km) in the wavelength range of 1.40 μ m to 1.60 μ m with confinement loss less than 10^{-8} dB/km is presented.

JThA92

Submarine Fibers with Novel Optical Properties Provided by a Restrict-Mode-Excitation Method, Katsunori Imamura, Kazunori Mukasa, Masateru Tadakuma, Ryuichi Ryuichi, Takeshi Yagi; Furukawa Electric co. Ltd., Japan. By applying a restrict mode excitation method, we successfully reduced dispersion slope of NZ-DSF to -0.04 ps/nm²/km and enlarged Aeff of N-MDF as large as 53μ m².

JThA93

A CMOS Photonics Based 10Gbps Fiber Optical Communication Link, Thomas G. Palkert, Mehrdad Saberi; Luxtera, USA. A 10Gbps fiber-optic communication link using CMOS photonics is analyzed and demonstrated to be feasible as a low cost, low power, highly integrated solution for next generation networks.

JThA94

Waveband MUX/DEMUX Using Concatenated AWGs -Formulation of Waveguide Connection and Fabrication, Shoji Kakehashi¹, Hiroshi Hasegawa¹, Ken-ichi Sato¹, Osamu Moriwak², Shin Kame², Yoshiteru Jinnouchi³, Masayuki Okuno³; ¹Nagoya Univ., Japan, ²NTT Photonics Labs, Japan, ³NTT Electronics, Japan. Recently we proposed a new waveband MUX/DEMUX that uses two concatenated AWGs. We formulate how to connect the two AWGs. We fabricate the device using silica PLC technology and experimentally confirm its feasibility.

Ballroom A

3:00 p.m.–5:00 p.m.

OThO • Fiber Dispersion and Cerenkov RadiationScott A. Hamilton; MIT Lincoln Lab, USA, *Presider***OThO1 • 3:00 p.m.**

Single-Shot Fiber Dispersionmetry, Akira Shirakawa, Takayuki Atsumi, Motoyuki Tanisho, Ken-ichi Ueda; *Inst. for Laser Science, Univ. of Electro-Communications, Japan*. A novel white-light interferometry is presented for fiber dispersion measurement. The acquired spectrally-resolved two-dimensional interferogram enables interference-instability-free, instantaneous determination of group delay and dispersion. Various fibers including a birefringent photonic-bandgap fiber were precisely characterized.

OThO2 • 3:15 p.m.

Method for Measuring High Order Dispersion in Optical Fibers, Jose M. Chavez Boggio, Jorge D. Marconi, Hugo L. Fragnito; *Optics and Photonics Res. Ctr., Brazil*. We report on a four-wave mixing based method for measuring the ratio between the third and the fourth-order dispersion coefficients with error of less than 3% in dispersion shifted and non-zero dispersion shifted fibers.

Ballroom B

3:00 p.m.–4:45 p.m.

OThP • Fiber Grating DevicesMartin Guy; *Teraxion, Canada, Presider***OThP1 • 3:00 p.m.**

FBG Based Distributed Lighting for Sensing Applications, Gary E. Carver¹, Ken S. Feder², Paul S. Westbrook²; ¹Princeton Lightwave, USA, ²OFS Labs, USA. An efficient distributed light source has been developed for line scan sensing. The source is based on diffracting light from a highly blazed grating written in the core of a single mode fiber.

OThP2 • 3:15 p.m.

Electrically Tunable Long Period Gratings in Liquid Crystal Photonic Bandgap Fibers, Danny Noordegraaf, Lara Scolari, Jesper Lægsgaard, Lars Riindorf, Thomas T. Alkeskjold; *COM•DTU Dept. of Communications, Optics and Materials, Technical Univ. of Denmark, Denmark*. We demonstrate an all-electrically tunable long period grating in a photonic crystal fiber infiltrated with a nematic liquid crystal. The spectral dips and the resonance wavelengths are tuned electrically and thermally, respectively.

Ballroom C

3:00 p.m.–5:00 p.m.

OThQ • Carrier ServicesNasir Ghani; *Tennessee Technological Univ., USA, Presider***OThQ1 • 3:00 p.m.****Tutorial**

Services from a Carrier's Perspective, Stuart Elby; *Verizon Communications, USA*. Emerging trends in workforce flexibility, personal mobility, and virtual worlds, to name a few, are driving Carriers to develop more dynamic, higher bandwidth services that provide personalization for the individual consumer and greater productivity for the enterprise. To succeed, Carriers must deploy a new set of technologies and carefully architect to isolate the rapidly changing services from the underlying network assets.



Dr. Stuart Elby is the Vice President of Network Architecture responsible for setting Verizon Telecomm and Verizon Business' network architecture vision encompassing broadband access, optical transport, fast packet and Ethernet switching, IP/MPLS routing, and emerging voice over IP and video technologies. Stuart is also responsible for defining service specific architectures to support product line marketing, specifying network element requirements, coordinating Verizon's Standards activities, and leading collaborative R&D activities with universities and industry partners. He has previously held several positions in Verizon including network platform testing, and technical support of product development and

Ballroom D

3:00 p.m.–5:00 p.m.

OThR • Network ElementsBarrie Keyworth; *JDS Uniphase, Canada, Presider***OThR1 • 3:00 p.m.****Tutorial**

ROADM Network Elements, Madhu Krishnaswamy; *JDSU, Canada*. ROADM network elements occupy a pivotal role in agile optical networks. This tutorial will provide an overview of key architectural, functional and operational metrics of ROADM network elements against a variety of networking application requirements.

Madhu Krishnaswamy is currently Senior Product Line Manager at JDSU, responsible for network element subsystems. Previously, Madhu was the founder and principle engineer of Ceyba, an optical networking startup that developed an agile, 10/40G ultra-long haul system. Prior to Ceyba, Madhu was part of the optical amplifier development team within the high-capacity optical transport group at Nortel Networks. Madhu received his Ph.D. from the University of Alberta in Edmonton, with a thesis dissertation on integrated erbium-doped waveguide amplifiers.

Ballroom E

3:00 p.m.–5:00 p.m.

OThS • WDM Transmission SystemsJin-Xing Cai; *Tyco Telecommunications, USA, Presider***OThS1 • 3:00 p.m.**

40 Gbit/s Double-Band DWDM Transmission over 46 km PCF-DSF Transmission Line, Kazuhide Nakajima, Kenji Kurokawa, Takashi Matsui, Katsusuke Tajima, Kazuyuki Shiraki, Izumi Sankawa; *NTT, Japan*. A wide-band transmission line is proposed using a PCF and DSE. The available bandwidth is quadrupled, and 40 Gbit/s DWDM signals have been transmitted over 46 km using the 1310 and 1550 nm bands simultaneously.

OThS2 • 3:15 p.m.

Analysis of Crosstalk in Mixed 43 Gb/s RZ-DQPSK and 10.7 Gb/s DWDM Systems at 50 GHz Channel Spacing, Cornelius Fuerst¹, Joerg-Peter Elbers¹, Horst Wernz², Helmut Griesser¹, Stefan Herbst^{1,2}, Marco Camera³, Fabio Cavaliere^{2,3}, Armin Ehrhardt³, Dirk Breuer³, Daniel Fritzsche³, Sascha Vorbeck³, Malte Schneiders³, Werner Weiershausen³, Ralph Leppa^{3,4}, Juergen Wendler⁴, Michael Schroedel^{4,5}, Thorsten Wuth⁵, Chris Fludger⁵, Thomas Duthe⁵, Biljana Milivojevic⁵, Christoph Schulien⁵; ¹Ericsson, Germany, ²Marconi SpA, Italy, ³T-Systems, Germany, ⁴T-Com, Germany, ⁵CoreOptics, Germany. In DWDM field experiments over 1047km of standard fiber and in simulations we analyze the impact of crosstalk on a 43Gb/s RZ-DQPSK channel both by 10.7Gb/s OOK and 43Gb/s RZ-DQPSK neighbors at 50GHz channel spacing.

Room 304 A/B

3:00 p.m.–5:00 p.m.**OThT • Novel Devices**

Ken Morito; Fujitsu Labs Ltd., Japan, *Presider*

OThT1 • 3:00 p.m.

Regeneration of Return-to-Zero 10 Gb/s Fiber Transmission Impairments Using a Monolithically Integrated, Widely-Tunable, Photocurrent Driven Wavelength Converter, Matthew N. Sysak, Henrik N. Poulsen, James W. Raring, Daniel J. Blumenthal, Larry A. Coldren; *Univ. of California at Santa Barbara, USA*. Regeneration of transmission impairments is performed using a monolithically-integrated photocurrent-driven wavelength converter. BER measurements show improved receiver sensitivity of 4, 4, and 11-dB for regeneration through the device after 0, 25 and 50-km of fiber.

OThT2 • 3:15 p.m.

Monolithically Integrated Multi-Stage All-Optical 10Gbps Push-Pull Wavelength Converter, Joseph A. Summers, Milan L. Masanovic, Vikrant Lal, Daniel J. Blumenthal; *Univ. of California at Santa Barbara, USA*. This paper reports on the novel design and operation of a monolithically integrated multi-stage push-pull wavelength converter. Results show 4 dB improvement in extinction ratio and error-free performance for 10Gbps push-pull operation.

Room 303 A

3:00 p.m.–4:45 p.m.**OThU • Novel Optical Devices**

Yoshinori Hibino; NTT Photonics Labs, Japan, *Presider*

OThU1 • 3:00 p.m.

Programmable Polarization-Independent Electrooptically Matched Bandpass Filter in Ti:LiNbO₃, Yang Ping, O. Eknoyan, C. K. Madsen, H. F. Taylor; *Texas A&M Univ., USA*. A polarization-independent two-port electro-optically tunable bandpass filter with programmable spectral output in the 1530 nm wavelength regime with nearest side lobes -20 dB, 10 nm tuning range, and maximum required voltage 31.5 V is presented.

OThU2 • 3:15 p.m.

Fabrication of Silica-Based Optical Waveguide Containing Densified Sampled Grating by UV Beam Scanning, Ken Kashiwagi, Shinji Yamashita; *Dept. of Electronic Engineering, Graduate School of Engineering, Univ. of Tokyo, Japan*. We present fabrication of silica-based optical waveguide containing densified sampled grating by UV beam scanning. By introducing preprocessed phase shift, 100GHz channel spacing reflection spectra was double densified to be 50GHz without elongating total length.

Room 303 B

3:00 p.m.–4:40 p.m.**NThE • Initial Applications of Emerging Technologies**

Mark Boduch; Tellabs, USA, *Presider*

NThE1 • 3:00 p.m.**Invited**

Applications of Liquid Crystal Technology to Telecommunication Devices, Jack Kelly; *CoAdna Photonics, USA*. Using the wavelength selective switch as a prototypical example, we examine the use of liquid crystal technology for telecom applications. Some key design issues and performance parameters are discussed.

Room 303 C

3:00 p.m.–5:00 p.m.**NThF • FTTx: New Directions (Panel Discussion)**

Mark Boduch; Tellabs, USA, *Presider*

NThF • 3:00 p.m.

FTTx: New Directions, Joseph Finn; *Verizon, USA*. The last few years have seen increasing deployment of access technologies such as Fiber to the Premises (FTTP) and Fiber to the Node (FTTN) that enable the delivery of triple play (POTS, high speed Internet, and broadcast video/VOD) services to customers. The fiber access networks, requiring billions of dollars of investment, will need to provide decades of service and therefore must support technology evolution from BPON to GPON and beyond to meet the increasing bandwidth demands while simultaneously lowering the cost of providing services. The panel presentations will provide an overview of the current state of technology and the various options under consideration by industry and standards organizations to evolve the technology.

Notes

Ballroom A

OThO • Fiber Dispersion and Cherenkov Radiation—Continued

OThO3 • 3:30 p.m.
Generation of Femtosecond Pulses at 1350 nm by Cherenkov Radiation in Higher-Order-Mode Fiber, Jennifer H. Lee¹, James van Howe¹, Chris Xu¹, Siddharth Ramachandran², Samir Ghalmi², Man F. Yan²; ¹Cornell Univ., USA, ²OFS Labs, USA. We demonstrate a method of generating femtosecond pulses at 1350 nm by exciting Cherenkov radiation in a higher-order-mode fiber with a 1064 nm source. We measure a 134 fs, 0.66 nJ output pulse.

OThO4 • 3:45 p.m.
Cherenkov Radiation in Optical Fiber Communication, Susan Law¹, Simon Fleming¹, Natalka Suchowerska^{2,3}, David McKenzie³, Terri Lim¹; ¹Optical Fibre Technology Ctr., Univ. of Sydney, Australia, ²Royal Prince Alfred Hospital, Australia, ³School of Physics, Univ. of Sydney, Australia. Theoretical predictions regarding the angular variation of Cherenkov radiation transmitted along optical fibers are experimentally verified. The implications for transmission in a radiation environment are considered.

Ballroom B

OThP • Fiber Grating Devices—Continued

OThP3 • 3:30 p.m. Invited
Recent Progress on FBG-Based Tunable Dispersion Compensators for 40 Gb/s Applications, Yves Painchaud, Martin Lapointe, François Trépanier, Richard L. Lachance, Carl Paquet, Martin Guy; TeraXion, Canada. The optical performance of state-of-the-art FBG-based tunable dispersion compensators is given in view of the recent advances. Results are given for a 33-channel device with 80 GHz-bandwidth and for a 51-channel device with 40 GHz-bandwidth.

Ballroom C

OThQ • Carrier Services—Continued

sales. Dr. Elby received a B.S. degree in Optical Engineering from the University of Rochester, NY, in 1982 and received a MSEE, M.Phil, and Ph.D. from Columbia University in 1989, 1992, and 1994, respectively.

Ballroom D

OThR • Network Elements—Continued

Ballroom E

OThS • WDM Transmission Systems—Continued

OThS3 • 3:30 p.m.
124 x 10 Gbit/s RZ-DPSK Transmission over 12380 km without Channelized Chromatic Dispersion Management, Laurent Du Mouza, Sebastien Dupont, Pierre Marmier, Patrick Bollaert, Melanie Jaouen, Vincent Letellier, Ghislaine Vareille; Alcatel Submarine Networks, France. We report transmission results of 124 RZ-DPSK channels modulated at 10.709 Gbit/s over 12380 km without channel chromatic dispersion management and we demonstrate industrial performance margins for Terabit/s systems over transpacific distances.

OThS4 • 3:45 p.m.
1,000-km Transmission of 20-Gbit/s QPSK-NRZ Co-Polarized DWDM Signals with Spectral Efficiency of 1 bit/s/Hz Using Coherent Detection, Sang-Yuep Kim, Kazuro Kikuchi; Univ. of Tokyo, Japan. We demonstrate co-polarized 20-Gbit/s DWDM NRZ-QPSK transmission over 1074 km using a phase-diversity optical homodyne receiver. The spectral efficiency is as high as 1.05 bit/s/Hz, which is limited by cross-phase modulation between DWDM channels.

OTTh • Novel Devices—Continued

OTTh3 • 3:30 p.m. Invited
Semiconductor-Based Optical Demultiplexing and Wavelength Conversion at 320 Gbit/s, H. J. S. Dorren¹, E. Tangdiongga¹, Y. Liu¹, Z. Li¹, H. de Waardt¹, A. M. J. Koonen¹, G. D. Khoe¹, Xuewen Shu²; ¹Eindhoven Univ. of Tech., Netherlands, ²Aston Univ., UK. We demonstrate error-free 320 Gb/s SOA based optical time-domain demultiplexing and wavelength conversion. We show that ultra-fast optical gating (1.8 ps) can be realized by using a single SOA and a detuned optical band-pass filter.

OTHu • Novel Optical Devices—Continued

OTHu3 • 3:30 p.m.
All-Optical Wavelength Conversion in As₂S₃ Chalcogenide Glass Rib Waveguides, Michael R. E. Lamont¹, Vahid G. Ta'eed¹, David J. Moss², Benjamin J. Eggleton¹, Duk-Yong Choi³, Steve Madden³, Barry Luther-Davies²; ¹CUDOS, Univ. of Sydney, Australia, ²Univ. du Quebec, Canada, ³CUDOS, Australian Natl. Univ., Australia. We report the first demonstration of all-optical wavelength conversion in a 5cm As₂S₃ rib waveguide over 15nm near 1550nm via cross-phase modulation, at low repetition rates and 10Gb/s RZ, while maintaining pulse amplitude and phase.

OTHu4 • 3:45 p.m.
Semi-Leaky Waveguide Optical Isolator, Tetsuya Mizumoto, Hideki Saito; Tokyo Inst. of Technology, Japan. A semi-leaky isolator was fabricated by bonding LiNbO₃ onto a magneto-optic garnet waveguide. A 1.6mm-long device provides an isolation of 20.2dB at a wavelength of 1.55μm.

NThE • Initial Applications of Emerging Technologies—Continued

NThE2 • 3:40 p.m.
A Novel Tunable DeMUX/MUX Solution for WSS-Based ROADMs and WXC Nodes, Lane Zong¹, Xiaodong Huang², Ting Wang¹, Philip Ji¹, Osamu Matsuda³, Milorad Cvijetic⁴; ¹NEC Labs America, USA, ²Univ. of Texas at Dallas, USA, ³NEC Corp., Japan, ⁴NEC America, Inc., USA. We introduce the applications and technologies of tunable demultiplexers/multiplexers (DeMUX/MUX) in wavelength division multiplexing (WDM) networks. We also propose a novel solution using fixed waveband filters to achieve similar provisioning flexibility and reduced control complexity.

NThF • FTTx: New Directions (Panel Discussion)—Continued

Ballroom A

OThO • Fiber Dispersion and Cerenkov Radiation—Continued

OThO5 • 4:00 p.m. **Tutorial**
Dispersion Compensating Fibers: Properties and Applications, *Lars Grüner-Nielsen*; OFS Denmark, Denmark. Properties of dispersion compensating fibers and importance for systems applications are reviewed. Specific application such as in Raman amplifiers, as enabler for cheap transmitters in short haul systems, and dispersion managed cable will be discussed.



Lars Grüner-Nielsen was born in Copenhagen, Denmark, in 1959. He received his master degree in electrical engineering and Ph.D. in optical fibers from the Technical University of Denmark in 1983 and 1998, respectively. From 1983 to 1994 he worked at the Danish cable manufacture NKT's R&D department for optical cables. Since 1994 he has worked at the R&D department at OFS Denmark. At OFS he has been working on development and application of new fibers and fiber components, especially dispersion compensating fibers (DCF). He has authored or co-authored close to 90 scientific papers, including more than 80 on DCF. He holds seven patents on DCF. He is member of the ECOC technical program committee since 2004 and a reviewer for several journals. Dr. Grüner-Nielsen is a member of OSA. In 2000 he received the electro prize from the Danish Society of Engineers.

Ballroom B

OThP • Fiber Grating Devices—Continued

OThP4 • 4:00 p.m. **Invited**
Chalcogenide Glass Waveguides and Grating Devices for All-Optical Signal Conditioning, *Benjamin J. Eggleton¹, V. G. Ta'eed¹, N. Baker¹, D. Y. Chor², K. Finsterbusch¹, L. B. Fu¹, M. R. E. Lamont¹, I. C. M. Littler¹, B. Luther-Davies², S. Madden², D. J. Moss¹, H. Nguyen¹, M. Shokoh-Saremi¹*; ¹Univ. of Sydney, Australia, ²Australian Natl. Univ., Australia. Review of recent achievements in chalcogenide glass waveguide and fiber based all-optical signal processing devices utilizing both short and long period gratings as well as the inherent ultra-fast, ultra-strong, third-order nonlinearities.

Ballroom C

OThQ • Carrier Services—Continued

OThQ2 • 4:00 p.m.
Multi-Area MPLS/GMPLS Interoperability Trial over 14-Vendor Packet/TDM/ROADM/OXC Network, *Wataru Imajuku¹, Eiji Oki¹, Rajiv Papneja², Shinichiro Morishita³, Kenichi Ogaki⁴, Masanori Miyazawa⁴, Akira Nagata⁵, Hiroaki Nakazato⁶, Hidetsugu Sugiyama⁷, John Allen⁷, Shinichi Hasegawa⁸, Nobuhiro Sakuraba⁸, Itaru Nishioka⁹, Shoichiro Seno¹⁰, Yoshihiro Nakahira¹¹, Daisuke Ishii¹², Satoru Okamoto¹², Sashi Vyravipillai¹³, Mark Blumhardt¹⁴, Hari Rakotoranto¹⁵, Richard Rabbat¹⁶, Vijay Pandian¹⁷*; ¹NTT, Japan, ²Isocore, USA, ³Toyo Corp., Japan, ⁴KDDI Labs, Japan, ⁵Fujitsu Labs, Japan, ⁶Fujitsu, Japan, ⁷Juniper Networks, Japan, ⁸ITOCHU Techno-Solutions Corp., Japan, ⁹NEC Corp., Japan, ¹⁰Mitsubishi Electric Corp., Japan, ¹¹Oki Electric Industry Co., Japan, ¹²Keio Univ., Japan, ¹³Agilent Technologies, Australia, ¹⁴Alcatel USA Inc., USA, ¹⁵Cisco Systems, USA, ¹⁶Fujitsu Labs of America, Inc., USA, ¹⁷Sycamore Networks, USA. A MPLS/GMPLS interoperability trial was conducted by switches from 14 vendors under interior gateway routing protocol based multi-area routing architecture. The results show the architecture is a promising solution and contain findings to improve interoperability.

OThQ3 • 4:15 p.m.
Dynamic Traffic Grooming of Subwavelength Connections with Known Duration, *Massimo Tornatore¹, Andrea Baruffaldi¹, Hongyue Zhu², Biswanath Mukherjee³, Achille Pattavina¹*; ¹Politecnico di Milano, Italy, ²Blade Networks Technologies, USA, ³Univ. of California at Davis, USA. For dynamic grooming of sub-wavelength connections in an optical mesh network, we investigate a new algorithm which exploits the holding time of connections to achieve significant reduction in blocking probability.

Ballroom D

OThR • Network Elements—Continued

OThR2 • 4:00 p.m.
Robust Gain Control Scheme of EDFA Based Reconfigurable OADM for WDM Metro Applications, *Tomasz J. Rogowski¹, Stefano Farall², Fabrizio Di Pasquale¹, Rodolfo Di Muro², Bimal Nayyar²*; ¹Scuola Superiore Sant'Anna, Italy, ²Ericsson Ltd., UK. A simple and efficient gain control scheme for EDFA-based Reconfigurable-OADM dedicated to metro applications is proposed. Each pair of input-output amplifiers is gain clamped by single control channel @1532nm which bypasses the ROADM node structure.

OThR3 • 4:15 p.m.
All-Optical 2R-Regenerative Interconnection Node for DPSK Polarization-Division Multiplexed Systems, *Mikio Yagi, Shuichi Satomi, Shiro Ryu*; Lab, SoftBank Telecom Corp., Japan. We propose an all-optical 2R-regenerative interconnection node which is applied between wide area network and metro area network for DPSK polarization-division multiplexed systems with the functions of signal format conversion and signal quality improvement.

Ballroom E

OThS • WDM Transmission Systems—Continued

OThS5 • 4:00 p.m.
Cost-effective 10.7-Gbit/s Long-Haul Transmission Using Fiber Bragg Gratings for In-Line Dispersion Compensation, *Dirk van den Borne¹, Vladimir Veljanovski², Erik de Mar³, Ulrich Gaubatz³, Claudio Zuccaro³, Carl Paquet⁴, Yves Painchaud⁴, Sander L. Jansen¹, Erich Gottwald³, Giok-Djan Khoe¹, Huug de Waard¹*; ¹Eindhoven Univ. of Technology, Cobra Inst., Netherlands, ²Siemens AG, Program and System Engineering, Germany, ³Siemens AG, Communications, Germany, ⁴TeraXion Inc., Canada. We show the feasibility of more cost-effective long-haul transmission using Fiber Bragg Gratings (FBG) for in-line dispersion compensation. 32x10.7-Gbit/s NRZ modulated channels are transmitted over 40x95 km of SSF using low group delay ripple FBGs.

OThS6 • 4:15 p.m.
Experimental Study of XPM in 10-Gb/s NRZ Pre-Compensated Transmission Systems, *Sander L. Jansen¹, Itsuro Morita¹, Dirk van den Borne², Giok-Djan Khoe², Huug de Waard², Peter Krummrich³*; ¹KDDI R&D Labs Inc., Japan, ²Eindhoven, Univ. of Technology, Netherlands, ³Siemens Communications, Germany. We experimentally assess the nonlinear tolerance of 10-Gb/s NRZ in a pre-compensated dispersion map. It is observed that even for relatively wide 100-GHz channel-spacing, XPM further reduces the nonlinear tolerance in contrast to periodically-compensated maps.

OThT • Novel Devices—Continued**OThT4 • 4:00 p.m.**

A Performance Optimization Method for SOA-MZI Devices, Jade P. Wang¹, Bryan S. Robinson¹, Shelby J. Savage¹, Scott A. Hamilton¹, Erich P. Ippen², Ruomei Mu³, Hongsheng Wang³, Jiten Sarathy³, Boris B. Stefanov³; ¹MIT Lincoln Lab, USA, ²MIT, USA, ³Alphion Corp., USA. We present a novel characterization method for semiconductor optical amplifier Mach-Zehnder interferometer (SOA-MZI) switches which combines a pump-probe measurement with an interferometer bias scan. This enables optimal bias identification and better understanding of switching dynamics.

OThT5 • 4:15 p.m.

THz Tunable Slow Light in Semiconductor Optical Amplifiers, Forrest G. Sedgwick, Bala Pesala, Jui-Yen Lin, Wai Son Ko, Xiaoxue Zhao, Connie Chang-Hasnain; Univ. of California at Berkeley, USA. We report tunable fractional delays up to 250% for 1ps pulses propagating through a 1.55um semiconductor optical amplifier at room temperature. Tuning is accomplished either optically or electrically with low amplitude variation across entire range.

OThU • Novel Optical Devices—Continued**OThU5 • 4:00 p.m.**

Polarized Saturable Absorbing Waveguide Using Carbon Nanotube-Polyimide Composite Material, Toshiyuki Oomuro^{1,2}, Ryosaku Kaji¹, Taro Itatani¹, Shun Matsuzaki^{1,2}, Hiromichi Kataura¹, Masafumi Yamashita², Youichi Sakakibara^{1,2}; ¹Natl. Inst. of Advanced Industrial Science and Technology (AIST), Japan, ²Tokyo Univ. of Science, Japan. In a waveguide using carbon nanotube-polyimide core we discovered polarized absorption probably due to the molecular alignment of nanotubes in the polyimide matrix. We observed efficient saturable absorption at the polarization along the molecular alignment.

OThU6 • 4:15 p.m.

An Ultra-Compact Optical Interleaver with High Performances Based on Double-Ring Assisted Mach-Zehnder Interferometer, Zhipeng Wang¹, S. J. Chang², C. Y. Ni², Y. J. Chen¹; ¹CSEE Dept., Univ. of Maryland, Baltimore County, USA, ²TTRI, Taiwan. We present an ultra-compact and high-performance optical interleaver based on micro-ring assisted Mach-Zehnder interferometer (MZI) using ultra-high-index-contrast (UHIC) waveguide ($\Delta n=17\%$). This interleaver exhibits flat and near-square passband and better than -30 dB stopband extinction ratio.

NThE • Initial Applications of Emerging Technologies—Continued**NThE3 • 4:00 p.m.****Invited**

The Advantages of PIC Based Digital Optical Networks, David F. Welch; Infinera Corp., USA. By changing the cost structure associated with the conversion of the optical signal into the electronic domain, Photonic Integrated Circuits (PICs) have spawned a new network architecture; the Digital Optical Network.

NThF • FTTx: New Directions (Panel Discussion)—Continued

Ballroom A

Ballroom B

Ballroom C

Ballroom D

Ballroom E

OThP • Fiber Grating Devices—Continued**OThP5 • 4:30 p.m.**

Impact of Phase Ripple in Fiber Bragg Grating Based Tunable Dispersion Compensator On 10-Gb/s NRZ Transmission, Xuefeng Tang¹, Na Young Kim¹, Serge Douset², Sophie LaRochelle², John C. Cartledge¹; ¹Dept. of Electrical and Computer Engineering, Queen's Univ., Canada, ²Dept. of Electrical and Computer Engineering, Univ. Laval, Canada. We investigate the impact of phase ripple on the performance of a tunable dispersion compensator using FBG-based distributed GTEs. The results reveal the implications of the phase ripple profile on the dispersion compensating performance.

OThQ • Carrier Services—Continued**OThQ4 • 4:30 p.m.**

Approaches to Support Various Types of Traffic in WDM Networks, Xin Liu, Chunming Qiao, Wei Wei; State Univ. of New York at Buffalo, USA. We investigate three traffic grooming and static and dynamic bandwidth provisioning approaches to support various types of traffic in WDM networks, and show in general, a polymorphous OCS/OBS approach is most efficient.

OThQ5 • 4:45 p.m.

Theoretical and Experimental Study of Statistical Decision Method for Link Capacity Adjustment in Photonic IX, Shuto Yamamoto¹, Ipei Shake¹, Tomohiko Kurahashi², Yukiyasu Tarui³, Mitsunori Fukutoku¹, Wataru Imajuku¹, Koji Sasayama¹; ¹NTT Corp., Japan, ²Internet Initiative Japan Inc., Japan, ³Internet Multifeed, Japan. This paper proposes a statistical decision method for link capacity adjustment and estimates the decision parameters in order to achieve stable operation. The experimental results conducted using multiple paths confirm the effectiveness of the method.

OThR • Network Elements—Continued**OThR4 • 4:30 p.m.** Invited

Multi-Granularity OXC Architecture, Atsushi Takada, Masafumi Koga; NTT Corp., Japan. The recent development of optical switching system has triggered research into the next step toward the multi-granularity optical cross-connect (MG-OXC). This paper highlights our recent activities on MG-OXC providing optical burst to waveband switching.

OThS • WDM Transmission Systems—Continued**OThS7 • 4:30 p.m.** Invited

Network Upgrade from Telecom Operators View, Dirk Breuer; Deutsche Telekom T-Systems, Germany. This paper looks into some possible upgrade strategies for network upgrade from a telecom operators point of view taking into account infrastructure conditions.

5:00 p.m.–5:30 p.m. Coffee Break, Exhibit Hall

5:30 p.m.–7:30 p.m. Postdeadline Paper Sessions

Room 304 A/B

OThT • Novel Devices—Continued**OThT6 • 4:30 p.m.**

Tunable Slow Light Using Quantum Dot VCSEL for Subcarrier Multiplexed System, P. C. Peng¹, C. T. Lin², H. C. Kuo², J. N. Liu², W. K. Tsai², G. Lin², H. P. Yang³, K. F. Lin³, J. Y. Chi², S. Chi², S. C. Wang²; ¹Natl. Chi Nan Univ., Taiwan, ²Natl. Chiao Tung Univ., Taiwan, ³Industrial Technology Res. Inst., Taiwan. We demonstrate that the slow light device can be used in a SCM system for the first time. Tunable slow light can be achieved by adjusting the bias current and wavelength detuning of QD VCSEL.

OThT7 • 4:45 p.m.

Monolithic Integration of Latchable Vertical Cavity Laser with Depleted Optical Thyristor for Optical Logic Gates, Woon-Kyung Choi¹, Doo-Gun Kim¹, Yon-Tae Moon¹, Do-Gyun Kim¹, Young-Wan Choi¹, Seok Lee², Deok-Ha Woo²; ¹Chung-Ang Univ., Republic of Korea, ²Korea Inst. of Science and Technology, Republic of Korea. We show latchable optical switches and optical logic gates using the monolithically integrated vertical cavity lasers with depleted optical thyristor. By simply changing a reference switching voltage, this single device operates as two logic functions.

Room 303 A

OThU • Novel Optical Devices—Continued**OThU7 • 4:30 p.m.**

Optical Burst and Transient Equalizer for 10Gb/s Amplified WDM-PON, Yang Liu¹, Chi Wai Chow², Chi Hang Kwok¹, Hon Ki Tsang¹, Chinlon Lin¹; ¹Chinese Univ. of Hong Kong, Hong Kong, ²Photonic Systems Group, Tyndall Natl. Inst. and Dept. of Physics, Univ. College Cork, Ireland. We propose and demonstrate an optical-burst-and-transient-equalizer (OBTE) on silicon-on-insulator (SOI) to provide a compact and low-cost solution to compensate gain-transient, gain-spectrum-tilt and to equalize the upstream packets amplitude in EDFA-amplified WDM-PON.

Room 303 B

Room 303 C

NThF • FTTx: New Directions (Panel Discussion)—Continued

Notes

5:00 p.m.–5:30 p.m. Coffee Break, Exhibit Hall

5:30 p.m.–7:30 p.m. Postdeadline Paper Sessions
