Service Provider Summit: Keynote Presentation

8:30 a.m.–9:00 a.m.
AT&T’s Network Revolution: Building for Tomorrow
Keynote Speaker: Chris Rice; AT&T Inc., USA

Service Provider Summit: Panel I

9:00 a.m.–10:30 a.m.
The Future of Metro and Core Networks
Moderator: Brad Kummer; Cogent Technologies, USA
Speakers:
Long-Haul Network Evolution Trends, Chuck Norman; Sprint, USA
Customer Controlled Optical Networking - An ASON Service, Scott Beckett; AT&T, USA
Future Deployment of WDM Systems in the UK, Dave Johnson; BT, UK
(See pages 11-12 for details.)

Service Provider Summit: Panel II

11:15 a.m.–12:45 p.m.
Update on FTTX around the Globe
Moderator: David Pichler; Harmonic, Inc., USA
Speakers:
Verizon's FTT Deployment, Vincent O’Byrne; Verizon, USA
FTTH Market - Growth and Expansion in Japan, Hiromichi Shinozaka; NTT Access Network Service Systems Labs, Japan
Project Lightspeed: FTTN and FTTP - Perfect Together, Ralph Ballart; AT&T Labs, USA
Being a Service Provider on an Open Wholesale FTTP Network, Paul Morris; Utah Telecommunication Open Infrastructure Agency, USA
(See pages 12-13 for details.)

Market Watch

2:00 p.m.–4:00 p.m.
Collapsing Layers and Technologies: How New Service Offerings Are Driving the Evolution of the Optical Communication Networks
Moderator: Alan Gribbeneyer; Siemens Communications, USA
Speakers:
Network Layer Convergence from the Residential to the Core, Hans-Juergen Schmidike; Siemens Communications Inc., USA
Migrating to a Packet over DWDM Network, Rajiv Ramaswami; Cisco Systems, Inc., USA
How Paths Collide: Network Layer and Technology Collapse Create New Opportunities and Threats, Dana A. Cooperson; Ovum-RHK, Inc., USA
The Role of SONET in an Ethernet-Centric World, Ralph Ballart; AT&T Labs, USA
Automation and Integration Are Key To Building Next Generation Networks! Glenn Wellbrock; MCI Communications, USA
(See page 16 for details.)
OWA1 • 8:00 a.m. Invited
Single Polarization Fibers and Applications, Daniel Nolan, Ming-Jun Li, Xin Chen, Joohyun Koh; Cerning Inc., USA. Single polarization fibers are designed so that one polarization propagates, while the other is cut off. Several classes of index profiles can be used. Applications include new transmission systems, sensors, and components.

OWB1 • 8:00 a.m.
Impact of Fiber Nonlinearities on Advanced Modulation Formats Using Electronic Pre-Distortion, Rene-Jean Essiambre, Peter J. Winzer; Lucent Technologies, Inc., USA. We analyze nonlinear transmission of intensity-encoded and phase-encoded modulation formats using electronic pre-distortion. We show that SPM similarly distorts all studied formats, and that XPM-induced burst errors remain strong for phase-encoded signals.

OWC1 • 8:00 a.m. Invited
High Performance InP-Based Optical Modulators, Takayuki Yamanaka, Ken Tozuki, Nobuhiro Kikuchi, Eiichi Yamaida, Yuu Shiibata, Hideki Fukano, Hiroshi Nakajima, Yuichi Akage, Hiroshi Yasaka; NTT Photonic Labs, Japan. We demonstrate a push-pull driven Mach-Zehnder modulator module and an electroabsorption modulator integrated with coplanar waveguides operating at 40 Gbit/s with reduced driving voltages of 1.3 V and 0.79 V, respectively.

OWD1 • 8:00 a.m.
A New Technique for Dynamic Gain Profile Control in a Multi-Wavelength Backward-Pumped Discrete Raman Amplifier, Xiang Zhou, Martin Birk; AT&T Labs, USA. We propose and experimentally verify a new dynamic gain profile control technique for a multi-wavelength backward-pumped discrete Raman amplifier without using a channel monitor. We demonstrate up to 9 dB static power correction and a dynamic implementation.

OWE1 • 8:00 a.m. Invited
Optical Parallel Processing Approach to All-Order PMD Compensation, Andrew Weiner1, M. Akbulut1, S. X. Wang1, P. J. Miller2; 1Purdue Univ., USA, 2CRI Inc., USA. We describe our research on PMD compensation and sensing using a parallel optical frequency domain approach and review our recent experiments on compensation of 600 fs pulses broadened to >2 ps via all-order PMD.

OWB2 • 8:15 a.m.
Chromatic Dispersion Tolerance of Coherent Optical Communications Systems with Electrical Equalization, Bernhard Spinnler, Peter M. Krummrich, Ernst-Dieter Schmidt; Siemens AG, Germany. Coherent demodulation provides linear transfer of distortions from the optical into the electrical domain. We show by use of Monte-Carlo simulations which equalizer structures available today are best suited to equalize chromatic dispersion after coherent demodulation.

OWD2 • 8:15 a.m.
OSNR Enhancement Using a Novel Pump-Wavelength Detuning Scheme for Forward-Pumped Distributed Raman Amplification in a 40 Gb/s-Based WDM In-Line Amplifier Transmission System, Takashi Kotaniwga1, Hiroji Masuda2, Toshiya Matsuda1; Shinji Matsuo1; 1NTT Network Service Systems Labs, Japan, 2NTT Network Innovations Labs, Japan. OSNR enhancement by using a novel pump-wavelength detuning scheme for forward-pumped distributed Raman amplification in a 40 Gb/s-based L-band WDM in-line amplifier transmission system is experimentally verified for the first time.

OWE2 • 8:00 a.m.
Optical Parallel Processing Approach to All-Order PMD Compensation, Andrew Weiner1, M. Akbulut1, S. X. Wang1, P. J. Miller2; 1Purdue Univ., USA, 2CRI Inc., USA. We describe our research on PMD compensation and sensing using a parallel optical frequency domain approach and review our recent experiments on compensation of 600 fs pulses broadened to >2 ps via all-order PMD.
OWF1 • 8:00 a.m.  Tutorial
Polymer Waveguides: The Future is Now,
Garo Khanarian, Robert Norwood; Rohm & Haas, USA. Polymer waveguides have begun to be commercialized for applications such as passive splitters, active switches and routing signals on backplanes. We will present the key attributes of polymer waveguides and new emerging applications.

Garo Khanarian is Program Manager for Optical Packaging and Distinguished Scientist at Rohm and Haas. His current research interests include encapsulants, photoresists, waveguides and packaging. He has a Ph.D. from the University of Sydney in Physical Chemistry and has worked previously at Bell Labs, the University of Massachusetts, Corning, and Hoechst Celanese.

OWG1 • 8:00 a.m.
Low-Biased Microwave-Photonic Link Using Optical Frequency or Phase Modulation and Fiber Bragg Grating Discriminator, Jinye Zhang, Thomas E. Darcie; Univ. of Victoria, Canada. A linear microwave-photonic link is presented in which a fiber Bragg grating converts phase modulation into intensity modulation. DC-bias-related noise is reduced using a grating response that provides linear intensity modulation with low DC bias.

OWH1 • 8:00 a.m.
Monolithic Vertical Integration of Metal-Oxide-Semiconductor Transistor with Subterranean Photonics in Silicon, Tejaswi K. Indukuri, Prakash V. Koonath, Bahram Jalali; Univ. of California at Los Angeles, USA. Monolithic integration of photonics and electronics has been achieved in silicon by vertically integrating Metal-Oxide-Semiconductor Field-Effect Transistors and waveguide-coupled microdisk resonators in a double-layer silicon-on-insulator wafer, thus paving the way towards dense three-dimensional optoelectronic integration.

OWH2 • 8:15 a.m.
An Optically Pumped Silicon Evanescent Laser Operating Continuous Wave at 60 ºC, Hyundai Park, Alexander W. Fang, John E. Bowers, Richard Jones, Mario J. Paniccia, Oded Cohen; Univ. of California at Santa Barbara, USA, Intel, USA, Intel, Israel. We demonstrate a silicon evanescent laser operating CW up to 60ºC. The laser operates at 1568nm with a maximum fiber-coupled output power of 4.5mW. Devices are fabricated with silicon waveguides bonded to AlGaNAs quantum wells.
OWA • Polarization in Fibers—Continued

OWA2 • 8:30 a.m.
Inelastic Strain Birefringence in Optical Fibers, Florian Diurei, Hans G. Limberger, René P. Salathé, Andrew D. Yablon; EPFL, Switzerland, ‘OFS Labs, USA. Retardation data captured by polarimetric stress-measurements in optical fibers have been reinterpreted in terms of both stress and inelastic strain. The linear dependence of strain birefringence on fiber drawing tension defines the Kohlrausch-Williams-Watt exponent.

OWB • Electronic Mitigation—Continued

OWB3 • 8:30 a.m. Invited
Electronic Dispersion Compensation by Signal Predistortion, Robert J. Kelley, Philip M. Watts, Madeleine Click, Polina Bayvel; Univ. College London, UK, ‘Intel Res., UK. We review recent work on electronic dispersion precompensation, and present the results of simulations investigating the compensation of chromatic dispersion and intra-channel fibre nonlinearity in 10 Gb/s systems using a programmable look-up table and linear finite impulse response filters.

OWC • High-Performance Modulation Sources—Continued

OWC2 • 8:30 a.m.
0.3 V Single-Drive Push-Pull InP Mach-Zehnder Modulator Module for 45-Gbit/s Systems, Ken Tsuzuki, Kimikazu Sano, Nobuhito Kikuchi, Norihide Kashti, Eiichi Yamada, Jiao Shibata, Tadao Ishibashi, Masami Tokumitsu, Hiroshi Yasaka; ‘NTT Corp., Japan, ‘NTT Electronics Corp., Japan. We have developed an ultra low driving voltage (355 mV) and very compact InP-based n-i-n Mach-Zehnder modulator module. The module has a built-in driver IC. 45 Gbit/s single-drive push-pull operation is demonstrated using this compact module.

OWD • Raman Amplification and Processing—Continued

OWD3 • 8:30 a.m.
A New High-Power and Low-RIN Raman Pump Laser for Improved Performance in Long Span Unrepeated WDM Transmission Systems, Gabriele Bolognini, Stefano Faralli, Giovanni Sacchi, Claudia Cantini, Fabrizio Di Pasquale; ‘Scuola Superiore Sant’Anna, Italy; ‘Photonic Networks Natl. Lab., CNIT, Italy. We propose a high-power and low-noise laser for effective first- and higher-order co-pumping in distributed Raman amplifiers. Experiments at 10 Gb/s, also confirmed by simulations, point out RIN-penalty free transmission up to 25 db of co-propagating ON-OFF Raman gain.

OWE • PMD Compensation—Continued

OWE2 • 8:30 a.m.

OWE3 • 8:30 a.m.
All-Fiber Electro-Optical Polarization Control, Oleksandr Tarasenko, Niklas Myré, Walter Margulis, Isabel C. S. Carvalho; Acreo, Sweden, ‘Pontificia Univ. Catolica do Rio de Janeiro, Brazil. Optical fibers gain a second order nonlinearity through thermal poling. The voltage induced birefringence is small. An all-fiber Mach-Zehnder interferometer was then constructed enabling electro-optical polarization control with 78 V and sub-micro-second response time.

OWC3 • 8:45 a.m.
Dual-Depletion-Region Electro-Absorption Modulator at 1.55-µm Wavelength for High-Speed and Low-Driving-Voltage Performance, Jin-Wei Shi, A. C. Shiao, C. H. Hsieh, Y. S. Wu, F. H. Huang, S. H. Chen, J. I. Chyi; Dept. of Electrical Engineering, Natl. Central Univ., Taiwan Republic of China. We demonstrate a novel electro-absorption modulator, which can not only release the trade-off between driving-voltage and bandwidth but also the burden imposed on downsampling of high-speed EAM. The electrical-to-optical measurement show very convincing results.

OWC4 • 8:45 a.m.

OWD4 • 8:45 a.m.
All-Fiber Electro-Optical Polarization Control, Oleksandr Tarasenko, Niklas Myré, Walter Margulis, Isabel C. S. Carvalho; Acreo, Sweden, ‘Pontificia Univ. Catolica do Rio de Janeiro, Brazil. Optical fibers gain a second order nonlinearity through thermal poling. The voltage induced birefringence is small. An all-fiber Mach-Zehnder interferometer was then constructed enabling electro-optical polarization control with 78 V and sub-micro-second response time.
OWG • Analog Systems—Continued

OWG3 • 8:30 a.m. Invited
Subcarrier Multiplexed Signals: A Tool for Optical Fiber System Characterization, Mary B. Phillips; Northwestern Univ., USA. The study of subcarrier-multiplexed lightwave systems has led to the understanding of numerous linear and nonlinear effects in fiber systems. We present two examples, cross-polarization modulation with polarization-dependent loss, and intensity noise caused by stimulated Brillouin scattering.

OWH • Silicon Photonics and Quantum Cryptography—Continued

OWH3 • 8:30 a.m. Invited
Recent Advances in Si Photonics, Tom Koch; Lehigh Univ., USA. No abstract available.
OWA • Polarization in Fibers—Continued

OWA4 • 9:00 a.m.
Experimental Validation of a Method for Low-PMD Measurements, Andrea Galtarossa¹, Luca Palmieri¹, Anna Pizzinati¹, Luca Sberna², Michele Guiglieri¹;
¹Dept. of Information Engineering, Univ. of Padova, Italy; ²Inst. Superiore Comunicazioni e Tecnologie dell’Informazione, Italy. Standard PMD measurement techniques are inaccurate for low DGD values. Thus, the measurements are usually repeated several times while randomly perturbing the fiber. We experimentally validate this approach by means of polarization sensitive reflectometric measurements.

OWA5 • 9:15 a.m.
Spin Profiles Reconstruction in Low-PMD Fibers by Long Range Polarization-Sensitive Optical Coherence Tomography, Maddalena Ferrario¹, Rudi Bratovich¹, Silvia M. Pietralunga¹, Mario Martinelli¹; ¹Dept. of Information Engineering, Univ. of Padova, Italy, ²Inst. Superiore Comunicazioni e Tecnologie dell’Informazione, Italy. Polarization-sensitive optical coherence tomography is proved an efficient non-destructive technique for spin profile reconstruction along spun fiber coils, allowing birefringence parameter spatial evolution to be recovered from backscattered light, with sub-centimetric resolution.

OWB • Electronic Mitigation—Continued

OWB4 • 9:00 a.m.

OWB5 • 9:15 a.m.
Mitigation of Intra-Channel Nonlinear Distortion in 42.7 Gb/s RZ Transmission Using a Single Chip Optical Equalizer, Vitaly Mikhailov¹, Christopher R. Doerr¹, Larry L. Bush², Wenhua Liu¹, Robert I. Killey¹, Polina Bayvel¹; ¹Univ. College London, UK, ²Bell Labs, Lucent Technologies, USA, ³ANDevices, USA. We experimentally demonstrated the mitigation of intra-channel nonlinear distortion in 42.7 Gb/s RZ transmission with 107.5 km amplifier spans without Raman amplification using an optical equalizer, allowing increased transmission distance from 2043 km to 3010 km.

OWC • High-Performance Modulation Sources—Continued

OWC4 • 9:00 a.m.
70dB Extinction-Ratio LiNbO₃ Optical Intensity Modulator for Two-Tone Lightwave Generation, Tetsuya Kanawaki¹, Takahide Sukanoto¹, Masahiro Tsuchiya¹, Masayuki Isutu¹, Shingo Mori², Kazuru Higashita¹; ¹Natl. Inst. of Information and Communications Technology, Japan, ²New Technology Res. Labs, Sumitomo Osaka Cement Co., Ltd., Japan. We demonstrated high extinction ratio intensity modulation for two-tone lightwave generation, using an integrated Mach-Zehnder modulator with active trimmers which can compensate imbalance in the modulator due to fabrication errors. The extinction ratio was larger than 70dB.

OWC5 • 9:15 a.m.
High Extinction Ratio Operation at 40-Gb Direct Modulation in 1.3-µm InGaAlAs-MQW RWG DFB Lasers, Souji Nakahara¹, Tomonobu Tsuchiya¹, Takeshi Kitanani¹, Kazuo Shiminoda¹, Takafumi Taniguchi¹, Takeshi Kikawa¹, Masahiro Aoki¹, Masaru Matsuakubu¹; ¹Hitachi, Central Res. Lab., Japan. InGaAlAs DFB RWG lasers at 40 Gb/s are numerically solved for randomly-birefringent spun fibers. High gain enhancement and reduced variance are attained even for large polarization mode dispersion-limited systems.

OWD • Raman Amplification and Processing—Continued

OWD4 • 9:00 a.m.
Suppression of Stimulated Raman Scattering in a High-Peak Power Pulsed 1060 nm Fiber MOPA Source with Purely Single-Mode Output Using W-Type Fiber, Jayanta Kumar Sahu, Pascal Dupriez, Jae-Sun Kim, Christophe Codemard, Johan Nilsson, David Payne; Optoelectronics Res. Ctr., UK. Suppression of stimulated-Raman-scattering in a 100 ps, 32MHz pulsed fiber source is demonstrated. 12.5 kW of peak power was achieved in a small core single-mode ytterbium-doped fiber amplifier where the stimulated-Raman-scattering was efficiently filtered out by a W-type waveguide structure.

OWD5 • 9:00 a.m.
Backward Raman Amplification in Randomly-Birefringent and Spin Fibers, Andrea Galtarossa, Luca Palmieri, Marco Santagiustina, Leonora Urzini; Dept. of Information Engineering, Univ. of Padova, Italy. The vector interaction of a counter-propagating Raman pump and a signal is numerically solved for randomly birefringent spun fibers. High gain enhancement and reduced variance are attained even for large polarization mode dispersion.
OWF2 • 9:00 a.m.
Low Loss and Highly Reliable Polymer Optical Waveguides with Perfluorinated Dopant-Free Core, Yasuhiko Kawana, Shotoru Takehara, Kouko Takayama, Shunjuke Yotagawa, Shunich Tadakama, Asahi Glass Co., Ltd., Research Ctr., Japan. Polarization independent and low propagation loss of 0.03 dB/cm even at 1650 nm was obtained by the polymer optical waveguide with the dopant-free core made of purely perfluorinated amorphous polymer. High durability to humidity was also shown.

OWG4 • 9:00 a.m.
Proposal of RoF Transmission System Using 850 nm VCSEL and 1.3 µm SMF with Low-Frequency Superposition Technique, Tsutomu Niiho, Koichi Masuda, Hiroyuki Sasai, Masaru Fuse, Matsushita Electric Industrial Co., Ltd., Japan. We propose a novel RoF transmission system with a combination of 850 nm VCSEL and 1.3 µm SMF. Using the low-frequency superposition technique, we demonstrate the RoF transmission of OFDM-64QAM signal with significant reduction of modal noise and distortions.

OWH4 • 9:00 a.m.
Multi-Frequency Laser Monolithically Integrating InGaAsP Gain Elements with Amorphous Silicon AWG, Martin H. Kwokernack, W. K. Chan, N. Maley, H. Mohseni, L. Yang, D. R. Capewell, V. Frantz, B. Khara, T. Mood, G. A. Pajer, D. A. Ackerman, J. G. Kim, Duk H. Lee; Sarnoff Corp., USA; Dewell Electronics Inc., Republic of Korea. We demonstrate a photonic integrated circuit using a novel monolithic integration platform combining InGaAsP gain elements and index matched amorphous silicon waveguide devices. The AWG based multi-frequency laser emits eight 100 GHz spaced wavelengths near 1550 nm.

OWF3 • 9:15 a.m.
UV Written 2x8 Optical Power Splitter for FTTH Applications, Massimo Olivero, Mikael Svalgaard; PhotonLab-Politecnico di Torino, Italy, COM, Technical Univ. of Denmark, Denmark. Silica based integrated optical 2x8 power splitters are reported for the first time using UV-writing waveguide fabrication technology. High performance, compactness and low production costs make these components well suited for deployment in FTTH networks.

OWG5 • 9:15 a.m.
Full-Duplex 1Gbps 60GHz-Band Radio-on-Fiber Access Based on Loop-Back Optical Heterodyne Technique, Tomohiro Taniguchi, Naoya Sakurai, Kiyomi Kamoasaki, Takahisa Imai; NTT Corp., Japan. In the system proposed herein, uplink and downlink share the optical-signal-generation module in the central station and electro-absorption modulators in the base stations without interfering with each other, which simplifies the system architecture significantly.

OWH5 • 9:15 a.m.
Silicon Impact-Ionization Multiplier for Optical Detection, Hong-Wei Lee, Joshua L. Beutler, Aaron R. Hawkins; Electrical and Computer Engineering Dept., Brigham Young Univ., USA. We demonstrate a current multiplier which can be operated with either silicon or indium-gallium-arsenide photodiodes for optical detection. Current gains above 100 along with pre-amplified leakage currents of less than 2 nA were measured.
OWA6 • 9:30 a.m.  Invited
Polarization Properties of Photonic Crystal Fibers, Anders Petersson1, Jes Broeng2, Kim P. Hansen1, Martin D. Nielsen1, Harald R. Simonsen1, Christian Jacobsen1, Jacob R. Folkenberg1, Thomas Schreiber1, E. Röser2, O. Schmidt2, Jens Limpert1, R. Rieß1, F. Lederer2, Andreas Tümermann2; 1Crystal Fiber, Denmark, 2Univ. of Jena, Germany. PCFs provide increased range of mode-field diameters for passive and active fibers. For a number of applications, it is desirable to introduce polarization maintaining properties of such fibers. In this presentation, we report on the latest development within this area.

OWB6 • 9:30 a.m.
MLSE Receivers for Narrow-Band Optical Filtering, Michael Rubsamen1,2, Peter J. Winzer1, René-Jean Estienne1; 1Bell Labs, Lucent Technologies, USA, 2Technical Univ. Aachen, Germany. We show that maximum likelihood sequence estimation (MLSE) permits significantly narrower optical filtering than threshold detection in high spectral efficiency systems. We consider MLSEs using one and two samples/bit, noise correlation, and exact probability densities.

OWB7 • 9:45 a.m.
Experimental Demonstration of 10 Gb/s NRZ Extended Dispersion-Limited Reach over 600km-SMF Link without Optical Dispersion Compensation, Nikola Alic1, George C. Papen1, Robert E. Superstein1, Rai Jiang1, Chris Marki1, Yeshuahu Fanmam1, Stojan Radic1, Peter A. Andrekson1; 1Univ. of California at San Diego, USA. We demonstrate extended dispersion-limited reach of 600 km at 10 Gb/s with conventional NRZ transmitter without optical dispersion compensation. Novel approach combines a new type of spectral filtering and electronic processing based on Viterbi algorithm at the receiver.

OWC6 • 9:30 a.m.  Invited
Chirp Managed Laser (CML): A Compact Transmitter for Dispersion Tolerant 10Gb/s Networking Applications, Daniel Matyregelah, Yasubiro Matsui, Xueyan Zheng, Zhenyan Frank Fan, Kevin McCallion, Parviz Tayebati; AZNA Corp., USA. We show that the compact combination of a directly modulated laser and an optical filter, generates a highly dispersion tolerant modulation format suitable for > 200 km reach at 10 Gbps without dispersion compensation.

OWD7 • 9:30 a.m.  Invited
Silicon Based Lasers and Amplifiers via Stimulated Raman Scattering, Haisheng Rong1, Richard Jones1, Ansheng Liu1, Mario Panciatici1, Oded Cohen2, Dani Hak2; 1Intel Corp., USA, 2Intel Corp., Israel. Light amplification and lasing are realized in silicon waveguides via stimulated Raman scattering. With a reverse biased p-i-n structure embedded in the waveguide, we achieve continuous-wave net gain and lasing in a single silicon chip.
**OWF4 • 9:30 a.m. Invited**
Replicated Polymer Waveguides for Optical Access Applications, Hayami Hosokawa, Yoshitsuka Ishida, Kazuyuki Hayamizu; Omron Corp., Japan. A replication technology for fabricating polymer optical waveguides has been developed. With this technology, coupler modules are successfully demonstrated with practical characteristics for low cost access applications. And V-groove integration onto those devices is introduced.

**OWG6 • 9:30 a.m.**
60GHz Radio-on-Fiber Downlink Systems Using Optically Injection-Locked Self-Oscillating Optoelectronic Mixers Based on InP/InGaAs HPTs, Jae-Young Kim, Jun-Hyuk See, Woo-Young Choi, Hideki Kamitsuna,Minoru Ida, Kenji Kurishima; Yonsei Univ., Republic of Korea, NTT Photonics Labs, NTT Corp., Japan. 30GHz optically injection-locked self-oscillating optoelectronic mixer is implemented with InP/InGaAs heterojunction phototransistor. Using this mixer as harmonic up-converter, 60GHz radio-on-fiber downlink transmission of 16QAM data is successfully demonstrated. The link performance is uniform over wide range of optical LO powers.

**OWH6 • 9:30 a.m. Invited**
Components for Quantum Cryptography, Hugo Zbinden1, Damien Stucki1, Grégoire Ribordy2; 1Univ. of Geneva, Switzerland, 2id Quantique, Switzerland. We demonstrate a new protocol for practical quantum cryptography, tailored for a high key generation rate using weak coherent pulses. We discuss the required features of the optical key components of the system.
OW14 A Design Criterion for Cleavage-Robust Microstructured Fibers, Véronique François, Seyed Sadreddin Abontorabi; École de Technologie Supérieure, Canada. Cleavage patterns of high air-fraction, double-clad microstructured fibers (MSFs) are analyzed using fracture mechanics. Critical fracture depth is shown to be a measure explaining the different patterns and is proposed as a criterion to design cleavage-robust MSFs.

OW15 Spectral Characteristics of Side-Polished Endlessly Single-Mode Photonic Crystal Fiber: Waveguide Dispersion, Nan-Kuang Chen¹, Sien Chi²; ¹Dept. of Photonics and Inst. of Electro-Optical Engineering/Natl. Chiao Tung Univ., Taiwan Republic of China, ²Dept. of Electrical Engineering/ Yuan Ze Univ., Taiwan Republic of China. We investigate spectral characteristics of side-polished endlessly single-mode photonic crystal fibers by polishing-depth and radius of curvature, which are important to evanescent coupling, waveguide loss, higher-order modes excitation, and dispersion slopes of photonic crystal fiber components.

OW16 Artificial Defects as Ingredients for Synthesizing Holey Fibers with Large Mode Area and Flat Chromatic Dispersion: An Emerging Technology for High Speed Transmission Platforms, Kanimasa Saitoh, Nikolaos J. Florous, Masanori Koshiba; Hokkaido Univ., Japan. We numerically demonstrate the operation of a novel class of holey fibers with artificial defects for engineering the large mode area and flat chromatic dispersion for applications in high speed optical transmission systems.

OW17 A Simple Tapered Bismuth-Based Nonlinear Optical Fiber for Low-Loss Coupling to Single-Mode Silica Fibers, Tomoharu Hasegawa, Tatsuo Nagashima, Naoki Sugimoto; Asahi Glass Co., Ltd., Japan. Spot-size-converter for low loss coupling of Bi₂O₃-based nonlinear optical fiber is proposed. The tapered structure for mode-field expansion is constructed by a simple fabrication procedure. The experimental results show the improvement of the coupling efficiency.

OW18 Split-Step Quasi-Spectral Finite Difference Method for Nonlinear Optical Pulse Propagation, Tristan Kremp; Inst. für Geometrie und Praktische Mathematik, RWTH Aachen University, Germany. Using finite differences with quasi-spectral properties, we introduce a switch-step method with optimum complexity for the nonlinear Schrödinger equation. For accurate simulations of large WDM systems, substantial speed-up factors over the split-step Fourier method are obtained.

OW19 Technique for Highly Sensitive Measurement of Raman Gain Coefficient of Optical Fiber Using Pump/Signal Sum-Frequency Lock-In-Detection, Kazu S. Abden; Natl. Inst. of Information and Communications Technology, Japan. A simple technique for measuring Raman gain in short optical fibers is demonstrated. This technique applies square-wave modulation to both pump and signal and performs lock-in-detection at sum-modulation-frequency, and measures on-off gain as small as 0.0015 dB.

OW20 Brillouin Suppression through Longitudinal Structural Variation in High Nonlinearity Silica Holey Fibers, Francesco Poletti; Kentaro Furusawa, Zaofadzi Yousuf, Periklis Petrovopoulos, Neil G. Broderick, Tanya M. Monro, David J. Richardson; Optoelectronics Res. Ctr., UK. We consider longitudinal variation in the fiber structure as a method of increasing the Brillouin linewidth and threshold within high nonlinearity silica holey fibers. Strategies to control the associated variation in nonlinearity and dispersion along the fiber length are described.

OW21 Brillouin Scattering in Optical Fibers for High Resolution Wavelength and Line Width Measurements, Kai-Uwe Lauderbach, Thomas Schneider; Deutsche Telekom Fachhochschule Leipzig, Germany. We present a simple method for measuring the wavelength and line width of optical sources with a resolution in the femtometer range. This method is based on the small bandwidth of Brillouin scattering.

OW22 Investigation of Fiber Based Gates for Time Division Multiplexing up to 640 Gbit/s, Vincent Marembart, Corina Schubert, Carsten Schmidt-Langhorst, Marcel Kroh, Sebastian Fether, H. G. Weber; Fraunhofer Inst. for Telecommunications, Germany. We experimentally investigate the switching performance of interferometric gates based on highly nonlinear fiber (HNLF), a Kerr-gate and a Nonlinear Optical Loop Mirror. Switching windows are measured and compared for different operation conditions and HNLFs.

OW23 Multimode Fiber Enabling 40 Gbit/s Multi-Mode Transmission over Distances > 400 m, Pier Matthijsse, Gerard Kuyt, Frans Gouwier, Frank Achten, Ronald Frenaud, Lutz Moelle, Christoph Caspar, Thomas Rosin, Detlef Schmidt, Andreas Beling, Thomas Eckhardt; ‘Draka Comtek’ Optical Fibre, The Netherlands, ‘Fraunhofer-Inst. for Telecommunications, Heinrich-Hertz-Inst., Germany. We have optimized multimode fiber performance at 1300 nm to a level that enables 40-Gbit/s serial transmission in the multimode regime well over 400 m in a 40 nm wavelength window with high launching tolerance.

OW24 Polarization-Independent OTDM Demultiplexer Based on a NOLM with a Polarization Diversity Loop, Zhaoxin Wang, Li Hua, Chunlin Lin, Chun-Kit Chan; Chinese Univ. of Hong Kong, Hong Kong Special Administrative Region of China. Polarization-independent all-optical time-division-demultiplexing is successfully demonstrated by incorporating a polarization diversity loop into the conventional NOLM. The polarization dependence is reduced from 6.3dB to 0.6dB in a 40 to 10-Gb/s OTDM experiment.

OW25 Cross-Polarization Modulation: Theory and Experiment of a Multiple-Wavelength System, S. L. Woodward¹, M. R. Phillips², Robin L. Smith³; ¹AT&T Labs-Res., USA, ²Northwestern Univ., USA, ³Cornell Univ., USA. The time-varying state of polarization of an optical channel modified by the intensity of other channels in a three-channel WDM system is measured. It compares well with theory expanded from a previously published two-channel model.
OW16  Probability Density Functions of Rotations in Loop-Synchronous Polarization Scrambling for Recirculating Loop Experiments, Lawrence Fomundam, John Zwick, Hai Xu, Hua Jiao, Gary M. Carter; Univ. of Maryland, Baltimore County, USA. The performance in a recirculating loop with a loop-synchronous polarization scrambler is independent of the choice of probability density function (pdf) for the rotations in the polarization scrambler, unless the pdf is strongly biased.

OW17  Frequency-Domain Modal Dispersion Measurement in Multimode Fibers Using Intermodal Interferometer, Tae-Jung Ahn, Saeheo Moon, Soan Kim, Kyungwhan Oh2, Dug Young Kim, Jens Kokeke1, Kay Schuster1, Johannes Kirchhof1; 1Gwangju Inst. of Science and Technology, Republic of Korea, 2Gwangju Inst.of Science and Technology, Republic of Korea. A modal dispersion measurement technique for a multimode optical fiber using an intermodal interferometer and optical frequency-domain reflectometry (OFDR) technique is demonstrated. A few-mode PCF and a commercial MMF are prepared to measure modal distortions using our measurement technique.

OW18  Differential Mode Delay Analysis for a Multimode Optical Fiber with Fourier-Domain Low-Coherence Interferometry, Ji Yong Lee, Tae-Jung Ahn, Saeheo Moon, Yong Min Jung, Kyung Ewan Oh, Dug Young Kim; Gwangju Inst. of Science and Technology, Republic of Korea. A novel differential mode delay (DMD) measurement for a multimode optical fiber using the Fourier-domain low-coherence interferometry (FLCI) for the first time has been proposed. Our experimental results have a good agreement with those results obtained using a conventional method.

OW19  Fiber Strain Due to Twist During Draw, James W. Fleming; OFS Labs, USA. Thermophysical property measurements in optical fibers have revealed that stress applied to fiber during the drawing process is recorded in the structure of the drawn fiber and fiber twisting during draw can be detected in these measurements.

OW20  Spinning-Induced Stress Distribution Affecting Beatlength in Constantly Spun Fibers, Maddalena Ferrari1, Silvia M. Pietralunga1, Matteo Tuccci1, Mario Martinelli1,2; 1CoreCom, Italy, 2Politecnico di Milano, Dept. di Elettronica e Informazione, Italy. The interplay of fiber drawing parameters and constant spinning process, affecting beatlength in spun fibers, is theoretically investigated. Experimental validation is provided by tomographic stress characterization on fibers spun at different rates and drawing speeds.

OW21  Fabrication of Cr-Doped Fibers by Drawing Tower, Yi-Ching Huang1, Yu-Kuan Lu1, Jiang-Cheng Chen1, Yi-Chen Hsu1, Yu-Ming Huang2, Hoei-Min Yang1, Maw-Tyan Sherr1, Sheng-Lung Huang1, Tae-Yun Chang1, Wood-Hi Cheng1; 1Inst. of Electro-Optical Engineering, Natl. Sun Yat-sen Univ., Taiwan Republic of China, 2Inst.of Electro-Optical Engineering, Natl. Sun Yat-sen Univ., Taiwan Republic of China, 3Inst. of Electro-Optical Engineering, Natl. Sun Yat-sen Univ., Taiwan Republic of China, 4Dept. of Physical Science and Technology, Republic of Korea. A novel Cr-doped fiber fabrication method in Raman amplifier with maximum pulse compression ratio of up to 80.

OW22  Negative Feedback Optical Amplifier Based on Cross-Gain Modulation in Erbium-Doped Fiber Amplifiers, Yoshinobu Maeda; Toyota Technological Inst., Japan. A widely (>50nm) wavelength-tunable self-oscillating electro-optic frequency comb generation using phase modulator was demonstrated. Wavelength of the oscillation was controlled by tuning asymmetric filtering. Co-injection of two lights enabled copying the comb to other wavelength.

OW23  Tunability of the Gain Spectrum in an Erbium-Doped Fiber with Depressed-Cladding, Federica Poli1, Matteo Foroni1, Annamaria Cucinotta1, Letizia Ruggeri1, Lorenzo Rosa1, Stefano Selleri1, Paolo Vavassori1; 1Univ. of Parma, Italy, 2Perceramic s.r.l., Italy. The bending losses of a depressed-cladding erbium-doped fiber have been exploited to tune the fiber amplifier gain in the wavelength range between the S-band and the C-band.

OW24  An All-Fiber Low-Noise Hybrid Erbium-Brillouin Amplified Laser Source, Lilin Yi1, Weisheng Hu1, Yikai Su1, Li Zhan1, Zheng Zheng1, Peigang Hu1, Yi Dong1, Ge Fan1, Haigen Shen1; 1State Key Lab of Advanced Optical Communication Systems and Networks, Dept. of Electronic Engineering, Shanghai Jiao Tong Univ., China, 2Beihang Univ., China. We demonstrate a novel all-fiber hybrid erbium-Brillouin amplified laser source, and achieve 8-dB reduction of RIN compared with an EDFA based source. The resulting spurious-free dynamic range in an analog system is improved by 6.8 dB.

OW25 10GHz Actively Mode-Locked Erbium-Doped Fiber Ring Laser Using an Electro-Absorption Modulator and a Linear Optical Amplifier, Lexin Xu1,2, L. F. K. Liu1, P. K. A. Wai1, H. Y. Tam1, M. S. Demokan1; 1Hong Kong Polytechnic Univ., 2Hong Kong Special Administrative Region of China, 3Univ. of Science and Technology of China, China. We demonstrated a 10-GHz actively mode-locked erbium-doped fiber laser that incorporates an electro-absorption modulator and a linear optical amplifier. Stable pulses with peak power of 120 mW and pulsewidth of 2.4 ps are obtained.

OW26 50-nm Wavelength-Tunable Self-Oscillating Electro-Optic Frequency Comb Generator, Takahide Sakamoto, Tetsuya Kawamata, Masayuki Izutsu; NICT, Japan. A widely (>50nm) wavelength-tunable self-oscillating electro-optic frequency comb generation using phase modulator was demonstrated. Wavelength of the oscillation was controlled by tuning asymmetric filtering. Co-injection of two lights enabled copying the comb to other wavelength.

OW27 10nm Tunable Multiwavelength Actively Mode-Locked Erbium-Doped Fiber Ring Laser Based on Distributed Dispersion Cavity, Shidong Pan, Caoyin Lou; Tongji Univ., China. A novel stable multimode, actively mode-locked erbium-doped fiber ring laser was demonstrated using distributed dispersion cavity. Simultaneous generation of wavelength tunable 10GHz pulses up to four different wavelengths was achieved.

OW28 50nm Tunable Multiwavelength Actively Mode-Locked Erbium-Doped Fiber Ring Laser Using an Electro-Absorption Modulator and a Linear Optical Amplifier, Lexin Xu1,2, L. F. K. Liu1, P. K. A. Wai1, H. Y. Tam1, M. S. Demokan1; 1Hong Kong Polytechnic Univ., 2Hong Kong Special Administrative Region of China, 3Univ. of Science and Technology of China, China. A novel 10GHz, >50nm multiwavelength active mode-locked erbium-doped fiber laser was demonstrated using distributed dispersion cavity. Simultaneous generation of wavelength tunable 10GHz pulses up to four different wavelengths was achieved.

OW29 10GHz Actively Mode-Locked Erbium-Doped Fiber Ring Laser Using an Electro-Absorption Modulator and a Linear Optical Amplifier, Lexin Xu1,2, L. F. K. Liu1, P. K. A. Wai1, H. Y. Tam1, M. S. Demokan1; 1Hong Kong Polytechnic Univ., 2Hong Kong Special Administrative Region of China, 3Univ. of Science and Technology of China, China. A novel multiwavelength active mode-locked erbium-doped fiber laser was demonstrated using distributed dispersion cavity. Simultaneous generation of wavelength tunable 10GHz pulses up to four different wavelengths was achieved.

OW30  Stabilization of an Actively Mode-Locked Erbium-Doped Fiber Ring Laser by Multi-Harmonic Phase Modulation, Jerome Vasseur1, Marc Hamma1, John M. Dudley1, Jianjun Yu3, John R. Barry2, Gee-Kwang Chang1; 1GTL-CNRS Telecom, France, 2Labs FEMTO-ST, France, 3Georgia Tech, USA. We demonstrate actively mode-locked operation of a fiber laser using a novel multi-harmonic phase modulation technique. By mixing two harmonics of the fundamental cavity frequency to drive a phase modulator, improved stability performance is observed.
OWI31 Distributed Raman Amplification on Fiber With Large Connector Losses, Michael H. Eiselt; ADV A AG, Germany. A simplified formula for the gain and noise figure of Distributed Raman Amplification on fibers with large connector losses is derived. It is shown that OTDR measurements are required to estimate the available Raman gain.

OWI32 Efficient Generation of CW Supercontinuum in Optical Fiber Pumped by ASE Light, Shengping Li, Boh Ruffin, Dmitrii Kuksenkov; Carning Inc., USA. We propose a new and efficient approach to generation of a continuous-wave supercontinuum in optical fiber pumped by an amplified spontaneous emission light. A bandwidth of 268 nm (at -15 dB level) with an average spectral density of 2.7 mW/nm is demonstrated.

OWI33 Ultra-Broadband Near-Infrared Emission from Bi-Doped Lithium Aluminum Silicate Glasses for Optical Amplification, Yasutake Ohishi, Takahiro Suzuki, Tatsuo Yamauchi; National Institute of Advanced Industrial Science and Technology, Japan. Our recent results on near-infrared ultra-broadband emission with the broadest bandwidth as much as 450 nm to our knowledge, has been observed from Bi-doped lithium alumino silicate glass.

OWI34 Wavelength- and Width-Tunable Optical Pulses Generated from Four-Wave Mixing in a 35-cm Bismuth Oxide Highly Nonlinear Optical Fiber, Mable Fok, Chester Shiu; Chinese Univ. of Hong Kong, Hong Kong Special Administrative Region of China. We demonstrate a 10-GHz optical pulsed source based on four-wave mixing in a 35-cm bismuth oxide highly nonlinear optical fiber. The pulse width is continuously tunable from 22 to 46 ps over a wavelength range of 10 nm.

OWI35 Numerical and Experimental Study of an Alternate Multiwavelength Mode-Locked Fiber Ring Laser, Jerome Vasseur, Marc Hannaë, John M. Dudley, Jianjun Yu, John R. Barry; Gee-Kong Cheng; 2GTL-CNRS Telecom, France, 3 Labs FEMTO ST, France, 1Georgia Tech, USA. We report the experimental generation of alternate multiwavelength pulse trains in a mode-locked fiber ring laser containing an unbalanced Mach-Zehnder interferometer at an aggregate repetition rate of 18.8 GHz. These results are compared with simulations.

OWI36 Novel Spacing-Tunable Multiwavelength Raman Fiber Laser, Xinyong Dong, Ping Shum, Chi Chun Chan, Nam Quoc Ngo; Nanyang Technological Univ., Singapore. We report a mult wavelength Raman fiber laser with a continuously tunable spacing and an independently adjustable channel number. Spacing tuning from 0.3 to 0.6 nm and channel number adjustment from 2 to 10 have been achieved.

OWI37 40 dB Gain S-Band Depressed-Cladding EDFA with Double- Pass Configuration, Matteo Foroni; Letizia Ruggeri; Federica Poli, Paolo Gaboardi; Annamaria Cucinotta; Stefano Selleri, Paolo Varvaro; 1 Univ. of Parma, Italy, 2 Petrocuemiches s.r.l., Italy. An efficient S-band depressed-cladding erbium-doped fiber amplifier with a double-pass configuration has been realized with a peak gain of 40 dB at 1512 nm. The EDFA performances have been analyzed for different signal configurations.

OWI38 Room-Temperature Tunable Multiwavelength Erbium-Doped Fiber Laser Based on Degenerate Four-Wave Mixing Effect in Dispersion-Shifted Fiber, Young-Geun Han, Sang Bae Lee; Korea Inst. of Science & Technology, Republic of Korea. We experimentally demonstrate a stably tunable multiwavelength erbium-doped fiber laser based on degenerate four-wave mixing in dispersion-shifted fibers at room temperature. The lasing wavelength can be continuously controlled by the polarization controller.

OWI39 Simultaneous All-Optical Inverted and Non-Inverted Wavelength Conversion Using a Single-Stage Fiber Optical Parametric Amplifier, Kenneth Kin-Yip Wong, Gwo-Wei Lu, Lian-Kuan Chen; 1 Univ. of Hong Kong, Hong Kong Special Administrative Region of China. We have demonstrated, for the first time to our knowledge, simultaneous all-optical inverted and non-inverted wavelength conversion by using a single-stage two-pump fiber optical parametric amplifier with extinction ratio between 7 and 14 dB over 24 nm.

OWI40 Application of the Magnus Expansion to Polarization Mode Dispersion and Polarization Dependent Loss, Michael A. Reimer, David Yevick; Univ. of Waterloo, Canada. We solve the differential equation for the frequency-dependent Mueller matrix for systems affected by both of PMD and PDL with a Magnus expansion approach. The formalism is then applied to compensator design.

OWI41 Least Squares Procedure for Measuring Mueller Matrices, Michael A. Reimer, David Yevick; Univ. of Waterloo, Canada. A least squares method is presented that allows the Mueller matrix of an optical fiber to be determined with high accuracy from measurements of the output Stokes vector for different unknown input polarization states.

OWI42 CO2-Laser Fabricated Long-Period Grating Sensors in Graded-Index Multimode Fibers, Lei Sai, Chao Lai, Kin Seng Chang; 1 Nanyang Technological Univ., Singapore, 2 City Univ. of Hong Kong, Hong Kong Special Administrative Region of China. We report long-period grating fabricated in a graded-index multimode fiber by deforming the geometry of the fiber periodically with a focused CO2 laser beam. The sensing applications of such multimode fiber long-period gratings are proposed.

OWI43 Fiber Optic Sensor for Simultaneous Leak Detection of Hydrazine and Nitrogen Dioxide in Bifurcated Chirped Fiber Bragg Grating, Ning Cheng, John C. Cartledge; Queen’s Univ., Canada. It is shown analytically and experimentally that the proper amount of residual dispersion can mitigate the power penalty induced by the phase response ripple of a tunable dispersion compensating fiber Bragg grating.

OWI44 Radial Basis Function Network for Non-Linear EDC in Optical Communication OOK System, Gilad Katz, Dan Sadot; Electrical and Computer Engineering, Ben-Gurion Univ. of the Negev, Israel. We introduce the Radial Basis Function network for electronic dispersion compensation in optical communication systems with OOK and a direct detection receiver. The RBF method introduces a non-linear equalization technique suitable for optical communication system.

OWI45 Gradient-Method Based Adaptive Control of Tunable Dispersion Compensator that Minimizes Time-Domain Waveform Error, Ken Taniwara, Akira Hirose; Dept. of Electronic Engineering, Univ. of Tokyo, Japan. We propose a novel technique to control tunable dispersion compensator adaptively. This technique is required for realizing high-speed all optical routing networks. Numerical simulation results show that the technique compensates the dispersion quickly and effectively.

OWI46 Effect of Residual Dispersion and Phase Response Ripple at 40 Gb/s Using a Tunable Chirped Fiber Bragg Grating, Ying Xue, John C. Cartledge; Queen’s Univ., Canada. It is shown analytically and experimentally that the proper amount of residual dispersion can mitigate the power penalty induced by the phase response ripple of a tunable dispersion compensating fiber Bragg grating.
OWI47
Impulse Response Measurements Using Optical Low Coherence Reflectometry with Tunable Source, Doruk Ergen1, Avishay Eyal1, Randal Salvatore2, Moshe Tur3, Xiaolin Tong4; 1Optical Air Data Systems, Univ. of Rochester, USA; 2Laser & Spectroscopy Lab., Technion, Israel; 3Tel-Aviv Univ., Israel; 4Infinera, USA, 2Ancom Corp., USA. A recently proposed technique is used for the first time to measure the complex impulse response of fiber gratings (kL=0.5-3) and a DFB laser. Good agreement with independent spectral measurement and spatial resolution ~0.3μm are obtained.

OWI48
Multi-Channel Dispersion Compensator Based on a Flexible Structure, Yitang Dai, Xiangfei Chen, Jie Sun, Yu Yao, Shizhong Xie; Dept. of Electronic Engineering, Tsinghua Univ., China. Multi-channel dispersion compensator is demonstrated based on the strongly-chirped, phase-shifted sampled Bragg gratings. Wideband dispersion compensators with different channel spacing, dispersion, and dispersion slope can be obtained with a single conventional phase mask.

OWI49
π-Phase Shifted Fiber Bragg Grating-Based Optical DPSK Demodulator with Optically Tunable Phase Shifter, Tae-Young Kim1, Masaori Hanawa2, Sun-Jong Kim1, Swook Hann1, Won-Tae Han1, Chang-Soo Park1; 1Gwangju Inst. of Science and Technology, Republic of Korea; 2School of Electronic Science & Technology, Univ. of Electronic Science & Technology, Sichuan, China. A novel optical DPSK demodulator is developed. The result agrees with independent spectral measurement and spatial resolution ~0.3μm are obtained.

OWI50
Highly Birefringent Long Period Gratings Fabricated with Femtosecond Laser, Mykhaylo Dubov, Thomas D. P. Allsop, Amos Martinez, Vladimir Mezentsev, Ian Bennion; Aston Univ., UK. Long Period Gratings (LPG) in standard fibre have been manufactured with a sharply focused near infrared (NIR) femtosecond laser beam. Polarization splitting of the attenuation bands is strongly dependent upon the inscription power.

OWI51
A Novel Flat-band Long Period Grating with Special Index Apodization Induced by High Frequency CO2 Laser Pulses, Yunjiang Rao1, Tao Zhu2; 1School of Communication and Information Engineering, Univ. of Electronic Science & Technology, China; 2Dept. of Optoelectronic Engineering, Chongqing Univ., China. A novel LPG with special index apodization was fabricated by high frequency CO2 laser pulses, and the experiments showed the top bandwidth and flatness were, respectively, up to 10nm and less than 0.5dB, which has potential applications in optical communications.

OWI52
Tunable Optical CDMA Encoder/Decoder Using Modified PN Code and FBG Array, Wonkyung Lee, Bong Kyu Kim, Heuk Park, Kwangsoon Kim; Electronics and Telecommunications Res. Inst., Republic of Korea. We propose a novel tunable CDMA encoder/decoder based on modified PN code FBG array. Bragg wavelengths of the FBG array are tuned by strain/temperature control and selected by a band-pass filter to realize the full-set of user codes.

OWI53
Symmetry Study for Optical Signals with Orthogonal Polarizations, William Sheih1, Rongqiang Han2, Xingwen Yi3; 1Univ. of Melbourne, Australia, 2Univ. of Kansas, USA. We experimentally investigate the symmetry for optical signals with orthogonal polarizations. The symmetry of degree-of-polarization is maintained for the orthogonal polarizations under first/higher-order PMD whereas the symmetry of higher-order PMD is broken under higher-order PMD.

OWI54
Low-Complexity Hybrid MLSE Equalizers for 10Gbps Ethernet Multi-Mode Fiber Links, Kasyapa Balamurthy, Stephen E. Ralph; Georgia Tech, USA. We demonstrate a new class of equalizers for 10Gbps multi-mode fiber links that combine the advantages of Viterbi equalizers and decision feedback equalizers (DFE) yielding a low complexity, readily implemented architecture with performance ~0.5-0.75dB better than an infinite-length DFE.

OWI55
Radiation Mode Analysis of Tilted Fiber Gratings, Yufeng Li; Univ. of Rochester, USA. Based on coupled-mode theory and new sets of HE and EH radiation modes, the scattering analysis of tilted fiber gratings is developed. The result agrees with the volume current method except at small scatter angles.

OWI56
A Polarization Controller for Air-Core Photonic-Bandgap Fiber, Matthew A. Terrel, Michel DIGONNET, Shanhui Fan; Stanford Univ., USA. We investigate the effects of twisting on the birefringence of an air-core fiber and demonstrate the first air-core fiber polarization controller, a simple device consisting of three short twisted fiber sections, with a 20-dB extinction ratio.

OWI57
Huge Birefringence in Couplers Made of Microfibers, Mathieu Gagne, Xavier Duchellet, Nicolas Goldbout, Suzanne Lacroix, Mikael Ledieu; Ecole Polytechnique de Montreal, Canada. We present the inscriptions power. We present the inscription power.

OWI58
Impact of Four-Wave-Mixing on Microwave Photonic Filters, Guoxiang Ning1, Duan Liu2, Ping Shum1, H. Dong1, S. Fu1, M. Tang1, Chongying Wu2; Network Technology Res. Ctr., Nanyang Technological Univ., Singapore, 2School of Science, Beijing Jiaotong Univ., China. Bandpass notch filters based on a dual-wavelength SOA and Raman fiber ring laser both with equalized peak power are proposed and demonstrated experimentally. Four wave mixing effect on the notch filters has been discussed.

OWI59
Ultra-Wide-Band Low Loss and PDL 1X32 Splitter Polymer Optical Waveguide, Shota Tanahara, Yoshitaka Kusumoto, Shunsuke Yokotsuka, Shunichi Kodama; Asahi Glass Co., Ltd., Japan. We fabricated 1x32 splitter device based on Si substrate using spin perfluorinated polymer. We could demonstrate 1x32 splitter device of low Loss and PDL in ultra-wide-band range (1.31μm/1.55μm/1.65μm).

OWI60
Programmable Spectral Design Using the Binary Supergrating (BSG), Daniel Levner1, Martin F. Foy2, J. M. Xu1; Stanford Univ., USA, 2Brown Univ., USA. We present the Binary Supergrating (BSG), a digital approach to spectral engineering that allows for the near-arbitrary control of optical amplitude and phase response in a wavelength-dependent manner, and uses a simple and practical form.

OWI61
A Simply Tunable Optical CDMA Encoder/Decoder for Two-Dimensional Cyclic Permutable Codes, Seungwhan Chung, Chang-Keun Lee, Younghim Kim, Yongjin Lim, Seung-Woo Seo, Byoungho Lee; Seoul Natl. Univ., Republic of Korea. We have proposed and experimentally demonstrated a simply tunable optical code using a cyclic wavelength shifter, which can be applied for two-dimensional optical CDMA schemes. The cyclic wavelength shifter is based on dual-band holographic grating.

OWI62
Spectral Phase Encoders for Optical CDMA Using Anti-Symmetric Gratings, Jose M. Castro, David E. Geraghty; Univ. of Arizona, USA. Spectral phase coding provides higher spectral efficiency and security than spectral amplitude coding. To simplify its implementation we propose novel and compact bipolar optical encoders based on the recently demonstrated anti-symmetric grating.
OWI63 Unique All-Fiber Tunable Filter Using a Single Resonant-Band LPG and Nanoparticle Dispersed Electro-Optic Polymer, S. Yor1, J. E. Lee1, Q. Chen1, Q. Zhang2, K. M. Beichard, D. Dittie1, J. Mazurowski1, M. J. Hackert1; 1Pennsylvania State Univ., USA, 2Applied Res. Lab, Pennsylvania State Univ., USA, 3Electro-Optics Ctr., Pennsylvania State Univ., USA, 4Naval Air Systems Command, USA. A single resonant band, thin cladding long-period grating (LPG) is tuned using a nanoparticle dispersed electro-optic polymer. The LPG has been tuned over 10 nm and has a potential tuning range upwards of 50 nm.

OWI64 Optical Add/Drop Multiplexer with Asymmetric Bandwidth Allocation and Dispersion Compensation for Hybrid 10-Gb/s and 40-Gb/s DWDM Transmission, Daniel A. Fishman, Jianping Yang, Xian Liu, S. Chudnovskikar, Alan H. Gnauck; Lucent Technologies, USA, 1Dept. of Electrical Engineering, Univ. of Californ-ia at Los Angeles, USA, 2Dept. of Electrical Engineering-Electrophysics, Univ. of Southern California, USA, 3Lumera Corp., USA. A simply structured hybrid integrated electrooptic polymeric digital optical switching is proposed and demonstrated. The loss of the devices is improved by integration of passive material with switching properties similar to switches without passive material.

OWI65 A Wavelength Switching Operation of a Si-Waveguide Asymmetric Mach-Zehnder Interferometer Having a Ferro-Electric Liquid Crystal Cladding, Ryuta Hotta, Katsumi Nakatsurara, Takakyo Nakagami; Kanagawa Inst. of Technology, Japan. We proposed and fabricated a novel optical switching device using a Si-waveguide asymmetric Mach-Zehnder interferometer with a ferro-electric liquid crystal cladding. We demonstrated the wavelength switching operation with the experimental device fabricated at 1550nm wavelength.

OWI66 General Approach to Hitless Switching and FSR Extension for Resonators in Integrated Photonic Circuits, Milos A. Popovic, Hermann A. Haus, Michael R. Watts; MIT, USA. A hitless bypass switch for microphotonic channel add-drop filters that is based on delta-beta switches is described. We generalize the design to a large class of devices enabling variants of the switch and application to free-spec- tral-range extension in tunable filters.

OWI67 Hybrid Integrated Electrooptic Polymeric Digital Optical Switches (DOS’s) with Lower Loss, Wei Yuan1, Seongku Kim, Harold R. Fettermann, William H. Steier2, Balasa Dina1, Dandhur Jit2; 1Dept. of Electrical Engineering, Univ. of Californ-ia at Los Angeles, USA, 2Dept. of Electrical Engineering-Electrophysics, Univ. of Southern California, USA, 3Lumera Corp., USA. A hybrid integrated electrooptic polymeric digital optical switching device is proposed and demonstrated. The loss of the devices is improved by integration of passive material with switching properties similar to switches without passive material.

OWI68 Ultra-Wide Temperature Range (-30–70 °C) Operation of Athermal AWG Module Using Pure Aluminum Plate, Junichi Hasagawa, Kazutaka Nara; Furukawa Electric, Japan. We have elucidated an origin of a temperature dependence of a center wavelength in an athermal AWG and demonstrated an ultra-wide temperature range (-30–70 °C) operation using a pure aluminum plate for the first time.

OWI69 Compact 1.31 and 1.49/1.55µm WDM Using Fiber Type Lens, Tetsuya Gamano, Tarou Hattori, Keiichi Motojima, Shigeru Hirai; Toyokuni Electric Cable Co., Ltd., Japan. Using a fiber collimator with a graded-index fiber type lens and applying the simple fabrication process, the compact 1.31 and 1.49/1.55µm WDM have been achieved. This WDM exhibits low insertion loss, high isolation and high reliability.

OWI70 An Efficient All-Fiber Interleaving Filter Using Fiber Gires-Tournois Etalons on a Michelson Interferometer, Qijie Wang, Ying Zhang1, Ying Chi Soh1; 1School of Electrical and Electronics Engineering, Nanyang Technical University, Singapore, 2Singapore Inst. of Manufacturing Technology, Singapore. We report the use of fiber Gires-Tournois Etalons on a fiber Michelson interferometer for implement-ing a 25/50 GHz interleaving filter with a 0.35 dB passband bandwidth of 18.5 GHz, Q-factor of 92.5 %, and channel isolation of 24 dB.

OWI71 High-Density Optical Wiring Technologies for Optical Backbone Interconnection Using Down-sized Fibers and Pre-Installed Fiber Type Multi Optical Connectors, Masaki Onhura1, Kazuhito Saito2; 1Sumitomo Electric Industries, Ltd, Japan, 2Opto- Electronic System Integration CRT, NRI, AIST, Japan. We have developed a high-A downsized MMF that can with-stand bending and a multi-fiber MT con- nector that allows on-site installation without polishing, as optical wiring tech-nologies for achieving high-density optical backbone interconnection within such devices.

OWI72 2-to-Many Lossless Optical Multicast Using an Optical Crosspoint Switch Matrix, Zhaowang Wang1, Nan Cui1, Syuan Yue1; Dept. of Electronics and Information Engineering, Tianjin Univ., China, 2Dept. of Electrical and Electronic Engineering, Univ. of Bristol, UK. 2-to-many optical multicast without splitting loss is demonstrated using optical crosspoint switch matrix. Power penalty of <4.5dB is found in switched signals. The measured results confirm the excellent switching and multicasting characteristics of this device.

OWI73 High-Speed Optical Switching of InAlGaAs/InAlAs Multi-Mode Interference Photic Switch with Partial Index-Modulation Region (MIPS-P), Shingo Kama1, Tomohiro Ishikawa1, Atsuki Okazaki2, Hidetaka Utsuki1, Shigeru Amanai1, Kenji Shionoya1; 1Waseda Univ., Japan, 2Mitsubishi Chemical Corp., Japan. A semi-conductor multi-mode interference pho-tonic switch with partial index-modula-tion regions (MIPS-P) was fabricated, and we demonstrated high-speed switching operation in a switching time of about 1.3ns, for the first time, at a repetition rate of 104Hz.

OWI74 Recovery Dynamics of Optically Excited Semiconductor Optical Amplifiers, Robin P. Giller, Robert J. Manning; Tyndall Natl. Inst., Ireland. For the first time, an investiga-tion of the recovery dynamics of semi- conductor optical amplifiers explains why the ultrafast component of the gain recov-ery is largely absent in the phase response. This has important implications for signal processing.

OWI75 High-Speed Optical Characterization of Intensity and Phase Dynamics of a 1.55µm VCSEL for Short-Reach Applications, Franz Fuller1, Samir Cerimovic1, Christophe Dorrer2; 1Inst. of Communi-ca-tions and Radio-Frequency Engineering, Vienna Univ. of Technology, Austria, 2Bell Labs - Lucent Technologies, USA. Using sonograms and phase retrieval we experi-mentally investigate the pattern depend-ence of the amplitude and phase dynam-ics, the linewidth enhancement factor, and the chirp of a data-modulated 1.55µm vertical-cavity surface-emitting laser (VCSEL).

OWI76 100 GHz Spaced 10 Gbit/s WDM over 10 °C to 70 °C Using an Uncooled DMR Laser, Cyril C. Renaud1, Martyn J. Fice1, Ian Leham1, Paul Cammard1, Lesley Rivers1, Abwyn J. Seed1; 1Univ. College London, UK, 2Ctr. for Integrated Photonics, UK. 100 GHz spaced 10Gbit/s (NRZ, PRBS 231-1) WDM transmission is demonstrated with an uncooled DMR laser. The wavelength of the laser was stabilised within 2 GHz from 10 °C to 70 °C using a predicting algo-rithm.

OWI77 Coaxial Laser Diode Module with a Front Facet Power Monitor Photo Diode, Toshio Takagi1, Hiroshi Inada1, Yasushi Igha2, Yasushi Fujimura1, Hiromi Karashima1, Katsuuma Uesaka1, Hiroshi Nakashita1, Atsushi Miki2; 1Transmission Devices R&D Div., Sumitomo Electric Industries, Ltd., Japan, 2Optical Transmission Components Div., Sumitomo Electric Industries, Ltd., Japan. A novel structure of coaxial LD module with a high-speed front facet power monitor PD was successfully de-veloped. The PD current variation was ten times smaller than a conventional LD module. This module is suitable for auto-matic extinction ratio control.
OWI78 Helium Implanted Silicon Waveguide Photodetectors for Optical Power Monitors, Yang Liu, Chi Wai Chow, Wing Tiu Cheung, Hon Ki Tsang; Chinese Univ. of Hong Kong, Hong Kong Special Administrative Region of China. The enhanced photoresponse of helium ion implanted silicon waveguides as a function of different anneal temperatures and durations is reported. The enhancement in responsivity at communication wavelengths was sufficient for use as optical power monitors.

OWI79 Demonstration of 28 GHz Ring Resonator Based Electric-Optic Polymer Modulator, Hidehisa Tazawa1, Ying-Hao Kuo1,2; 1Dept. of Electronic Engineering, The Chinese Univ. of Hong Kong, Hong Kong, Hong Kong Special Administrative Region of China, 2Scuola Superiore Sant’Anna, Italy. An all-optical electro-optic modulator using polymer waveguides is demonstrated for the first time. An InP laser diode with an InGaAs/InP p-n junction provides an electro-optic effect. A 3 dB bandwidth of 7 GHz is achieved.

OWI80 Phase Correcting Element for Intra-Cavity Laser Beam Control, Fat Kit Lau1, Chyngwen Tee1, Xin Zhao1, Richard V. Penty1, Ian H. White1, Nicolas Michel1, Michel Krakowski2; 1Cambridge Univ., UK, 2Cambridge Univ., UK. A novel semiconductor laser cavity concept comprising an integrated phase correcting element is proposed and demonstrated. Characterization of the design for divergence angle reduction and near-field broadening revealed an improvement of 30.8% and 10.8%, respectively.

OWI81 Optical Modulator Bias Monitoring with Two-Photon-Absorption in Si-APD in Advanced Modulation Formats Optical Transmitters, Cechan Tian, Takao Naito; Fujitsu Labs of America, Inc, USA. We have demonstrated more sensitive monitoring of modulator bias point with two-photon-absorption in Si-APD. For NRZ, RZ and CS-RZ signals, the sensitivity with TPA monitoring is at least double that of with power monitoring.

OWI82 Widely Tunable Multi-Channel Grating Cavity Laser Based on a Light-Deflector, Kwon Oh-Kee, Jong-Hui Kim, Kang-Ho Kim, Eun-Deok Sim, Kwang-Ryong Oh; Electronics and Telecommunication Res. Inst., Republic of Korea. Widely tunable multi-channel grating cavity laser is proposed and demonstrated. It is realized by monolithically integrating all elements in an InP. Wavelength tuning of 30nm has been successfully achieved for the 6-channel device.

OWI83 All-Optical ASK Header and DPSK Payload Separator, C. H. Kwok, C. W. Chow, H. K. Tang, Chintoon Lon; Dept. of Electronic Engineering, The Chinese Univ. of Hong Kong, Hong Kong, Hong Kong Special Administrative Region of China. We demonstrate an all-optical scheme to separate ASK header and DPSK payload based on cross-gain-modulation and nonlinear polarization rotation in semiconductor optical amplifiers. The scheme is automatic and does not require any external header detector.

OWI84 Monolithically Integrated High Speed DFB BH Laser Arrays for 10Gb/s LX4 Application, Chien-chung Lin, Gideon Yoffe, Mark Emanuel, Steve Bishonton, Dinh Ton, Sarah Zou, Bo Lu, Bardas Pezeshk; Santor Corp., USA. A novel DFB laser array is demonstrated for application to the 10Gbit Ethernet LX4 scheme. The array delivers multiple mW output power and high-speed operation (3.125Gbps) at 850C.

OWI85 Inhibiting Pattern-Effects in Semiconductor Optical Amplifier Using Carrier Reservoir in an Asymmetrical Multiple Quantum Well Structure, S. M. Wani1, H. K. Tsang1, Y. S. Su2, C. F. Lin2; 1Dept. of Electrical Engineering, Chinese Univ. of Hong Kong, Hong Kong, Hong Kong Special Administrative Region of China, 2Dept. of Electrical Engineering, Natl. Taiwan Univ., Taiwan Republic of China. We propose an asymmetric quantum well semiconductor optical amplifier in which the wider bandgap quantum wells act as carrier-reservoirs replenishing carriers in narrower quantum wells of the active region. 10Gbps pattern-effect free gain was demonstrated.

OWI86 Burst Mode Operation of a DS-DBR Widely Tunable Laser for Wavelength Agile System Applications, Ben Puttnam1, Alessandro Biancotti2, Michael Dueser1, Benn C. Thomsen1, Roberto Gaudino2, Polina Bayvel1, Gianciuto Busico3, Lalitha Ponnampalam1, David Robbins2, Neil Whitbread3; 1Univ. College London, UK, 2Politecnico Di Torino, Italy, 3T-Systems, Germany. We demonstrate an integrated phase correcting semiconductor laser cavity concept comprising an integrated phase correcting element is proposed and demonstrated. Characterization of the design for divergence angle reduction and near-field broadening revealed an improvement of 30.8% and 10.8%, respectively.

OWI87 All-Optical Ultra-Fast 2x2 Switch Based on XPM-Induced Polarization Rotation in Highly Nonlinear Fiber, Gianluca Berritelli, Gianluca Meloni, Paolo Ghelfi, Antonella Bogoni, Luca Potti; 1CEIR-C, 2Politecnico Di Torino, Italy, 3T-Systems, Germany. A single mode coupled cavity laser is demonstrated as an XPM-based switch. A high power vertically emitting DFB laser is also demonstrated as a fast light switch using an angle-etch FIB process.
OW1 • 1:30 p.m.
ULH Systems with Strong Filters Acting as Amplitude Regenerators
Dov Levy, Mark Shafir; Tel Aviv Univ., Israel. It is shown that strong optical filtering taking place in dynamic gain equalizers can enhance or suppress amplitude noise, depending on filter positioning along the system. Considering the nonlinear dynamics, a strategy for effectively selecting filter positions is proposed.

OWK1 • 1:30 p.m. Tutorial
Electronic Dispersion Compensation, Doug McGhan, Maurice O’Sullivan, Chandra Bonta, Kim Roberts; Nortel, Canada. Electronic dispersion compensation promises to enable more flexible and cost effective high capacity optical networks by eliminating the need for fiber dispersion management and the associated optical domain dispersion compensation elements. This tutorial outlines current practical implementations and performance.

OWL • 1:30 p.m.
Hybrid and Monolithic Integration
Gregory Fish; Agility Communications Inc., USA, Presider

OWM1 • 1:30 p.m. Invited
High-Power Amplification of Ultrashort Pulses, Martin Ferman; IMRA America, USA. Self-similar propagation of similariton and cubicon pulses in optical fibers is reviewed. Asymptotic pulse solutions are obtained in the presence of self-phase modulation, gain and gain narrowing, allowing for the generation of high energy pulses in fiber oscillators and amplifiers.

OWN2 • 1:45 p.m.
Error-Free Spectral Encoding and Decoding Operation of InP O-CDMA Encoder, Jia Cao1, Ronald G. Brooker2, Nicolas K. Fontaine1, Wei Cong1, Chen Ji1, Yixue Du1, Nikolai Chubun1, Kania Ashard1, Anh Vu Pham1, J. P. Heritage1, B. H. Kohner2, S. J. B. You2, Fredrik Olson3, Sebastian Lourdoudess1, P. L. Stephenson1; 1Univ. of California at Davis, USA, 2Royal Inst. of Technology, Sweden, 3Lawrence Livermore Natl. Lab, USA. We report error-free spectral encoding and decoding operation of an InP monolithic, ultra-compact optical-CDMA encoder/decoder photonic chip pair. The experimental results demonstrate the strong potential for realizing high performance O-CDMA networks with InP micro-systems.
Much progress has been made in the effective control of optical systems and networks, and applications such as grid computing are developing architectures and middleware needing reconfigurable gigabit reconfigurability. However there are “seam” issues between the players that need to be solved if reconfigurable optical networking is to take off. This panel will bring together architects from equipment manufacturers, carriers, standards groups, and applications to discuss the status and prognosis for solving these “seam” issues.

**OWC2 • 1:50 p.m.**
Insights on Delivering an IP Triple Play over EPON and GPON, Mark Abrams, Ariel Maislos; Passave, USA. This presentation will examine ways for the carriers to utilize GPON and GE-PON technologies to deliver a carrier class quality full triple play with services being carried over IP.
OWJ3 • 2:00 p.m.
Effect of Partially Polarized ASE Noise on Q-Factor Estimation Using OSNR, Jun Huang Lee, Dong Min Yeo, Yun C. Chung, Korea Advanced Inst. of Science and Technology, Republic of Korea. We report on the effect of the partially polarized amplified spontaneous emission (ASE) noise on the Q-factor estimation by using optical signal-to-noise ratio (OSNR).

OWJ4 • 2:15 p.m.
A Simple Analytical Model for PMD Temporal Evolution, Cristian Antonelli1, Antonio Mecozzi2, Misha Brodsky2, Misha Boroditsky3; 1Univ. of L’Aquila, Italy, 2AT&T Research, USA. We introduce a simple two-parameter analytical model for the time dynamics of Polarization Mode Dispersion (PMD) and PMD-induced penalty based on the Ornstein-Uhlenbeck process, and demonstrate that it provides good agreement between theory, simulations and experimental results.

OWJ5 • 2:30 p.m.
Design of Raman-Based NOLM for Optical Transport Entities, Sonia Boscolo, Ranjeet Bhamber, Sergei K. Turitsyn; Photonics Res. Group, School of Engineering and Applied Science, Aston Univ., UK. We present a concept for all-optical DPSK signal regeneration, based on a new design of Raman-amplified nonlinear-loop-mirror (RA-NOLM). We demonstrate simultaneous amplitude-shape regeneration and phase noise reduction in high speed DPSK systems by use of the RA-NOLM combined with spectral filtering.

OWK • Dispersion Compensation and Monitoring—Continued

OWL • Hybrid and Monolithic Integration—Continued

OWL3 • 2:00 p.m.
Frequency Stability in High Speed Frequency Switching of Digitally Tunable Laser Using Ladder Filter, Shinji Matsuo, Soek-Hwan Jeong, Toru Segawa, Hiroshi Okamoto, Yoshihiro Kawaguchi, Yasuhito Kondo, Hiroyuki Suzuki, Yozo Yoshikuni; NTT Photonics Labs, Japan. A monolithically integrated digitally tunable laser has been developed that employs ladder filter and ring resonator. Device exhibits 34-channel (100-GHz spacing) digitally tunable laser operation and high speed frequency switching with the frequency drift less than 500 MHz.

OWL4 • 2:15 p.m.
External Cavity Wavelength Tunable Laser Utilizing On-Chip VOA, Shinya Sudo, Kenji Mizuno, Takashi Katazaki, Takeshi Okamoto, Kiyotaka Tsuura, Kenji Sato, Koji Kudo; System Devices Res. Labs, NEC Corp., Japan. We demonstrated an external cavity wavelength tunable laser using a novel gain chip with monolithically integrated VOA function. Over 15-dBm output power and an output power tuning range of 55 dB were obtained over the whole C-band.

OWL5 • 2:30 p.m.
Hybrid Integration of Access Modules Using Surface Mount Photonics, A. Benzoni; Xponent Photonics Inc, USA. No abstract available.

OWN • Optical Performance Monitoring—Continued

OWN2 • 2:00 p.m.
Bi2O3-Based Erbium Doped Fiber for Short Pulse Amplification, Seiki Ohara, Tatjana Nagaevskaya, Tomoharu Hasegawa, Naoki Sugiimoto; Aoihi Glass Co., Ltd., Japan. We demonstrate short pulse amplification, and compare the nonlinear tolerance of a Bi2O3-based erbium doped fiber (EDF) with a conventional silica-based EDF. The Bi2O3-based EDF shows highly nonlinear tolerance and superior short pulse amplification performances.

OWN3 • 2:15 p.m.
Multiple Phase-Shift All-Fibre DFB Lasers, Nyuk Y. Voo, Morten Ibsen; Univ. of Southampton, UK. A double-phase-shift Er/Yb fibre DFB laser shows a 50% reduction of the shift in lasing wavelength for increasing pump and a 10% reduction of the linewidth, compared to standard single phase-shifted fibre DFB designs.

OWN4 • 2:30 p.m.
A 13C2H2 Frequency-Stabilized, Polarization-Maintained 1.54 µm Erbium Fiber Ring Laser with a New Feedback System, Kenjiro Konno, Masato Miyazaki, Kenjiro Konno, Tohoku Univ., Japan. The frequency of a 1.54 µm erbium fiber laser was stabilized to a 13C2H2 absorption line by employing a new feedback system with a LiNbO3 frequency modulator and a double-balanced mixer. The stability reached as high as 2.2×10^-11 for τ=100 s.

OWN5 • 2:30 p.m.
Invited
Monitoring Requirements for Optical Transparent Networks, Wolfgang Grupp, Acterna Germany, Germany. The contribution addresses optical performance monitoring from a network management perspective. The applicability of optical power monitoring, spectral analysis and Q-factor measurements for fault configuration- and performance management of optical transport entities will be discussed.
 powered consumption only 30 mW without deterioration in the optical properties by using tapered narrow ridge structures.

OWP3 • 2:15 p.m.
Specification and Operation of 160 Gbit/s/Port Interface Optical Packet Switch Prototype with Narrow-Band Optical Code Label Processor and High Extinction Ratio Optical Buffer, Hideaki Furukawa, Naoyu Wada, Tetsuya Miyazaki; Natl. Inst. of Information and Communications Tech., Japan. We have achieved error-free 160 Gbit/s/port optical packet switching (OPS) operation with real packet BERs of less than 10^-10 by OPS prototype based on 25 Gchip/s narrow-band optical code label processor and optical buffers with noise reduction function.

OWP4 • 2:30 p.m.
Multi-Path, Multi-Wavelength Packet Routing at 40Gb/s over an SOA Based Optical Switch Fabric with Nanosecond Reconfiguration Time, Tieo Lin1, Kevin A. Williams1, Xavier G. H. Janssens1, Richard V. Penty1, Ian H. White1, Madeleine Glick2, Michael Dale2, 1Univ. of Cambridge, UK; 2Intel Res. Cambridge, UK. The first multi-path physical layer assessment of a multiple host routing system employing an optical switch fabric is reported. 40Gb/s data is routed from three inputs with wavelength and path dependant crosstalk contributing 0.3-0.6dB penalty.

NWA • Advances in PON Technology—Continued

Dr. Wei-Ping Huang received his bachelor’s degree from Shandong University, China, in 1982, a master’s degree in 1984 from the University of Science and Technology of China, and the Ph.D. degree in 1989 from MIT. He has held faculty positions at the University of Waterloo and McMaster University, Canada, as well as visiting, adjunct and consulting positions with academic and industrial institutions in China, U.S., Japan and Canada. Dr. Huang is internationally known for his contributions and expertise in photonic devices and integrated circuits. He has authored and co-authored over 120 journal papers and 70 conference papers and holds seven US patents. He is currently the project leader for the FTTH transceiver research and development at Ontario Photonics Consortium (OPC) and Canadian Institutes for Photonics Innovations (CIPI).

NWC • Broadband Technologies for Packet-Based Services—Continued

Wednesday, March 8
OWJ • Nonlinear and Propagation Effects—Continued

OWJ6 • 2:45 p.m.
High Extinction Ratio Pulse Generation from FM Modulated Signal Using Dispersion Imbalanced Fiber Loop Mirror, Shiquan Yang, Xiaoyi Bao; Dept. of Physics, Univ. of Ottawa, Canada. A dispersion imbalanced fiber loop mirror is used to compress the FM modulated optical signal to pulse and improve its extinction ratio simultaneously. The pulse-width is adjustable by controlling the driving RF power.

OWJ7 • 3:00 p.m.
Propagation Effects at High Bit Rates, Alexei Pilipetskii; Tyco Telecommunications, USA. The constant drive to increase bit rate per channel faces significant challenges due to linear and nonlinear propagation effects. Shorter pulses increase the sensitivity to dispersion effects including higher order, polarization mode dispersion and fiber nonlinearity.

OWK • Dispersion Compensation and Monitoring—Continued

OWK3 • 2:45 p.m.
In-Service Monitoring of Chromatic Dispersion and Polarization Mode Dispersion for RZ-DPSK Signal Based on Asynchronous Amplitude Histogram Evaluation, Zhihong Li, Guifang Li; College of Optics & Photonics: CREOL & FPCE, USA. We demonstrate an in-service monitoring technique based on asynchronous amplitude histogram evaluation for RZ-DPSK signals that can monitor chromatic dispersion and polarization-mode dispersion simultaneously. The principle of operation was studied and verified by experiments.

OWK4 • 3:00 p.m.
Chromatic Dispersion Monitoring Using Synchronous Sampling, Nairis Benlachtar, Robert J. Kelley, Polina Bayvel; Univ. College London, UK. We experimentally demonstrate that by synchronously sampling on both sides of the eye diagram, group velocity dispersion of up to 1800ps/nm can be accurately assessed. The effect of noise and self phase modulation on the accuracy is also investigated.

OWL • Hybrid and Monolithic Integration—Continued

OWL6 • 3:00 p.m.
A Low-Cost Micro-BOSA Using Si Microlenses Integrated on Si Optical Bench for PON Application, Hiroshi Sasaki, Masahiro Uekawa, Yoshinori Maeno, Kyoko Katani, Daiisuke Shimura, Ryo Sekikawa, Takehi Takamori, Teijiro Ori, Koichiro Masuka, Yoichiro Katokai; Oki Electric Industry Co., Ltd., Japan. We propose single TO-CAN type bi-directional optical sub-assembly in which, LD, PD chips, filter and Si microlenses are passively integrated on Si optical bench. High performance such as minimum sensitivity of -28dBm was experimentally demonstrated.

OWL7 • 3:15 p.m.
Integrated Optical Label Read and Pay-load Envelope Detection Circuit for Optical Label Swapping, Brian R. Koch, Zhiyuan Xing, John E. Bowers, Daniel J. Blumenthal; Univ. of California at Santa Barbara, USA. We demonstrate the first integrated 10 Gbps optical label recovery and 40 Gbps optical payload envelope detector circuit. Error free optical label recovery, nanosecond payload envelope detection, and optical label swapping are demonstrated.

OWN • Novel Fiber Lasers—Continued

OWN5 • 2:45 p.m.
ASE-to-Signal Coupling Limitations to Generate Hundreds to Thousands of Optical Replica from a Unique Pulse, Alain Joly, Jean Francois Gleyze, Patrick Le Boudec; 2CEA, France, 2IDIL, France. An efficient design using a re-circulation fibre loop is proposed to generate huge amounts of pulse-shape replica, from one single pulse at 1053nm. We analyze the limitations due to the ASE noise-to-signal sequential transfer.

OWN6 • 3:00 p.m.
A Novel Robust OSNR Monitoring Technique with 40-dB Dynamic Range Using Phase Modulator Embedded Fiber Loop Mirror, Yuenv-Ching Ku, Chun-Kit Chan, Lian-Kuan Chen; Chinese Univ. of Hong Kong, Hong Kong Special Administrative Region of China. A novel in-band OSNR monitoring technique using phase modulator embedded fiber loop mirror (PM-FLM) is proposed and demonstrated. Monitoring error can be kept <0.25dB for OSNR between 0 to 40dB in 10-Gb/s non-return-to-zero (NRZ) system.

OWN7 • 3:15 p.m.
Characterization of High-Speed Optical Pulses Based on Spectral Shearing Interferometry in Intensity Modulator with Bias Sweeper, Yasuyuki Ozaki, Shigenori Takasaka, Mitsu Sakamoto; PRESTO, Japan Science and Technology Agency, Japan, 2Furukawa Electric Co., Ltd., Japan. 10-GHz, pico-second optical pulse trains are experimentally characterized with high sensitivity and reliability. The principle is based on phase modulation in a Mach-Zehnder modulator and spectral fringe synthesis with a bias sweeper.
OWO • Planar Lightwave Circuits I: Design Innovations—Continued

OWP • Optical Packet Switching I—Continued

NWA • Advances in PON Technology—Continued

NWC • Broadband Technologies for Packet-Based Services—Continued
OWQ1 • 4:00 p.m. 
High-Bandwidth Biomedical, Telemedicine, and E-Earth Science Applications
and Their Requirements on Optical Transport Networks, Albert Yee; Calit2, Irvine Div., USA. No abstract available.

OWQ2 • 4:30 p.m.
Building Light-Forest to Support Group Multicast Sessions in Mesh-based Optical Grid Networks, Tanvir Rahman, Mohammad M. Ali, Georgios Ellinas; 1Graduate Ctr. CUNY, USA, 2Univ. of Cyprus, Cyprus. We investigate the problem of group multicasting in optical mesh networks using light-forests. Distributed concurrent light-trees are supported by a light-forest session. Our proposed linear light-trees for Drop-and-Continue node architecture show efficient light-forest construction.

OWQ3 • 4:30 p.m.
Experimental Investigations of Mode Group Diversity Multiplexing on Multimode Fibre, Stefan Schollmann, Chunmin Xia, Werner Rosenkranz; Univ. of Kiel, Germany. We present experimental possibilities of mode multiplexing using two launch positions and successful demultiplexing using two detection areas in order to double the data rate from 10 Gb/s to 20 Gb/s over multimode fibre.

OWR1 • 4:00 p.m.
Nonlinear Limitations of Electronic Dispersion Pre-Compensation by Intrachannel Effects, Axel Klekamp, Fred Buchali, Michel Audet; 1Henning Balou; 1Alcatel SEL AG, Germany, 2Alcatel CTT, France. The nonlinear-threshold characteristics of 30 Gbit/s transmission using electronic pre-compensation is studied by numerical simulations over 1 and 12 spans of 80km SMF for NRZ and DQPSK. We found a reduction of NLT of up to 9 dB for ASK.

OWR2 • 4:15 p.m.
Electrical Dispersion Compensation for Different Modulation Formats with Optical Filtering, Chunmin Xia, Werner Rosenkranz; Univ. of Kiel, Germany. We present electrical dispersion compensation by using maximum-likelihood-sequence-estimation (MLSE) and decision-feedback equalization for different modulation formats. Especially, MLSE performance with strong optical filtering is investigated.

OWR3 • 4:30 p.m.
Monolithically Integrated Widely Tunable Delayed Interference Based 40Gbps Wavelength Converter, Wenbin Zhao, Junqiu Liu, Chunmin Xia, Werner Rosenkranz; Chair for Communications, Univ. of Kiel, Germany. We present experimentally the possibility of mode multiplexing using two launch positions and successful demultiplexing using two detection areas in order to double the data rate from 10 Gb/s to 20 Gb/s over multimode fibre.

OWS1 • 4:00 p.m.
Experimental Demonstration of Slow Light via Four-Wave Mixing in Semiconductor Optical Amplifiers, Zhangxuan Chen, Bala Pesalu, Connie Chang-Huaun; Univ. of California at Berkeley, USA. We demonstrate experimentally the generation of slow light at room temperature via four-wave mixing in SOAs. Tunable delays up to 913 ps were obtained at 0.5 GHz, corresponding to a record delay-bandwidth product of 0.46.

OWS2 • 4:15 p.m.
An Automatic Gain-Controlled Raman/Gain-Clamped SOA for Metro WDM Networks with Changes in Span Loss, Han Hyub Lee, Sang Geun Koo, Donghan Lee; Chungnam Natl. Univ., Republic of Korea. We propose an automatic gain-controlled semiconductor based hybrid optical amplifier that consists of a Raman fiber amplifier and a gain-clamped SOA. The signal power remains within 0.15 dB when the span loss is varied from +5 dB to -5 dB.

OWS3 • 4:30 p.m.
Monolithically Integrated Widely Tunable Delayed Interference Based 40Gbps Wavelength Converter, Wenbin Zhao; Milan Musanovic, Vikrant Lal, David Wolfson; Gregory A. Fish; Daniel J. Blumenthal; Univ. of California at Santa Barbara, USA, 1Agility Communication Inc, USA. 40 Gbps operation of a novel monolithically integrated wavelength converter consisting of a sampled grating DBR laser, long SOA and a delay interferometer (D1)-MZI is reported. Chip performance is studied in detail as function of output filter bandwidth and detuning.

OWT1 • 4:00 p.m.
Tutorial
Fiber Parametric Amplifiers, R. M. Jopson; Bell Labs, Lucent Technologies, USA. Parametric gain has been used extensively in bulk optic systems. As high pump powers become available and highly nonlinear fiber continually improves, fiber-based parametric gain promises to find extensive application as well.

OWT2 • 4:30 p.m.
Optical Networking Testbeds in China, Jintong Lin, Jian Wu; Beijing Univ. of Posts and Telecoms, China. National R&D activities on optical networking testbeds in China, including CAINONET, 3Tnet and OBS testbeds, are described for investigating key technologies of next generation optical networking.

OWU1 • 4:00 p.m.
Optical Networking Testbeds in Europe, Bernhard Fabianek; European Commission, Belgium. This talk will present an update on the status of optical networking testbeds and the large scale utilisation of photonic communications systems by the research community in Europe.
X-Couplers via Direct UV Writing, Single-Step Fabrication of Raised Index PLCs.

OWW1 • 4:00 p.m. Invited Recent Advances on Laser Processing in Silica-Based PLCs, Masaki Kohtoku, Yusuke Nasa, Makoto Abe; NTT Photonics Labs, Japan, Laser processing is a powerful tool for realizing highly functional silica-based PLCs that can provide simple methods for tuning device characteristics and enhance new functionalities. This letter reviews and pick up the topics of laser processing technologies for silica-based PLCs.

OWW2 • 4:30 p.m. Single-Step Fabrication of Raised Index X-Couplers via Direct UV Writing, Faisal Rafiq Mahamd Adikan1, Corin B. E. Gawith1, Peter G. R. Smith1, Ian J. G. Sparrow1, Gregory D. Emmerson2, Christos Riziotis3; 1Optoelectronics Res. Ctr., Univ. of Southampton, UK, 2Stratophase Ltd., UK, Gawith, Christos; Univ. of Peloponnese, Greece. Recent Advances on Laser Processing in Silica-Based PLCs, Masaki Kohtoku, Yusuke Nasa, Makoto Abe; NTT Photonics Labs, Japan, Laser processing is a powerful tool for realizing highly functional silica-based PLCs that can provide simple methods for tuning device characteristics and enhance new functionalities. This letter reviews and pick up the topics of laser processing technologies for silica-based PLCs.

OWW2 • 4:30 p.m. 160 Gb/s Raman-Assisted Notch-Filtered XPM Wavelength Conversion and Transmission, Michael Galili, Leif K. Oxenløwe, Hans C. H. Mulvad, Darko Zibar, Anders T. Clausen, Palle Jeppesen; Res. Ctr. COM, Denmark. In-line wavelength conversion of 160 Gb/s data by Raman-assisted notch-filtered XPM is demonstrated for 130 km total transmission. The improvement in system performance from applying Raman gain during conversion is shown.

OWW3 • 4:40 p.m. Digital Work Design Tools for FFTP, Aaron J. Johnson1, George H. Collier2, Stanley T. Sarama1, Julie Charland2, Antoine Dagenais 3, Marcel Kroh, Sebastian Ferber, Corin B. E. Gawith1, Peter G. R. Smith1, Ian J. G. Sparrow1, Gregory D. Emmerson2, Christos Riziotis3; 1Optoelectronics Res. Ctr., Univ. of Southampton, UK, 2Stratophase Ltd., UK, 3Univ. of Peloponnese, Greece. Recent Advances on Laser Processing in Silica-Based PLCs, Masaki Kohtoku, Yusuke Nasa, Makoto Abe; NTT Photonics Labs, Japan, Laser processing is a powerful tool for realizing highly functional silica-based PLCs that can provide simple methods for tuning device characteristics and enhance new functionalities. This letter reviews and pick up the topics of laser processing Technologies for silica-based PLCs.
OWQ3 • 4:45 p.m.
Managing and Controlling GMPLS Network Resources for Grid Applications, Michiaki Hayashi1, Takahiro Miyamoto1, Tomohiro Otani1,2, Hideaki Tomotani, Atsuko Tikefusia, Hidenori Nakadaita, Tomohiro Kudoh1, Naohide Nagatatsu, Yasunori Sameehima1, Shuichi Okamoto1,2; 1KDDI R&D Labs Inc., Japan, 2NICT, Japan. We report the first demonstration of a workflow for GMPLS network management and control for a grid computing application.

OWR4 • 4:45 p.m.
Experimental Demonstration of Postnonlinearity Compensation in a Multi-Span DPSK Transmission, Guanghao Zhu, Linn Mollenauer, Chris Xu; Cornell Univ., USA. We demonstrate performance improvement in a multi-span 10Gb/s DPSK transmission by employing postnonlinearity compensation. Significant improvements in BER were obtained for both dispersion managed soliton and quasi-linear transmission.

OWS5 • 5:00 p.m.
New Operation Scheme of SOA-MZI All-Optical Wavelength Converter Canceling Cross Gain Modulation, Masaharu Hattori, Kobsuke Nishimura, Sigezuki Watanabe; KDDI R&D Labs Inc., Japan. New operation scheme of SOA-MZI all-optical wavelength converter by which effect of cross gain modulation is cancelled out utilizing bidirectional data signal input is proposed and experimentally verified for the first time.

OWT2 • 5:00 p.m.
A Novel Demultiplexer for Ultra High Speed Pulses Using a Perfect Phase-Matched Parametric Amplifier, Shunsuke Ono, Ryo Okabe, Fumio Futami, Hideaki Tomotani; Fujitsu Labs, Japan. A novel transparent demultiplexer for ultra fast pulse trains using a 19 m long HNLF-based parametric amplifier is proposed. Using this multiplexer, 320-10 Gb/s transparent OTDM DEMUX with parametric gains over 20 dB were successfully implemented.

OWU3 • 5:00 p.m. Invited
Today’s Optical Network Research Infrastructures for E-Science Applications, Gigi Karmous-Edwards; MCNC, USA. Some of today’s scientific discoveries (E-science) involve both compute intensive and data intensive applications requiring collaboration on a global scale, and high capacity Optical infrastructures. This talk will discuss some of the optical networking challenges.
OWV • Planar Lightwave Circuits II: Advances in Fabrication—Continued

OWV3 • 4:45 p.m.
Fabrication and Investigation of Fast Response Variable Optical Attenuator on Silica Substrate, Kotaro Tanaka, Nobuaki Kitano, Yukio Abe, Haruyasu Komano, Takaumi Chiba, Masahiro Okawa, Seiichi Kashimura, Hisato Uetsuka; Hitachi Cable, Ltd., Japan. We have developed fast response variable optical attenuator (VOA) on silica substrate by analyzing thermal response using equivalent circuit. The response time and power consumption are 2.5msec and 100mW respectively.

OWV4 • 5:00 p.m.
Ultra-Compact 3-Port WDM Filter Arrays Based on Novel Planar Lightwave Circuit Assembly Technique, Michiko Harumoto, Osamu Shimakawa, Kenichiro Takahashi, Mitsuki Tanuma; Sumitomo Electric Industries, Ltd., Japan. We propose a novel configuration of ultra-compact 1310/1490/1550-nm WDM filter arrays compounded of a thin-film filter and two planar lightwave circuits. By using simple assembly techniques to optimize the arrangement, the insertion loss less than 0.7 dB is successfully achieved.

OWW • Optical Processing—Continued

OWW3 • 4:45 p.m.
35-dB Channel Suppression in OTDM Add-Drop Multiplexing Based on Time-Frequency Signal Processing, Paulo J. S. Almeida, Francesca Parmigiani, Martien Ibsen, Kazunori Mukasa, Periklis Petropoulos, David J. Richardson; Univ. of Southampton, UK. We demonstrate a time division add/drop multiplexer based on TDM-WDM-TDM conversion and fiber Bragg grating (FBG) filters with 35-dB channel suppression for the dropped channel. No crosstalk penalty is observed between the added and through channels at 40Gb/s.

OWW4 • 5:00 p.m.
High-Speed Broadband Polarization-Independent Optical Clock Recovery in a Silicon Detector, Amir A. Ahmadz, Reza Salem, Thomas E. Murphy; Univ. of Maryland, USA. We have successfully used a silicon detector for optical clock recovery at 1550 nm and speeds up to 80 Gb/s. We introduce a novel optical dithering scheme that eliminates polarization dependence without introducing additional jitter.

NWD • FTTX Design and Components—Continued

NWD3 • 5:00 p.m.
Planar Lightwave Circuits for PON Applications, Kenneth A. McGreer, Hao Xu, Calvin Ho, Nizar Kheraj, Qing Zhu, Marc Stiller, Jane Lam; Neophotonics, USA. Many components used in passive optical networks can be fabricated on a planar lightwave circuit using Y-branches and Mach-Zehnder interferometers. Reliable 1x32 splitters, broadband 2x2 splitters, 2x32 splitters, and video overlay filters are demonstrated.

NWF • Ethernet and Packet-Based Networks—Continued

NWF3 • 5:00 p.m.
Packet and TDM Transport Integration: How, When and Why? Tom Rarick1, Steve Gringeri2; 1Tellabs, USA, 2Verizon, USA. This paper describes NG Transport and introduces the Optical Transport Platform (OTP). The OTP combines flexible DWDM with ROADM technology, TDM grooming, and packet transport. The interworking between these technologies provides an effective transition platform to the NG transport network.
This paper experimentally evaluates the provisioning and switching performance in a photonic IP network.

OWQ5 • 5:15 p.m.
Demonstration of Automatic Multi-Reliability Service Class LSP Provisioning via Coordination of GMPLS/OIF-OUNI protocols is successfully demonstrated for the first time. This paper experimentally evaluates the provisioning and switching performance in a photonic IP network.

OWQ6 • 5:30 p.m.
Design of MPLS/GMPLS Multilayer Network Considering Protection and Restoration, Wataru Imajuku1, Takuya Ohara1, Ryota Takehira2, Tomohiko Uyematsu3, Ken-Ichi Sato1; 1NTT, Japan, 2Tokyo Inst. of Technology, Japan, 3Nagoya Univ., Japan. This paper presents a study on the design of an MPLS/GMPLS multilayer network. This paper evaluates the impact of the optical path creation policy according to the electrical path demand considering optical path protection and restoration.

OWQ7 • 5:45 p.m.
Router-OXC Cooperation for Fault Recovery Employing GMPLS Control Plane for Photonic IX, Mitsunori Fukutoku, Tomohito Kurashahi, Yukiyasu Irie2, Ippei Shake1, Wataru Imajuku1, Shuto Yamanoto1, Koji Sasayama1; 1NTT, Japan, 2Internet Initiative Japan Inc., Japan, 3Internet Multifeed Co., Japan. This paper proposes fault recovery procedures to improve the reliability and network resource utilization of photonic Internet Exchanges employ cooperation between routers and OXCs using GMPLS control plane. The experimental results that confirm the feasibility of the proposed procedures.
OWV • Planar Lightwave Circuits II: Advances in Fabrication—Continued

OWV5 • 5:15 p.m.
Tunable Gain Tilt Compensator Using Adiabatic Mode Multiplexing, Romanas Narevich1, Edvordas Narevicius1, Gerhard Heise2, Jens Dieckroeger2, Detlef Krabe2, Sunil Survaiya2, Peter Schicketanz2, Ilya Vorobiechik1, Edwin Wagner1, Steve Wang2; 1OpTun Inc., USA, 2OpTun GmbH, Germany. We built gain tilt compensator in silica on silicon using adiabatic mode multiplexer and y-branch based Mach-Zehnder interferometer. Process and design tolerant building blocks allow flexibility in achieving required response, either normally bright or tilted, and excellent optical performance.

OWW • Optical Processing—Continued

OWW5 • 5:15 p.m.
Tunable All-Optical Wavelength Conversion of 160 Gbit/s RZ Signals Based on Cascaded SFG-DFG in PPLN Waveguide, Hideaki Furukawa1, Ampalavanapillai Nimalalathas, Naoya Wada1, Satoshi Shinada1, Hiroshi Tsukuba, Tetsuya Miyazaki1; 1Natl. Inst. of Information and Communications Technology, Japan, 2Univ. of Melbourne, Australia, 1OPTOQUEST CO., Ltd., Japan. We first report on error-free tunable all-optical wavelength conversion of 160 Gbit/s return-to-zero signals based on cascaded sum-frequency and difference-frequency generation in a periodically poled LiNbO3 waveguide. The BER of less than 10^-9 is achieved in 23 nm tuning range.

NWD • FTTX Design and Components—Continued

NWD5 • 5:20 p.m.
Novel Passive Free Space Compact CWDM Technology for Outdoor Applications, Ji Pan, Yousheng Wu, Joy C. Jiang, James Guo, Kejian Guan, Yafei Zheng; Lightwaves2020 Inc, USA. Utilizing unique technologies of thin film coatings and compact no-shift packaging, a novel free-space optics CWDM module is introduced. The total loss of a 8-channel module is only 0.7dB within ±7.5nm passband, and PDL of 0.1dB.

NWD6 • 5:40 p.m.
Raman Crosstalk Control in Passive Optical Networks, Barry Calella, Frank J. Effenberger, Cory Shimer, Feng Tian; Motorola, USA. We present a new solution to the Raman coupling problem in PON systems carrying sub-carrier modulated analog video. This is done by shaping the spectrum of the digital signals while maintaining the line signal format.

NWF • Ethernet and Packet-Based Networks—Continued

NWF5 • 5:20 p.m.
Next-Generation Packet-Based Transport Networks Economic Study, Don O’Connor, Sunan Han, William Yue; Fujitsu Network Communications, USA. Abstract: This paper investigates the potential advantages of packet-based transport by providing a quantitative economic comparison between a model Packet Transport Network (PTN) and a model Circuit Switched Transport Network (CTN).

NWF6 • 5:40 p.m.
Converged Network Management: Challenges and Solutions, Praveen Gorur; Wipro Technologies, India. With traditional SONET/SDH, wireless and wireline networks converging, network management of converged networks in becoming a challenge. This paper explores the various challenges faced and possible solutions in building an unified network management solution.