THURSDAY 14:00 – 15:30
ROOM SALER
PDP.1
Chair: Peter Krummrich, Technische Universität Dortmund, Germany

PDP.1.1 ● 14:00 – 14:15

Elephant Coupler: Vertically Curved Si Waveguide with Wide and Flat Wavelength Window Insensitive to Coupling Angle

T. Yoshida, E. Omoda, Y. Atsumi, M. Mori, Y. Sakakibara
Electronics and Photonics Research Institute, National Institute of Advanced Industrial Science and Technology (AIST), 1-1-1, Umezono, Tsukuba, Ibaraki, 305-8568, JAPAN

Few-micron-scale vertical silicon coupler that has high coupling efficiency, weak wavelength dependence, and weak incident angle dependence of wavelength window was achieved with vertically curved silicon waveguide "elephant coupler" formed by ion implantation method compatible with LSI manufacturing technology.

PDP.1.2 ● 14:15 – 14:30

Ultra-Compact Plasmonic IQ-Modulator

C. Haffner[1*], W. Heni[1*], Y. Fedoryshyn[1], B. Baeuerle[1], A. Josten[1], Y. Salamin[1], R. Bonjour[1], C. Hoessbacher[1], A. Emboras[1], D. L. Elder[2], P. Leuchtmann[1],D. Hillerkuss[1],L. R. Dalton[2], C. Hafner[1], and J. Leuthold[1*]
[1]ETH Zurich, Institute of Electromagnetic Fields, Zurich, Switzerland,
[2]University of Washington, Department of Chemistry, Seattle, WA 98195-1700, United States

Plasmonic IQ-modulators with a record small footprint are demonstrated to operate up to 72 GBd. The devices have shown the ability to encode QPSK and 16-QAM modulation formats with power consumption as low as 27 fJ/bit at 18 GBd-16QAM.

PDP.1.3 ● 14:30 – 14:45

Error-free 56 Gb/s NRZ Modulation of a 1530 nm VCSEL Link

Daniel M. Kuchta[(1)], Fuad E. Doany[(1)], Laurent Schares[(1)], Christian Neumeyr[(2)], Aidan Daly[(2)], Benjamin Kögel[(2)], Jürgen Rosskopf[(2)], and Markus Ortsiefer[(2)]
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[(2)] Vertilas GmbH, Daimlerstrasse 11d, 85748 Garching, Germany

We demonstrate a 1530 nm VCSEL that can operate error-free without DSP or FEC to 56 Gb/s. At 50 Gb/s, error-free operation is attained up to 2 km of SMF. A 2-tap FFE driver is used to precompensate the VCSEL.

PDP.1.4 ● 14:45 – 15:00

100 Gbit/s OOK Using a Silicon-Organic Hybrid (SOH) Modulator

W. Hartmann[(1,2)], M. Lauermann[(1)], S. Wolf[(1)], H. Zwickel[(1)], Y. Kutuvantavida[(1,2)], J. Luo[(3)], A. K.-Y. Jen[(3)], W. Freude[(1)], C. Koos[(1,2)]

[(1)] Karlsruhe Institute of Technology, Institute of Photonics and Quantum Electronics, Karlsruhe, Germany

[(2)] Karlsruhe Institute of Technology, Institute of Microstructure Technology (IMT), Karlsruhe, Germany

[(3)] Department of Materials Science and Engineering, University of Washington, Seattle, Washington, USA

We demonstrate a silicon-organic hybrid (SOH) Mach-Zehnder modulator suitable for 100 Gbit/s on-off keying (OOK) with peak-to-peak drive voltages of 1.4 V and energy consumption below 100 fJ/bit. Devices were fabricated using standard processes on a commercial silicon photonic platform.

PDP.1.5 ● 15:15 – 15:30

Low cost 112 Gb/s InP DFB-EAM for PAM-4 2 km Transmission

C. Caillaud[(1)], M. A. Mestre Adrover[(2)], F. Blache[(1)], F. Pommereau[(1)], J. Decobert[(1)], F. Jorge[(1)], P. Charbonnier[(1)], A. Konczykowska[(1)], J.-Y. Dupuy[(1)], H. Mardoyan[(2)], K. Mekhazni[(1)], J.-F. Paret[(1)], M. Faugeron[(1)], F. Mallecot[(1)] and M. Achouche[(1)]

(1) III-V lab, a joint laboratory between ALBLF, TRT and CEA Leti

(2) Alcatel-Lucent Bell Labs France

A 112-Gb/s PAM4 transmitter module which integrates InP DFB and EAM demonstrated for the first time 2 km transmission with only 3-taps equalizer due to 50 GHz bandwidth, >13 dB extinction ratio and 1.5 mW output power.

THURSDAY 14:00 – 15:30
ROOM PERELLO
PDP.2
Chair: Ton Koonen, COBRA TU Eindhoven, The Netherlands

PDP.2.1 ● 14:00 – 14:15

Efficient Annular Cladding Amplifier with Six, Three-Mode Cores

Cang Jin[1;2], Bin Huang[1;3], Kuanping Shang[1], Haoshuo Chen[1], Roland Ryf[1], R. J. Essiambre[1], Nicolas K. Fontaine[1], Guifang Li[3], L. Wang[2], Y. Messaddeq[2], S. LaRochelle[2]

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[3] CREOL, the University of Central Florida, Orlando, Florida 32816, USA

We demonstrate a multi-core, multi-mode optical amplifier with 18 spatial channels pumped by a single 15-W multi-mode pump diode. The amplifier has >20-dB gain per mode, <3-dB mode and core dependent gain, and >31 mW per spatial channel.

PDP.2.2 ● 14:15 – 14:30

160-Gbps Nyquist PAM4 Transmitter Using a Digital-Preprocessed Analog-Multiplexed DAC

Hiroshi Yamazaki[(1,2)], Munehiko Nagatani[(1,2)], Shigeru Kanazawa[(3)], Hideyuki Nosaka[(2)], Toshikazu Hashimoto[(2)], Akihide Sano[(1)], and Yutaka Miyamoto[(1)]

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[(2)] NTT Device Technology Labs., NTT Corporation, 3-1 Morinosato-Wakamiya, Atsugi, Kanagawa, Japan

[(3)] NTT Device Innovation Center, NTT Corporation, 3-1 Morinosato-Wakamiya, Atsugi, Kanagawa, Japan

We proposed an ultra-wide-band DAC configuration consisting of a digital preprocessor, two sub-DACs, and an analog multiplexer. The output bandwidth is nearly doubled from that of the sub-DACs. The idea was verified by a 160-Gbps Nyquist PAM4 transmission.

PDP.2.3 ● 14:30 – 14:45

Polarization Division Multiplexed Intensity, Inter Polarization Phase and Inter Polarization Differential Phase Modulation with Stokes Space Direct Detection for 1λ×320 Gb/s 10 km Transmission at 8 bits/symbol

M. Morsy-Osman[(1)], M. Chagnon[(1)], D. V. Plant[(1)]

[(1)] ECE dept., McGill University, Montréal, Qc, H3A 2A7, Canada,

We propose modulation and Stokes space direct-detection of four orthogonal degrees of freedom of one laser; the intensity on two polarizations, inter-polarization phase and inter-polarization differential phase, to achieve 320 Gb/s 10 km transmission <HD-FEC at 8 bits/symbol.

PDP.2.4 ● 14:45 – 15:00

Direct Detection Transceiver at 150-Gbit/s Net Data Rate Using PAM 8 for Optical Interconnects

M. A. Mestre[(1)], H. Mardoyan[(1)], A. Konczykowska[(2)], R. Rios-Müller[(1)], J. Renaudier[(1)], F. Jorge[(2)], B. Duval[(2)], J-Y. Dupuy[(2)], A. Ghazisaeidi[(1)], P. Jennevé[(1)], S. Bigo[(1)]

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[(2)] III-V Lab-Common laboratory of Alcatel-Lucent Bell Labs France', 'Thales Research and Technology' and 'CEA Leti', Route de Nozay, 91460 Marcoussis, France

We demonstrate a single-polarization driver-free, direct-detection 56-GBaud PAM-8 transceiver enabled by a high-speed selector power DAC fabricated in InP DHBT, and successfully transmit 168 Gbit/s line-rate over 2 km distance without optical amplification.

PDP.2.5 ● 15:00 – 15:15

Distributed 1-Tb/s All-Optical Aggregation Capacity in 125-GHz Optical Bandwidth by Frequency Conversion in Fiber

Thomas Richter[1], Carsten Schmidt-Langhorst[1], Robert Elschner[1], Lutz Molle[1], Saleem Alreesh[1] Tomoyuki Kato[2], Takahito Tanimura[2], Shigeki Watanabe[2], Johannes Karl Fischer[1], Colja Schubert[1]

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[(2)] Fujitsu Laboratories Ltd., 4-1-1 Kamikodanaka, Nakahara-ku, Kawasaki 211-8588, Japan

We demonstrate the spatially distributed aggregation of four 31.1-GBd PDM-32QAM sub-carriers into a 1-Tb/s net data rate superchannel occupying only 125-GHz optical bandwidth, and its subsequent transmission over 160-km SSMF with broadband reception in a single coherent receiver.

THURSDAY 14:00 – 15:30
ROOM MALVARROSA
PDP.3
Chair: Ronald Freund, Fraunhofer Heinrich Hertz Institute, Germany

PDP.3.1 ● 14:00 – 14:15

2.15 Pb/s Transmission Using a 22 Core Homogeneous SingleMode Multi-Core Fiber and Wideband Optical Comb

B. J. Puttnam [(1)], R. S. Luís[(1)] , W. Klaus, J. Sakaguchi, J.-M. Delgado Mendinueta[(1)] , Y. Awaji[(1)] , N. Wada[(1)], Yoshiaki Tamura[(2)] , Tetsuya Hayashi[(2)] , Masaaki Hirano[(2)] and J. Marciante[(3)]

[(1)] Photonic Network System Laboratory, National Institute of Information and Communications Technology (NICT), 4-2-1 Nukui-Kitamachi, Koganei, Tokyo 184-8759, Japan. [(2)] Sumitomo Electric Industries, Ltd., 1, Taya-cho, Sakae-ku, Yokohama, 244-8588. Japan [(3)] RAM Photonics, 4901 Morena Blvd., Suite 128, San Diego, CA 92117, USA.

We use a wideband optical comb source with 10THz bandwidth for 2.15 Pb/s transmission over 31km of a new, homogeneous 22-core single-mode multi-core fiber using 399 x 25GHz spaced, 6.468 Tb/s spatial-super-channels comprising 24.5GBaud PDM-64QAM modulation in each core.

PDP.3.2 ● 14:15 – 14:30

2.05 Peta-bit/s Super-Nyquist-WDM SDM Transmission Using 9.8-km 6-mode 19-core Fiber in Full C band

D. Soma [(1)] , K. Igarashi [(1,2)] , Y. Wakayama [(1)] , K. Takeshima [(1)] , Y. Kawaguchi [(1)] , N. Yoshikane [(1)] , T. Tsuritani [(1)] , I. Morita [(1)] , and M. Suzuki [(1)]

[(1)] KDDI R&D Laboratories Inc., 2-1-15 Ohara, Fujimino-shi, Saitama, 356-8502 Japan, da-souma@kddilabs.jp [(2)] Osaka University, 2-1 Yamadaoka, Suita-shi, Osaka, 565-0871 Japan

We demonstrate ultra-dense SDM transmission of 360-channel Super-Nyquist-WDM DPQPSK signals over 9.8-km 6-mode 19-core fiber, achieving the record fiber capacity of 2.05 Pbit/s (360WDMx114SDMx50Gbit/s) with the highest aggregate spectral efficiency of 456 bit/s/Hz.

PDP.3.3 ● 14:30 – 14:45

10-Mode Mode-Multiplexed Transmission over 125-km Single-Span Multimode Fiber

R. Ryf[(1)], H. Chen[(1)], N. K. Fontaine[(1)], A. M. Velazquez-Benítez [(1,2,3)], Jose Antonio-López[(3)], C. Jin[(1,4)] , B. Huang[(1,3)], M. Bigot-Astruc [(5)], D. Molin[(5)], F. Achten[(5)], P. Sillard[(5)], R. Amezcua-Correa[(3)]

[(1)]Bell Laboratories, Alcatel-Lucent, 791 Holmdel-Keyport Rd, Holmdel, NJ, 07733, USA [(2)] Instituto de Investigaciones en Materiales, UNAM, Cd Universitaria, D.F., 04510, Mexico [(3)] CREOL, the University of Central Florida, Orlando, Florida 32816, USA [(4)]COPL, Universite Laval, Quebec QC, Canada G1V0A6 [(5)]Prysmian Group, Parc des Industries Artois Flandres, 62092 Haisnes Cedex, France.

We demonstrate combined wavelength- and mode-multiplexed transmission over a 125-km multimode single span composed of 10- and 15-mode fibers with a spectral efficiency of 29 b/s/Hz. A transmission capacity of 115.2 Tb/s is achieved over a distance of 87 km.

PDP.3.4 ● 14:45 – 15:00

Experimental Demonstration of Capacity Increase and Rate-Adaptation by Probabilistically Shaped 64-QAM

F. Buchali[(1)], G. Bocherer [(2)], W. Idler[(1)], L. Schmalen[(1)], P. Schulte[(2)], and F. Steiner[(2)]
[(1)] Alcatel-Lucent Bell Labs, Stuttgart, Germany, [(2)] Technische Universitat Munchen, Germany

We implemented a flexible transmission system operating at adjustable data rate and fixed bandwidth, baudrate, constellation and overhead using probabilistic shaping. We demonstrated in a transmission experiment up to 15% capacity and 43% reach increase versus 200 Gbit/s 16-QAM.

THURSDAY 14:00 – 15:30
ROOM PINEDO
PDP.4
Chair: Andreas Kirstaedter, University of Stuttgart, Germany

PDP.4.1 ● 14:00 – 14:15

First Demonstration of Multi-vendor and Multi-domain EON with S-BVT and Control Interoperability over Pan-European Testbed

O. Gonzalez de Dios[(1)], R. Casellas[(2)] , F. Paolucci[(3)], A. Napoli[(4)] , Ll. Gifre[(5)] , S. Annoni[(6)] , S. Belotti[(6)] , U. Feiste[(4)] , D. Rafique[(4)] , M. Bohn[(4)] , S. Bigo[(7)] , A. Dupas[(7)] , E. Dutisseuil[(7)] , F. Fresi[(3)] , , B. Guo[(8)] , E. Hugues[(8)] , P. Layec[(7)] ,V. López[(1)] , G. Meloni[(3)] , S. Misto[(6)] , R. Morro[(9)] , T. Rahman[(10)] , G. Khanna[(11)] , R. Martínez[(2)] , R. Vilalta[(2)] , F. Cugini[(3)] , L. Potì[(3)] , A. D'Errico[(12)], R. Muñoz[(2)] , Y. Shu[(8)] , S. Yan[(8)] , Y. Yan[(8)] , G. Zervas[(8)] , R. Nejabati[(8)] , D. Simeonidou[(8)] , L. Velasco[(5)] and J. Fernández-Palacios[(1)]
[(1)] Telefónica I+D, Spain, [(2)] CTTC, Spain, [(3)] CNITScuola Superiore Sant' Anna, Italy, [(4)] Coriant R&D, Germany, [(5)] UPC GCO, Spain, [(6)] Alcatel-Lucent, Italy, [(7)] Alcatel-Lucent, France, [(8)] University of Bristol, UK, [(9)] Telecom Italia, Italy, [(10)] TU/e Eindhoven, Netherlands, [(11)] Technische Universität München, Germany, [(12)] Ericsson Research, Italy.

The operation of multi-domain and multi-vendor EONs can be achieved by interoperable Sliceable Bandwidth Variable Transponders, a GMPLS / BGP-LS-based control plane and a planning tool. This paper reports the first full demonstration and validation this end-to-end architecture.

PDP.4.2 ● 14:15 – 14:30

LIGHTNESS: A Deeply-Programmable SDN-enabled Data Centre Network with OCS/OPS Multicast/Unicast Switch-over

G. M. Saridis[(1)] , S. Peng[(1)] , Y. Yan[(1)] , A. Aguado[(1)] , B. Guo[(1)] , M. Arslan[(1)] , C. Jackson[(1)] , W. Miao[(2)] , N. Calabretta[(2)] , F. Agraz[(3)] , S. Spadaro[(3)] , G. Bernini[(4)] , N. Ciulli[(4)] , G. Zervas[(1)] , R. Nejabati[(1)] , D. Simeonidou[(1)]
[(1)] HPN, University of Bristol, U.K., [(2)] COBRA, Eindhoven University of Technology, the Netherland, [(3)] Universitat Politecnica de Catalunya, Spain, [(4)] Nextworks, Pisa, Italy.

We demonstrate an all-optical dynamic DCN utilizing a fully SDN-enabled data-plane including programmable FPGA-based NICs, offering Network Function Virtualization OCS/OPS driven multicasting for Virtual DC applications enabling link recovery and VM migration.

PDP.4.3 ● 14:30 – 14:45

Demonstration of symmetrical 25 Gbps TDM-PON with 31.5 dB optical power budget using only 10 Gbps optical components

Vincent Houtsma and Doutje van Veen
Bell-Labs/Alcatel Lucent, Murray Hill, New Jersey, USA,

First demonstration of symmetrical 25-Gbps TDM-PON with 31.5-dB class N2 power-budget over 0-20 km at 1556-nm using only 10-Gbps optical components. EDFAs are used as booster and preamplifier at the OLT. Low-cost dispersion compensating schemes are applied to increase reach.

PDP.4.4 ● 14:45 – 15:00

First Demonstration of Real-Time End-to-End 40 Gb/s PAM-4 System using 10-G Transmitter for Next Generation Access Applications

Jinlong Wei[(1)], Nicklas Eiselt[(1, 2)] , Helmut Griesser[(3)] , Klaus Grobe[(3)] , Michael Eiselt[(1)] , Juan José Vegas-Olmos[(2)], Idelfonso Tafur Monroy[(2)] , and Jörg-Peter Elbers[(3)]
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We demonstrate the first known experiment of a real-time end-to-end 40-Gb/s PAM-4 system for next generation access applications using 10G class transmitters only. Up to 25-dB upstream link budget for 20 km SMF is achieved.

PDP.4.5 ● 15:00 – 15:15

Field-Trial of a Real-Time Bidirectional UDWDM-PON Coexisting with GPON, RF Video Overlay and NG-PON2 Systems

Ricardo M. Ferreira[(1)], Ali Shahpari[(1)], Fernando P. Guiomar[(1)], Sofia B. Amado[(1)] , Cláudio Rodrigues[(2)], Jacklyn D. Reis[(3)], Armando N. Pinto[(1)] and António L. Teixeira[(1)]
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We report a field-trial of bidirectional coherent Nyquist UDWDM-PON using off-the-shelf real-time FPGA-based transceivers, coexisting with GPON, RF Video and NG-PON2. A sensitivity of -44.5 dBm is achieved for 64×2.5 Gb/s DQPSK, with a 17 dB dynamic power range for US channels.