Silicon CMOS Photonics Platform for Enabling High-Speed DQPSK Transceivers

P. Sanchis,[1,*] M. Aamer,[1] A. Brimont,[1] A.M. Gutierrez,[1] N. Sotiropoulos,[2] H. de Waardt,[2] D. J. Thomson,[3] F. Y. Gardes,[3] G. T. Reed,[3] K. Ribaud,[4] P. Grosse,[4] J. M. Hartmann,[4] J.-M- Fedeli,[4] D. Marris-Morini,[5] E. Cassan,[5] L. Vivien,[5] D. Vermeulen,[6] G. Roelkens,[6] and A. Hakansson[7]

[1]*Nanophotonics Technology Center, Universitat Politècnica València, 46022 Spain*
[2]*Eindhoven University of Technology, Eindhoven, 5600 MB NL, The Netherlands*
[3]*Optoelectronics Research Centre, University of Southampton, Southampton, UK*
[4]*CEA, LETI, Minatec Campus, 38054, Grenoble Cedex, France*
[5]*Univ. Paris-Sud, CNRS, UMR8622, Bât. 220, F-91405 ORSAY cedex – France*
[6]*Photonics Research Group, INTEC, Ghent University / imec, Sint-Pietersnieuwstraat 41, 9000 Ghent, Belgium*
[7]*DAS Photonics, Camino de Vera s/n Ed 8F 2ª pta, 46022 Valencia, Spain*
**Corresponding author: pabsanki@ntc.upv.es*

ABSTRACT
In this work we review the results obtained under the framework of FP7-HELIOS project for integrated DQPSK transceivers in silicon photonics. A differential DQPSK receiver with balanced zero biased Germanium photodiodes has been demonstrated at 10Gbit/s with an error floor around 10^{-15}. Furthermore, DPSK modulation up to 10Gbit/s with a bit error rate below 10^{-9} is also demonstrated using a silicon push-pull operated dual-drive Mach-Zehnder modulator (MZM) based on carrier depletion. The results indicate the potential of the silicon CMOS photonics platform for boosting next-generation optical networks based on advanced modulation formats.

Keywords: photonic integrated circuits, silicon photonics, optical transceivers, modulation, DQPSK.

1. INTRODUCTION

An ever growing amount of access network bandwidth is required by end users, and the deployment of passive optical networks, operating up to 10 Gbit/s has already begun to address this demand [1]. Higher bit rates will probably be required in the future, with network operators preferring solutions based on reusing the existing infrastructure and components developed for legacy links. Therefore, advanced modulation formats allowing to scale the bit rate while keeping the use of narrow bandwidth devices are highly desirable. One of the most promising approaches is based on phase-shift keying (PSK) modulation formats, which offer a greater flexibility to achieve higher spectral efficiencies when compared with traditional on-off keying (OOK) modulation. Silicon photonics technology has attracted a great deal of attention during the last years due to its high index contrast and compatibility with complementary metal oxide semiconductor (CMOS) processes thus allowing high density optical circuit layouts and monolithic integration with electronics. Hence, silicon photonics is expected to provide an excellent platform for enabling the low-cost, low-power and highly-scalable photonic integrated circuits (PICs) required for deploying next generation optical transceivers.

In this paper, we review the results obtained under the framework of FP7 HELIOS project for developing 10Gbit/s differential quadrature phase-shift keying (DQPSK) transceivers in silicon photonics for optical access networks [3]. Differential detection could provide significant savings in cost and power consumption compared with coherent detection solutions thus making it more suitable for access networks. Different approaches have been proposed for achieving differential silicon receivers, mainly based on the use of standard Mach-Zehnder delay interferometer (MZDI) [3] or using microring resonators [4]. While the ring resonator approach allows a very compact implementation, optimal performance usually requires a tuning mechanism, increasing the complexity and power consumption of the receiver. On the other hand, DQPSK modulation has also been proposed based on silicon Mach-Zehnder modulators (MZM) and ring-based modulators. In the latter, unique features in terms of small footprint and low drive voltage are achieved but they suffer from a low optical bandwidth making thermal control elements also necessary [5]. Therefore, the MZM approach has been chosen as a more robust solution and with the potential of higher operation speeds. Very recently, 112Gbit/s dual-polarization QPSK modulation based on silicon nested MZM has been demonstrated for optical transport networks [6,7].

2. DQPSK RECEIVER

The DQPSK differential receiver is depicted in Fig. 1. The proposed device was fabricated on top of a 200-mm SOI wafer with silicon core thickness of 220 nm and buried oxide of 2 μm. The process starts with the deposition of 100 nm High Temperature Oxide (HTO) on top of the silicon layer. To couple light from the input fiber to the receiver, and in order to minimize the size of the chip, curved gratings were used with a coupling loss of about 6 dB. The gratings and the waveguide arms are first patterned, followed by RIE silica etching with C_4F_8, which defines a hardmask. The silicon is then partially etched (65 nm) with HBr and controlled by ellipsometry in order to define precisely the grating teeth depth. In the second lithography step, the gratings are protected by the resist and the remaining hardmask serves for the waveguides in a self-alignment process. Then a full silicon etch down to the box completes the waveguide fabrication. We then defined cavities for the selective epitaxial growth of Germanium (Ge). This is achieved by deposition of a silica layer which is etched at the end of waveguides. In order to achieve direct coupling, the silicon part of the cavities is etched down to 50 nm on top of the BOX. Germanium was then selectivity grown in the cavities and chemical-mechanical planarization (CMP) used to adjust the thickness around 300nm. The doped regions (N and P) of the lateral Ge photodetector are defined sequentially by ion implantation of Phosphorus and Boron. A 400 nm thick SiO_2 was deposited and a deposition and etching of 100 nm of Ti/TiN defined the heaters. Then after deposition of 500 nm of SiO_2 and two-step openings, the electrodes were defined by Ti/TiN/AlCu metal stack deposition and Cl2 etching.

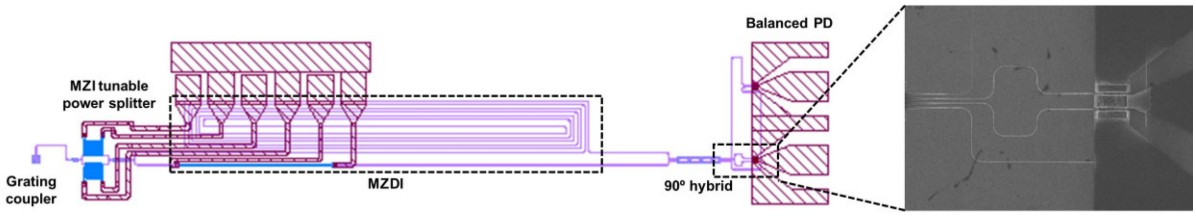

Figure 1. 10 Gbit/s DQPSK differential receiver and SEM image of the Ge-PD.

The different building blocks of the receiver are depicted in Fig. 1(a). A thermo-optically tunable MZI power splitter was first used before the Mach-Zehnder delay interferometer (MZDI). In case of unbalanced behaviour at the output of the MZDI due to excess loss in the delay line, micro-heaters can be used to actively tune the power at the MZDI input, resulting in an increase in the extinction ratio of the MZDI [8], and consequently in the sensitivity of the receiver. At the output of the power splitter, the MZDI was placed. A waveguide length of 18 mm was required for 10 Gbit/s operation. Therefore, compact spirals were used in order to minimize the size of the structure. The propagation losses in the MZDI were about 3dB. The MZDI outputs were coupled to a 2×4 Multimode Interference (MMI) acting as 90º hybrid, with an insertion loss of about 6.5 dB [9]. In order to have a 3 dB increase in the sensitivity of the receiver and minimize power consumption, zero bias balanced detection was used based on a Germanium photodetector pair (Ge-PD) in lateral *pinpin* configuration [10]. A scanning electron microscope (SEM) image of the 10µm-length Ge-PD is shown in the right side of Fig. 1. The responsivity was measured to be 1 A/W at 1550 nm using 0 to -2 V bias. The total optical excess loss of the receiver was around 15 dB.

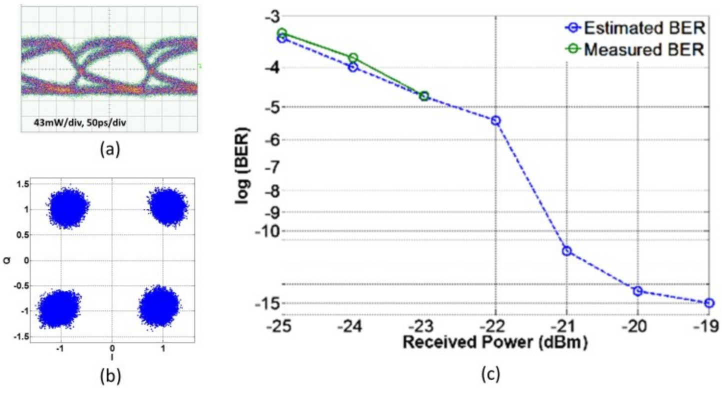

Figure 2: (a) DQPSK eye diagram; and (b) symbol constellation for a received power of -19dBm; (c) Measured and estimated BER versus received power.

For characterizing the receiver, a 10 Gbit/s DQPSK signal was generated using a commercial single-drive Lithium Niobate nested MZ modulator, biased at minimum transmission and driven by the outputs of the pulse pattern generator (PPG), appropriately decorrelated, aligned and amplified at $2V_{\pi}$. The bits were generated from a pseudorandom binary sequence pattern generator (PRBS) with a pattern length of 2^{13}-1. Well opened eye-diagrams and remarkably good constellation diagrams were obtained, as shown in Fig. 2(a)-2(b) for a received power of -19 dBm. The error vector magnitude (EVM) as well as the bit error rate (BER) as a function of the received power was measured. However, as the quality of the received signal was quite good so that no significant amount of errors were recorded in the captured length of the data, which was 100k symbols, the EVM of the signal was used to estimate the BER for received powers above -23 dBm. Figure 2(c) shows the measured and estimated BER. It should be noticed that for input powers lower than -21 dBm, the erbium doped fiber amplifier (EDFA), used for counteract insertion losses, was no longer able to amplify the signal to a constant output power value of +16 dBm, and lower powers reach the balanced photodiodes. Even so, an error floor value of around BER = 10^{-15}, which corresponds to a EVM = 12.5%, was obtained confirming the excellent performance of the proposal DQPSK receiver for 10Gbit/s operation.

3. DPSK TRANSMITTER

The DPSK modulator is depicted in Fig. 3. MMI were used as input/output 3 dB couplers. The silicon waveguide core has also a height of 220 nm, a width of 450 nm, and a slab thickness of 100 nm, as depicted in Fig. 3(c). Optical phase modulation is achieved by depleting the majority carriers from a reverse biased pn junction with doping concentrations of $1.6\cdot10^{17}$ cm^{-3} in the p-type region and $8\cdot10^{17}$ cm^{-3} in the n-type region. The fabrication process is based on a self-alignment process described in Ref. [11]. The travelling-wave electrodes are formed by depositing a compound AlCu layer on top of highly doped p+ and n+ regions with concentrations of $1\cdot10^{20}$ cm^{-3}. A dual-drive electrode configuration was chosen for push-pull operation.

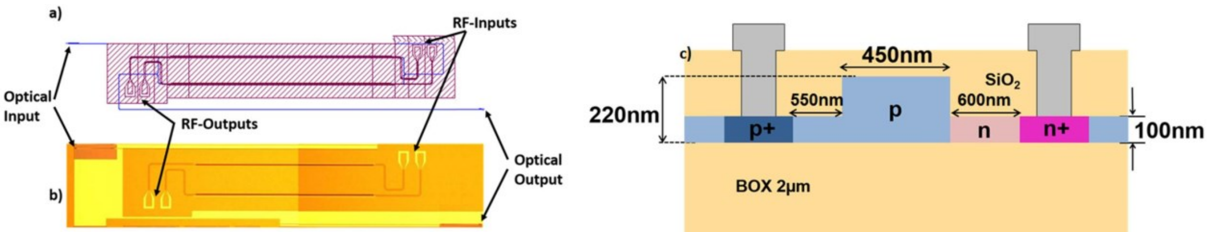

Figure 3. DPSK modulator: (a) GDS design, (b) optical photograph of fabricated device and (c) cross-section of the pn junction.

The DPSK modulator was firstly characterized in DC. Different voltages were applied to the MZM and extinction ratios as high as 30 dB were achieved under these DC conditions. A V_π value of 12 V was measured, which for the 3 mm modulation length gives rise to a $V_\pi\cdot L$ product of 3.6 V·cm. The insertion loss, including phase shifter and MMI losses, was about 10 dB. Next, the high speed operation of the modulator was characterized. Digital data signals were generated from a pseudorandom binary sequence pattern generator with a pattern length of 2^7-1, delivered by a bit pattern generator (BPG) connected to an external clock. The signals were appropriately decorrelated and aligned before being fed to the electrodes with 8 V peak-to-peak voltage. A double RF signal probe with GSGSG configuration was used to drive the MZM, while another double RF signal probe with 50 ohm terminators was applied at the electrode output (see Figs. 3(a)-3(b)). A reverse DC bias was applied to the phase shifters for operation in carrier depletion.

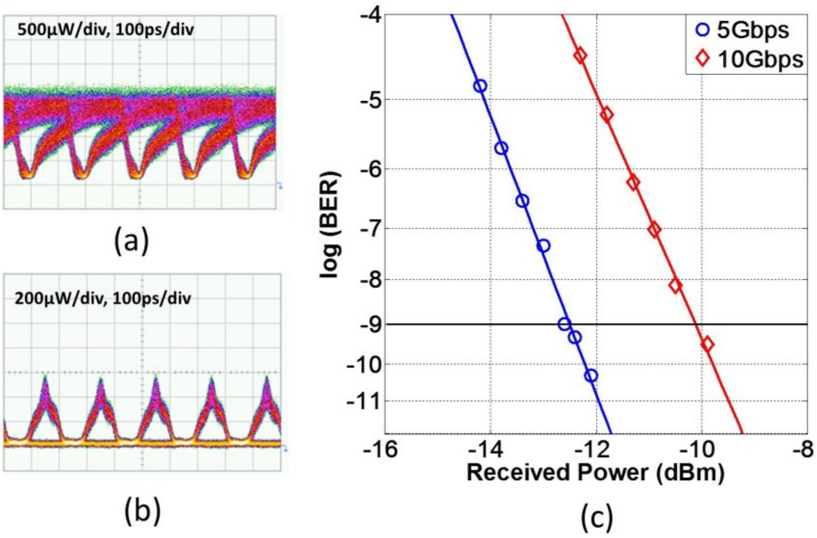

Figure 4. DPSK (a) modulated and (b) AMI demodulated eye diagrams; (c) Measured BER versus received power for 5 Gbit/s and 10 Gbit/s DPSK demodulation.

In order to measure the bit error rate (BER), the optical DPSK modulated signal was passed through an external demodulation circuit based on a polarization delay-interferometer [12]. The measured eye diagram of the modulated DPSK signal at 5 Gbit/s is shown in Fig. 4(a). The noise is mainly due to the limitation in the drive voltage which is not high enough to achieve V_π in each phase shifter of the MZM (the driver only offers 66.6% of the required V_π). However, as digital data information is in the phase of the optical signal, clear eye diagrams were obtained after demodulation, as demonstrated in Fig. 4(b), which shows the alternate-mark inversion (AMI) demodulated eye diagram. The performance of the DPSK modulator was further evaluated by measuring the BER. As shown in Fig. 4(c), error-free (BER < 10^{-9}) DPSK modulation for 5 Gbit/s is obtained. Furthermore, higher data rates were also tested to characterize the high-speed performance of the modulator. Error-free DPSK modulation was also achieved for 10 Gbit/s with a power penalty of around 2 dB, as shown in Fig. 4(c). DPSK modulation up to 20 Gbit/s was also successfully achieved though it was not possible to measure the BER due to a limitation in the experimental set-up. However, DPSK modulated eye diagrams clearly showed that inter-symbol interference (ISI) did not occur, which confirms the high speed operation of the modulator. Remaining challenges are the reduction of the V_π value as well as insertion losses.

4. CONCLUSIONS

A compact differential DQPSK receiver with zero biased balanced photodetection has been demonstrated at 10 Gbit/s. Furthermore, a dual-drive silicon MZM has also been successfully demonstrated to operate at such data rate. The DQPSK transmitter would be achieved by arranging the MZM in a nested configuration. The results clearly confirm the potential of silicon photonics technology for developing low-power consumption and cost-effective integrated DQPSK transceivers for next-generation optical access networks.

ACKNOWLEDGEMENTS

The authors acknowledge funding by the European Commission under project HELIOS (pHotonics Electronics functional Integration on CMOS), FP7-224312. P. Sanchis also acknowledges financial support from TEC2012-38540 LEOMIS and Universidad Politécnica de Valencia for PAID2011/1914. The authors would also like to thank Paul Crozat from IEF, Dr. Javier Herrera and Rakesh Sambaraju for fruitful discussion.

REFERENCES

[1] F. Effenberger: The XG-PON system: Cost effective 10 Gb/s access, *J. Lightwave Technol.*, vol. 29, pp. 403-409, 2011.
[2] http://www.helios-project.eu/
[3] C.R. Doerr *et al.*: PDM-DQPSK silicon receiver with integrated monitor and minimum number of controls, *IEEE Photonics Technol. Lett.*, vol. 24, pp. 697-699, Apr. 2012.
[4] K. Xu *et al.*: Tunable integrated variable bit-rate DPSK silicon receiver, *Opt. Lett.*, vol. 37, pp. 4738-4740, Nov. 2012.
[5] P. Dong *et al.*: Silicon microring modulators for advanced modulation formats, in *Optical Fiber Communication Conference*, OSA Technical Digest (online) (Optical Society of America, 2013), paper OW4J.2.
[6] P. Dong *et al.*:112-Gb/s monolithic PDM-QPSK modulator in silicon, in *European Conference and Exhibition on Optical Communication*, OSA Technical Digest (online) (Optical Society of America, 2012), paper Th.3.B.1.
[7] B. Milivojevic *et al.*: 112Gb/s DP-QPSK transmission Over 2427km SSMF using small-size silicon photonic IQ modulator and low-power CMOS driver, in *Optical Fiber Communication Conference*, OSA Technical Digest (online) (Optical Society of America, 2013), paper OTh1D.1.
[8] M. Aamer *et al.*: Increased sensitivity through maximizing the extinction ratio of SOI delay-interferometer receiver for 10G DPSK, *Opt. Exp.*, vol. 20, pp. 14698-14704, Jun. 2012.
[9] R. Halir *et al.*: High-performance 90° hybrid based on a silicon-on-insulator multimode interference coupler, *Opt. Lett.*, vol. 36, , pp. 178-180, Jan. 2011.
[10] L. Vivien *et al.*: Zero-bias 40Gbit/s germanium waveguide photodetector on silicon, *Opt. Exp.*, vol. 20, pp. 1096-1101, Jan. 2012.
[11] D. Thomson *et al.*: High speed silicon optical modulator with self-aligned fabrication process, *Optics express*, vol. 18, pp. 19064-19069, 2010.
[12] C. W. Chow *et al.*: Polarization-independent DPSK demodulation using a birefringent fiber loop, *IEEE Photonics Technology Letters*, vol. 17, pp. 1313-1315, 2005.

15th International Conference on Transparent Optical Networks

- Home
- Conference Programme
- Committees
- Plenary Talks
- Social Events
- Registration
- Venue
  - Travel
  - Visa
  - Accommodation
- Local Information
  - Beaches
  - Culture
  - Links

Co-located with:

- 12th European Symposium on Photonic Crystals (**ESPC**)
- 12th Workshop on All-Optical Routing (**WAOR**)
- 10th Anniversary Global Optical & Wireless Networking Seminar (**GOWN**)
- 9th Reliability Issues in Next Generation Optical Networks Workshop (**RONEXT**)
- 9th Photonic Integrated Components & Applications Workshop (**PICAW**)
- 8th Nanophotonics for All-Optical Networking Workshop (**NAON**)
- 8th Special Session on Photonic Atoms & Molecules (**PAM** – former MPM)
- 8th Special Industrial Session
- 7th Special Session on **Novel Glasses** for photonic devices
- 6th Special Session on Market in Telecommunications (**MARS**)
- 5th COCONUT Workshop on Broadband **Access** (former ACCORDANCE)
- 5th Sub-Wavelength Photonics Conference (**SWP**) with:
  EU FP7-**REGPOT** Project Special Session on "Plasmon Enhanced Diffractive Elements"
  Special Session on "Nanophotonics and Smart Optical Nanostructures" (**NSON**)
- 4th Workshop on Communication in Transportation Systems (**CTS**)
- 3rd Workshop on Green Optical Communications (**GOC**)
- 3rd Special Session on Intelligent Systems for Optical Networks Design (**ISOND**)
- 3rd Special Session on Microwave Photonics (**MP**)
- 2nd Optical Wireless Workshop (**OWW**)
- EU FP7 Projects **SOFI/NAVOLCHI** Special Session on "CMOS Fabrication-Based Photonic Technologies for Communications"
- EU FP7 Projects **ASTRON/FOX-C** Special Session on "Physical Layer Technologies for Flexible/ Elastic Optical Networks"
- Workshop on "How to Create a Photonic **SME**"
- Workshop on Network Optimization (**NeO**)

Welcome

The National Institute of Telecommunications, Department of Transmission and Optical Technologies in Warsaw, together with the Department of Information Technologies and Communications of the Universidad Politécnica de Cartagena, and the IEEE Photonics Society Poland Chapter are pleased to announce the **2013 15th International Conference on Transparent Optical Networks (ICTON 2013)** which will be kindly hosted at the El Batel Auditorium and Convention Center, Cartagena, Spain, June 23-27, 2013. The conference is technically co-sponsored by the IEEE and the IEEE Photonics Society.

The El Batel Auditorium is located next to the seafront and the marina, walking-distance to city centre, cultural and touristic places. Cartagena is famous of its unique artistic heritage, with a number of landmarks such as the Roman Theatre and a lot of Phoenician, Roman, Byzantine and Moorish remains.

The scope of the Conference is concentrated on the applications of transparent and all-optical technologies in telecommunications, computing and novel applications, and includes:

Digital all-optical networks
Ultra-fast optical time domain multiplexing
Optical switching and routing (WAOR)
Optical memories and data storage
Network reliability and availability (RONEXT)
Radio-over-fibre transmission
Market in telecommunications (MARS)
Photonic crystal fibres
Nanoscale and ultrafast photonics (NAON)
Microresonators and photonic molecules (MPM)
New transmission windows
Photonic component integration (PICAW)
Non-conventional optical communications
Communication in transportation systems (CTS)
Ultra-dense wavelength-division multiplexing
Next generation networking
Optical packet networks and services
Optical transparency and network scalability
Wireless and optical networking (GOWN)
Broadband metro and access networks
Photonic band-gap structures (ESPC)
Nonlinear and active PBG devices
VCSELs and other novel light sources
Novel glasses
Polarisation mode dispersion
Network planning and design tools
Sub-wavelength photonic devices (SWP)
Other relevant topics

IEEE Copyright

IEEE Catalog Number: CFP13485-USB
ISBN: 978-1-4799-0682-6

Formal publisher:
National Institute of Telecommunications
Department of Transmission and Optical Technologies
1 Szachowa Street, Warsaw, Poland.

Editors: **Marek Jaworski**, **Marian Marciniak**

Contact

email: icton2013@upct.es

Organization

INSTYTUT ŁĄCZNOŚCI
PAŃSTWOWY INSTYTUT BADAWCZY
National Institute of Telecommunications

Technical sponsors

Collaborations

AYUNTAMIENTO DE CARTAGENA
www.cartagena.es

15th International Conference on Transparent Optical Networks
June 23-27, 2013 - Cartagena (Spain)

W3C CSS W3C WAI-AA W3C XHTML 1.0

J. Hoxha, **G. Cincotti**	(*Invited*) **M. Kroh**, M. O'Keefe, K. Voigt, S. Fedderwitz, G.B. Preve, S. Lischke, T. Brast, D. Petousi, C. Stamatiadis, E. Kehayas, R. Nogueira, D. Korn, D. Roccato, P.C. Schindler, I. Lazarou, C. Koos, W. Freude, J. Leuthold, H. Avramopoulos, A.G. Steffan, L. Stampoulidis, L. Zimmermann	optical access (*Invited*) **L.H. Spiekman**	**N. Wada**, H. Furukawa, H. Harai	V.M. Shalaev, V.P. Drachev	L. Maigyte, **C.M. Cojocaru**, V. Purlys, J. Trull, D. Gailevičius, M. Peckus, M. Malinauskas, K. Staliunas
14:30 We.C1.2 Impact of reduced complexity inverse Volterra series transfer function-based nonlinear equalizer in coherent OFDM systems for next-generation core networks(*Invited*) **E. Giacoumidis**, N. J. Doran, I. Aldaya, V. Vgenopoulou, Y. Jaouën	14:20 We.C2.2 Evolution of fabless generic photonic integration (*Invited*) **P. Munoz**, J.D. Domenech, I. Artundo, J.H. den Bested, J. Capmany	14:20 We.C3.2 Self-seeding of semiconductor lasers for next-generation WDM passive optical networks (*Invited*) **M. Presi**, A. Chiuchiarelli, R. Corsini, E. Ciaramella	14:20 We.C4.2 Alternate architectures for an all-optical core network based on new subwavelength switching paradigms (*Invited*) **R. Aparicio-Pardo**, A. Triki, E. Le Rouzic, B. Arzur, E. Pincemin, F. Guillemin	14:20 We.C5.2 Grating resonances as an alternative to plasmon resonances in nanophotonics applications (*Invited*) **A.I. Nosich**, V.O. Byelobrov, O.V. Shapoval, D.M. Natarov, T.L. Zinenko, M. Marciniak	14:20 We.C6.2 Direct inscription of photonic band-gap waveguides into bulk optical glass (*Invited*) **A. Fuerbach**, S. Gross, A. Arriola, M. Alberich, M. Withford
14:50 We.C1.3 Equalization techniques for high-speed OFDM-based access systems using direct modulation and direct detection (*Invited*) N. Sequeira André, K. Habel, **H. Louchet**, A. Richter	14:40 We.C2.3 Nanoscale Si-based photonics for next generation integrated circuits (*Invited*) **L. Wosinski**, Fei Lou, L. Thylén	14:40 We.C3.3 Wavelength protection within coexistence of current and next-generation PON networks (*Invited*) D. Korček, **J. Müllerová**	14:40 We.C4.3 Javanco: A software framework for optical network modelling and optimization (*Invited*) **S. Rumley**, R. Hendry, K. Bergman	14:40 We.C5.3 Excitation and propagation of electromagnetic pulses along dielectric-air interface (*Invited*) **A. Popov**, I. Prokopovich, S. Zapunidi	14:40 We.C6.3 Light scattering from one-dimensional photonic crystals under total internal reflection (*Invited*) **G.V. Morozov**, F. Placido, D.W.L. Sprung
15:10 We.C1.4 Bandwidth variable transponders based on OFDM technology for elastic optical networks (*Invited*) **M. Svaluto Moreolo**, J.M. Fabrega, L. Nadal, F.J. Vilchez, G. Junyent	15:00 We.C2.4 Photonic wire bonding: Nanophotonic interconnects fabricated by direct-write 3D lithography (*Invited*) **C. Koos**, J. Leuthold, W. Freude, N. Lindenmann, S. Koeber, J. Hoffmann, T. Hoose, P. Huebner		15:00 We.C4.4 Cloud orchestration with SDN / OpenFlow in carrier transport networks (*Invited*) **A. Autenrieth**, J-P. Elbers, P. Kaczmarek, P. Kostecki	15:00 We.C5.4 *Ab initio* determination of basic dielectric properties (*Invited*) **A. Quandt**, R. Warmbier	15:00 We.C6.4 Hyperspectral near-field imaging of light bending in a graded photonic crystal (*Invited*) B. Cluzel, J. Dellinger, K-V. Do, E. Cassan, **F. de Fornel**
15:30 We.C1.5 Orthogonal multipulse modulation in optical datacommunications (*Invited*) **J.D. Ingham**, R.V. Penty, I.H. White				15:20 We.C5.5 Design and simulation of apodized SOI fiber to chip coupler by sub-wavelength structure (*Invited*) J. Chovan, A. Kuzma, **F. Uherek**	15:20 We.C6.5 Negative diffraction by a periodically modulated loss (*Invited*) **M. Botey**, N. Kumar, R. Herrero, L. Maigyte, R. Pico, K. Staliunas
					15:40 We.C6.6 Optical absorption enhancement by quasi-photonic crystals in thin films for photovoltaic applications (*Invited*) **P.A. Postigo**, J. M. Llorens
Coffee break (15:50 – 16:10)	**Coffee break** (15:20 – 15:50)	**Coffee break** (15:00 – 15:30)	**Coffee break** (15:20 – 15:40)	**Coffee break** (15:40 – 16:10)	**Coffee break** (16:00 – 16:20)
SESSION We.D1 **ICTON XI** Chair: **Ivan Djordjevic** **(16:10 Wednesday, June 26)**	**SESSION We.D2** **ICTON XV** Chair: **Maciej Dems** **(15:50 Wednesday, June 26)**	**SESSION We.D3** **ASTRON/FOX-C** Chair: **Gabriella Cincotti** **(15:30 Wednesday, June 26)**	**SESSION We.D4** **RONEXT** Chair: **Paolo Monti** **(15:40 Wednesday, June 26)**	**SESSION We.D5** **SWP XI** Chair: **Robert Czaplicki** **(16:10 Wednesday, June 26)**	**SESSION We.D6** **NAVOLCHI/SOFI** Chair: **Ioannis Tomkos** **(16:20 Wednesday, June 26)**
16:10 We.D1.1 Next generation optical network and its optical components (*Invited*) **Yaping Zhang**	15:50 We.D2.1 High-speed, low-power optical modulators in silicon (*Invited*) **J. Leuthold**, C. Koos, W. Freude, L. Alloatti, R. Palmer, D. Korn, J. Pfeifle, M. Lauermann, R. Dinu, S. Wehrli, M. Jazbinsek, P. Gunter, M. Waldow, T. Wahlbrink, J. Bolten, M. Fournier, J.M. Fedeli, W. Bogaerts, H. Yu	15:30 We.D3.1 All-optical implementation of OFDM/NWDM Tx/Rx (*Invited*) J. Hoxha, **G. Cincotti**, N.P. Diamantopoulos, P. Zakynthinos, I. Tomkos	15:40 We.D4.1 Core network physical topology design for energy efficiency and resilience (*Invited*) T.E.H. El-Gorashi, Xiaowen Dong, A. Lawey, **J.M.H. Elmirghani**	16:10 We.D5.1 Metamaterial fishnet structures and small (70 nm) split ring resonators formed by nanoimprint lithography (*Invited*) **N.P. Johnson**, G.J. Sharp, M. Yuce, Xiaolon Hu, M. Sinworapun, A.Z. Khokhar	16:20 We.D6.1 Waveguide-coupled nanolasers in III-V membranes on silicon (*Invited*) **V. Dolores-Calzadilla**, D. Heiss, A. Fiore, M. Smit
16:20 We.D1.2 Dual stage carrier phase estimation for 16-QAM systems based on a modified QPSK-partitioning algorithm **S.M. Bilal**, G. Bosco	16:10 We.D2.2 High performance travelling wave Mach-Zehnder modulators for emerging generations of high capacity transmitter	15:50 We.D3.2 Nyquist-WDM-based system performance evaluation (*Invited*) **R.I. Killey**, M. Sezer Erkilinc, R. Maher, M. Paskov,	16:00 We.D4.2 Multicast service for UltraFlow access networks (*Invited*) **D. Larrabeiti**, L. Kazovsky, M.I. Urueña,	16:30 We.D5.2 Plasmonic dimer metamaterials and metasurfaces for polarization control of terahertz and optical waves (*Invited*) S.V. Zhukovsky,	16:40 We.D6.2 Optical properties of SOI waveguides functionalized with close-packed quantum dot films (*Invited*)

15th International Conference on Transparent Optical Networks

	components (*Invited*) ***R. Kaiser***, *B. Gomez Saavedra, K.O. Velthaus, M. Gruner, M. Hamacher, D. Hoffmann, M. Schell*	*S. Kilmurray, R. Bouziane, B.C. Thomsen, S.J. Savory, P. Bayvel*	*A.R. Dhaini, Shuang Yin, J.A. Hernández, P. Reviriego, T. Shunrong Shen*	*M. Zalkovskij, R. Malureanu, A. Andryieuski, A. Novitsky, P.U. Jepsen,* ***A.V. Lavrinenko***, *P. T. Tang, C. Kremers, D.N. Chigrin*	***Z. Hens***, *A. Omari, P. Geiregat, D. Van Thourhout*
16:35 **We.D1.3** Synchronization of the time-domain wavelength interleaved networks ***I. Popescu***, *L. Sadeghioon, A. Gravey, P. Gravey, M. Morvan*	16:30 **We.D2.3** Application of extended Taylor series based finite difference method in photonics (***Invited***) ***S. Sujecki***	16:10 **We.D3.3** High resolution optical spectral filtering technology: Reaching the sub-GHz resolution range (***Invited***) ***D.M. Marom***, *D. Sinefeld, O. Golani, N. Goldshtein, R. Zektzer, R. Rudnick*	16:20 **We.D4.3** Optimal technicians' allocation problem with respect to failure reparation (***Invited***) ***C. Mas Machuca***, *B. de la Cruz Miranda*	16:50 **We.D5.3** Low-loss and multi-band metamaterials (***Invited***) ***C. Sabah***	17:00 **We.D6.3** Light coupling from active polymer layers to hybrid dielectric-plasmonic waveguides (***Invited***) ***I. Suárez***, *E.P. Fitrakis, H. Gordillo, P. Rodriguez-Cantó, R. Abargues, I. Tomkos, J. Martinez-Pastor*
16:50 **We.D1.4** Performance enhancement of partial-42.7Gb/s DPSK via an asymmetrical receiver design ***N.J. Murray***, *O.A. Olubodun, P. Harper, N.J. Doran*	16:50 **We.D2.4** Modelling the bandwidth behaviour of fibre Bragg gratings excited by low-frequency acoustic waves (***Invited***) ***A. de Almeida Prado Pohl***, *R.E. da Silva, M.A. Ruggieri Franco, P. de Tarso Neves Jr., H. Bartelt*	16:30 **We.D3.4** Almost-optimal design for optical networks with Hadoop cloud computing: Ten ordinary desktops solve 500-node, 1000-link, and 4000-request RWA problem within three hours (***Invited***) ***Gangxiang Shen***, *Yongcheng Li, Limei Peng*	16:40 **We.D4.4** Balancing the benefits inherent in reconfigurable coherent optical transceivers (***Invited***) ***B.T. Teipen***, *M.H. Eiselt*	17:10 **We.D5.4** Energy flow canalization of evanescent cylindrical-vector beams (***Invited***) ***C.J. Zapata-Rodríguez***, *J.J. Miret*	17:20 **We.D6.4** Low energy routing platforms for optical interconnects using active plasmonics integrated with silicon photonics (***Invited***) ***K. Vyrsokinos***, *S. Papaioannou, D. Kalavrouziotis, F. Zacharatos, L. Markey, J-C. Weeber, A. Dereux, A. Kumar, S.I. Bozhevolnyi, M. Waldow, G. Giannoulis, D. Apostolopoulos, T. Tekin, H. Avramopoulos, N. Pleros*
17:05 **We.D1.5** Performance evaluation of strongly filtered asymmetric 42.7 Gb/s coherent 50% RZ-BPSK system ***O.A. Olubodun***, *N.J. Murray, P. Harper, N.J. Doran*		16:50 **We.D3.5** Towards 400G/1T flexible optical transport networks (***Invited***) ***E. Pincemin***, *M. Song, Y. Loussouarn, G. Thouenon, C. Betoule*	17:00 **We.D4.5** Energy saving in access networks: Gain or loss from the cost perspective? (***Invited***) *P. Wiatr, J. Chen, P. Monti,* ***L. Wosinska***		
			17:20 **We.D4.6** Dynamic traffic provisioning in mixed-line-rate networks with launch power determination (***Invited***) *H. Cukurtepe,* ***A. Yayimli***, *M. Tornatore, B. Mukherjee*		

Thursday, June 27

SESSION Th.A1 **ICTON XII** Chair: ***Jarmila Müllerová*** **(8:30 Thursday, June 27)**	SESSION Th.A2 **ICTON XVI** Chair: ***Elzbieta Bereś-Pawlik*** **(8:30 Thursday, June 27)**	SESSION Th.A3 **NeO III** Chair: ***Walter Cerroni*** **(8:30 Thursday, June 27)**	SESSION Th.A4 **WAOR II** Chair: ***Pablo Pavón Mariño*** **(8:30 Thursday, June 27)**	SESSION Th.A5 **SWP XII** Chair: ***Sergei Zhukovsky*** **(8:30 Thursday, June 27)**	SESSION Th.A6 **NSON** Chair: ***Marian Marciniak*** **(8:30 Thursday, June 27)**
8:30 **Th.A1.1** The time lens concept applied to ultra-high-speed OTDM signal processing (***Invited***) ***A.T. Clausen***, *E. Palushani, H.C. Hansen Mulvad, H. Hu, J. Laguardia Areal, M. Galili, L.K. Oxenløwe, P. Jeppesen*	8:30 **Th.A2.1** WDM-enabled optical RAM architectures for ultra-fast, low-power optical cache memories (***Invited***) *G.T. Kanellos, T. Alexoudi, D. Fitsios, C. Vagionas, P. Maniotis, S. Papaioannou, A. Miliou,* ***N. Pleros***	8:30 **Th.A3.1** Anycast end-to-end resilience for cloud services over virtual optical networks (***Invited***) *Minh Bui, B. Jaumard,* ***C. Develder***	8:30 **Th.A4.1** Performance of ring-resonator based optical backplane in high capacity routers (***Invited***) *G. Rizzelli, D. Siracusa,* ***G. Maier***, *M. Magarini, A. Melloni*	8:30 **Th.A5.1** Radial Bragg laser as a miniaturized rotation sensor (***Invited***) *E. Ben-Basat, Y. Karni,* ***J. Scheuer***	8:30 **Th.A6.1** Inverse design of novel nanophotonic structures (***Invited***) ***I. Andonegui***, *A. Blanco, I. Calvo, A.J. Garcia-Adeva*
8:50 **Th.A1.2** Effect of all-optical phase regeneration on fiber transmission capacity (***Invited***) *G. Hesketh,* ***P. Horak***	8:50 **Th.A2.2** Optimizing silicon-on-oxide 2D-grating couplers ***L. Carroll***, *D. Gerace, I. Cristiani, L.C. Andreani*	8:50 **Th.A3.2** Routing and network design for HEAnet (***Invited***) ***D. Mehta***, *B. O'Sullivan, L. Quesada, M. Ruffini, D. Payne, L. Doyle*	8:50 **Th.A4.2** Scalable and energy-efficient optical tree-based greedy router (***Invited***) *S. Sahhaf, A. Dixit, W. Tavernier,* ***D. Colle***, *M. Pickavet, P. Demeester*	8:50 **Th.A5.2** Simulation of optical Bloch oscillations and breathing modes in the waveguide arrays ***M. Gozman***, *Y. Polishchuk, I. Polishchuk*	8:50 **Th.A6.2** Nonlinear complex photonic structures (***Invited***) ***M. Boguslawski***, *P. Rose, F. Diebel, S. Brake, C. Denz*
9:10 **Th.A1.3** Digitally processed modulation formats and integrated photonics for flexible optical metro-access networks (***Invited***) ***J.A. Lázaro***, *B. Schrenk, M. Malligaraj, I. Cano, M. Sridharan, G. Junyent*	9:05 **Th.A2.3** Dynamics of SHB and SDP on 9XX EDFAs: Dependence on spectral allocation of input channels ***J.M. Ferreira***, *D. Fonseca, P. Monteiro, A.N. Pinto, L. Rapp*	9:10 **Th.A3.3** A column generation approach for large-scale RSA-based network planning (***Invited***) ***M. Ruiz***, *M. Żotkiewicz, L. Velasco, J. Comellas*	9:10 **Th.A4.3** An adaptive path restoration algorithm based on power series routing for all-optical networks (***Invited***) *C.J.A. Bastos-Filho, R.C. Freitas,* ***D.A.R. Chaves***, *R.C.L. Silva, M.L.P. Freire, H.A. Pereira, J.F. Martins-Filho*	9:05 **Th.A5.3** Giant circular dichroism in chiral metamaterials ***F. Dincer***, *M. Karaaslan, E. Unal, M. Bakir, U. Erdiven, C. Sabah*	9:10 **Th.A6.3** Ways to optimize the second-harmonic response from metamaterials (***Invited***) ***R. Czaplicki***, *H. Husu, M. Zdanowicz, J. Mäkitalo, K. Koskinen, R. Siikanen, J. Laukkanen, J. Lehtolahti,*

Tu.D1.3 Spectral and energy efficiency considerations in mixed-line rate WDM networks with signal quality guarantee (*Invited*) *A. Udalcovs*, ***P. Monti***, *V. Bobrovs*, *R. Schatz*, *L. Wosinska*, *G. Ivanovs*	Tu.D2.3 Membrane InP saturable absorbers on silicon as building blocks for transparent optical networks (*Invited*) ***O. Raz***, *G. Roelkens*, *H.J.S. Dorren*, *M. Tassaert*	Tu.D3.3 Results from the EU project ACCORDANCE on converged OFDMA-PON networks (*Invited*) ***K. Kanonakis***, *I. Tomkos*, *H.-G. Krimmel*, *F. Schaich*, *C. Lange*, *E. Weis*, *M. Dreschmann*, *R. Schmogrow*, *P. Kourtessis*, *M. Milosavljevic*, *I. Cano*, *J. Prat*, *J.A. Torrijos Gijón*	Tu.D4.3 Storage, schedule and switching – A new data delivery paradigm in the big data era? (*Invited*) ***Weiqiang Sun***, *Fengqin Li*, *Wei Guo*, *Yaohui Jin*, *Weisheng Hu*	Tu.D5.3 Inverse scattering problems in subsurface diagnostics of inhomogeneous media (*Invited*) ***K.P. Gaikovich***	Tu.D6.3 Eu-doped polymer fibers (*Invited*) ***R. Caspary***, *S. Möhl*, *A. Cichosch*, *R. Evert*, *S. Schütz*, *H-H. Johannes*, *W. Kowalsky*
17:00 Tu.D1.4 Energy efficiency analysis of next-generation passive optical network (NG-PON) technologies in a major city network (*Invited*) *S. Lambert*, *J. Montalvo*, *J.A. Torrijos*, ***B. Lannoo***, *D. Colle*, *M. Pickavet*	17:00 Tu.D2.4 Highly efficient channel waveguide lasers at 2 µm (*Invited*) *K. van Dalfsen*, *S. Aravazhi*, *C. Grivas*, *S.M. Garcia-Blanco*, ***M. Pollnau***	16:40 Tu.D3.4 Passive optical networks based on OFDM: Perspectives and experimental verifications (*Invited*) ***J. von Hoyningen-Huene***, *W. Rosenkranz*	17:00 Tu.D4.4 Adaptive coded-modulation for the next-generation intelligent optical transport networks ***Yequn Zhang***, *I.B. Djordjevic*	17:00 Tu.D5.4 Why optical nonlinear characterisation using imaging technique is a better choice? (*Invited*) ***G. Boudebs***, *V. Besse*, *C. Cassagne*, *H. Leblond*, *F. Sanchez*	
17:20 Tu.D1.5 Adaptive bit loading in FHT-based OFDM transponders for flexi-grid optical networks ***L. Nadal***, *M. Svaluto Moreolo*, *J.M. Fàbrega*, *G. Junyent*	17:20 Tu.D2.5 Microring resonators: Opportunities and challenges for future optical networks (*Invited*) ***A. Bianco***, *M. Garrich*, *R. Gaudino*, *Jinan Xia*	17:00 Tu.D3.5 GPON redundancy eraser algorithm for long-reach extension (*Invited*) ***J. Segarra***, *V. Sales*, *J. Prat*	17:20 Tu.D4.5 Traffic demand estimation for hybrid switching systems ***Pingqing Li***, *Weiqiang Sun*, *Shilin Xiao*, *Weisheng Hu*	17:20 Tu.D5.5 Plasmonic materials and metamaterials by bottom-up approach: Manufacturing and properties (*Invited*) ***D.A. Pawlak***, *M. Gajc*, *P. Osewski*, *K. Sadecka*, *A. Stefanski*, *A. Klos*, *A. Belardini*, *G. Leahu*, *C. Sibilia*	

20:00 ***Gala Dinner at Restaurant "La Cartuja"***

Wednesday, June 26

SESSION We.A1 **ICTON VIII** *Chair:* ***João Pedro*** **(9:00 Wednesday, June 26)**	**SESSION We.A2** **PICAW II** *Chair:* ***Peter Horak*** **(9:00 Wednesday, June 26)**	**SESSION We.A3** **Access III** *Chair:* ***Ioannis Tomkos*** **(9:00 Wednesday, June 26)**	**SESSION We.A4** **GOC I** *Chair:* ***Lena Wosinska*** **(9:00 Wednesday, June 26)**	**SESSION We.A5** **SWP VIII** *Chair:* ***Brana Jelenković*** **(9:00 Wednesday, June 26)**	**SESSION We.A6** **ESPC I** *Chair:* ***Crina Cojocaru*** **(9:00 Wednesday, June 26)**
9:00 We.A1.1 Creating new generation optical network service (*Invited*) ***N. Yamanaka***, *H. Takeshita*, *S. Okamoto*, *T. Sato*	9:00 We.A2.1 Optical delay in silicon photonic crystals using ultrafast indirect photonic transitions (*Invited*) ***D.M. Beggs***, *I.H. Rey*, *T. Kampfrath*, *N. Rotenberg*, *L. Kuipers*, *T.F. Krauss*	9:00 We.A3.1 Optical single sideband generation optimized to support multi-services OFDM over hybrid long-reach FTTH networks ***P. Almeida***, *H. Silva*	9:00 We.A4.1 Energy-efficient space-time optical interconnection architectures for data centers (*Invited*) ***P. Castoldi***, *I. Cerutti*, *P.G. Raponi*, *N. Andriolli*, *O. Liboiron-Ladouceur*	9:00 We.A5.1 Self-pulsing and nonlinear dynamics in micro and nanolasers (*Invited*) ***S. Barbay***, *F. Selmi*, *S. Haddadi*, *R. Braive*, *I. Sagnes*, *R. Kuszelewicz*, *A.M. Yacomotti*	9:00 We.A6.1 Asymmetric light propagation in photonic devices (*Invited*) ***H. Kurt***
9:20 We.A1.2 Dynamic grooming and spectrum allocation in optical metro ring networks with flexible grid (*Invited*) *F. Musumeci*, *F. Puleio*, ***M. Tornatore***	9:20 We.A2.2 Numerical simulation and design of organic integrated optical circuits: The PHOTOPOLIS approach (*Invited*) ***T. Kamalakis***, *D. Alexandropoulos*, *G. Dede*, *P. Kanakis*, *T. Politi*, *N. Vainos*	9:20 We.A3.2 OFDM-PON performance with limited quantization ***X. Escayola***, *I. Cano*, *M. Santos*, *J. Prat*	9:20 We.A4.2 Enhancing data centre networking using energy aware optical interconnects (*Invited*) ***I. Glesk***, *T. Osadola*, *S. Idris*	9:20 We.A5.2 Effect of shell size on single photon emission performances of core/shell dot-in-rods colloidal nanocrystals (*Invited*) *F. Pisanello*, *G. Leménager*, *L. Martiradonna*, *L. Carbone*, *A. Bramati*, ***M. De Vittorio***	9:20 We.A6.2 Controlling the emission from single quantum dots with electro-opto-mechanical photonic crystal cavities (*Invited*) ***L. Midolo***, *F. Pagliano*, *T. B. Hoang*, *T. Xia*, *F.W.M. van Otten*, *A. Fiore*, *L.H. Li*, *E.H. Linfield*, *M. Lermer*, *S. Höfling*
9:40 We.A1.3 Flexible next-generation optical access (*Invited*) ***M. Forzati***, *A. Gavler*	9:40 We.A2.3 A polymer waveguide-based 40 Gb/s optical bus backplane for board-level optical interconnects (*Invited*) ***N. Bamiedakis***, *A. Hashim*, *R.V. Penty*, *I.H. White*	9:35 We.A3.3 16×2.5 Gbit/s and 5 Gbit/s WDM PON based on self-seeded RSOA ***Sy Dat Le***, *Q. Deniel*, *F. Saliou*, *A. Lebreton*, *P. Chanclou*	9:40 We.A4.3 Energy-efficient, high-performance optoelectronic packet switching for intra-data center network (*Invited*) ***Ken-ichi Kitayama***, *S. Debnath*, *Y. Yoshida*, *R. Takahashi*, *A. Hiramatsu*	9:40 We.A5.3 Super spontaneous four-wave mixing (*Invited*) ***M. Liscidini***, *T. Onodera*, *L.G. Helt*, *J.E. Sipe*	9:40 We.A6.3 Active photonic crystal switches: Modeling, design and experimental characterization (*Invited*) ***M. Heuck***, *Y. Yu*, *P.T. Kristensen*, *N. Kuznetsova*, *K. Yvind*, *J. Mørk*
10:00 We.A1.4 Dispersion constraints in optical burst switched metropolitan networks with WDM/OCDM technology ***L.H. Bonani***, *A.B. dos Santos*, *L. Galdino*	10:00 We.A2.4 Robust multi-objective optimization of 2x2 multimode interference coupler using expected improvement ***S. ur Rehman***, *M. Langelaar*, *F. van Keulen*	9:50 We.A3.4 Optimal trade-off for a bidirectional single-fibre single-wavelength TDM-PON rSOA-based ONU ***E.T. López***, *V. Polo*, *J.A. Lázaro*, *J. Prat*	10:00 We.A4.4 Energy saving in TWDM(A) PONs: Challenges and opportunities (*Invited*) ***L. Valcarenghi***, *P. Castoldi*, *Y. Yoshida*, *A. Maruta*, *Ken-ichi Kitayama*	10:00 We.A5.4 Surface enhanced Raman scattering and photo-luminescence through Bloch surface waves in dielectric multilayers (*Invited*) *S. Pirotta*, *X.G. Xu*, *A. Delfan*, *S. Mysore*, *S. Maiti*, *G. Dacarro*, *M. Patrini*, *G. Guizzetti*, *D. Bajoni*, *J.E. Sipe*, *G.C. Walker*, *M. Liscidini*, ***M. Galli***	10:00 We.A6.4 Multiple functionality in III-V on SOI hybrid photonic crystals for systems applications (*Invited*) *F. Raineri*, *P. Monnier*, ***R. Raj***, *A. Bazin*
10:15 We.A1.5 An efficient add/drop architecture for large-scale subsystem-modular OXC ***H. Ishida***,		10:05 We.A3.5 Off-set filtering for enhanced transmission in RSOA based WDM-PON ***A. Gatto***, *P. Parolari*, *L. Marazzi*, *M. Brunero*,	10:20 We.A4.5 A blocking analysis for green WDM networks with transponder power management ***F. Musumeci***, *M. Tornatore*,		

Tremblay **(13:50 Tuesday, June 25)**	**Pohl** **(13:50 Tuesday, June 25)**	**(13:30 Tuesday, June 25)**	**Parca** **(13:50 Tuesday, June 25)**	*Chair:* **Rafał Kotyński** **(13:50 Tuesday, June 25)**	**Vigreux** **(13:30 Tuesday, June 25)**
13:50 Tu.C1.1 Trunk reservation for elastic optical networks (***Invited***) *F. Lezama Cruzvillasante,* ***F. Callegati****, W. Cerroni, L.H. Bonani*	13:50 Tu.C2.1 Are few-mode fibres: A practical solution to the capacity crunch? (***Invited***) ***A. Ellis****, N. Doran*	13:30 Tu.C3.1 UltraFlow Access Networks: A dual-mode solution for the access bottleneck (***Invited***) ***L.G. Kazovsky****, A.R. Dhaini, M. De Leenheer, T.S. Shen, Shuang Yin, B.A. Detwiler*	13:50 Tu.C4.1 On the cost efficiency of flexible optical networking compared to conventional SLR/MLR WDM networks (***Invited***) *I. Stiakogiannakis, E. Palkopoulou,* ***I. Tomkos***	13:50 Tu.C5.1 3D optical data storage by nonlinear processes in thin films of coumarin-containing copolymers (***Invited***) ***D. Gindre****, E. Champigny, K. Iliopoulos, M. Sallé*	13:30 Tu.C6.1 Chalcogenide-silica fibers: A new base for linear and nonlinear nanophotonic devices (***Invited***) ***M.A. Schmidt***
14:10 Tu.C1.2 An elastic networks OMNET++ -based simulator (***Invited***) *A. Asensio, A. Castro, L. Velasco,* ***J. Comellas***	14:10 Tu.C2.2 Ultra-large capacity transmission over trans-oceanic distances with multi-core fibers and EDFAs (***Invited***) ***M. Suzuki****, H. Takahashi, K. Igarashi, K. Takeshima, T. Tsuritani, I. Morita*	13:50 Tu.C3.2 Towards ultra-dense wavelength-to-the-user: The approach of the COCONUT project (***Invited***) *J. Prat, M. Angelou, C. Kazmierski, R. Pous, M. Presi, A. Rafel, G. Vall-llosera, I. Tomkos,* ***E. Ciaramella***	14:10 Tu.C4.2 Twenty years of open fibre network in Stockholm: A socio-economic study (***Invited***) ***M. Forzati****, C. Mattsson*	14:10 Tu.C5.2 Self-assembly of nanostructures by a phase separation in holographic layers of dichromated polysaccharide (***Invited***) *S. Savić-Šević, D. Pantelić, B. Jokić,* ***B. Jelenković***	13:50 Tu.C6.2 Chalcogenide glass fibers for photonic devices (***Invited***) ***J.L. Adam****, L. Brilland, P. Toupin, V. Nazabal, J. Troles*
14:30 Tu.C1.3 Optimization algorithms for data center location problem in elastic optical networks (***Invited***) ***M. Klinkowski****, K. Walkowiak, R. Goścień*	14:30 Tu.C2.3 On the dependence of differential mode delay of few-mode fibers with the number of modes (***Invited***) *F. Ferreira,* ***D. Fonseca****, H. Silva*	14:10 Tu.C3.3 High-speed coherent WDM PON for next-generation access network (***Invited***) ***Y.C. Chung***	14:30 Tu.C4.3 Total cost of ownership comparison between single and mixed line rates networks (***Invited***) ***A.N. Pinto****, R.M. Morais, J. Pedro, P. Monteiro*	14:30 Tu.C5.3 Fluorescent nanoparticles for biosensing applications (***Invited***) ***S. Tomljenovic-Hanic****, B.C. Gibson, T.J. Karle, A. Khalid, K. Chung, D.A. Simpson, P. Tran, P. Domachuk, H. Tao, J.E. Moreau, D.L. Kaplan, F.G. Omenetto, H. Amekura, A.B. Djurisic*	14:10 Tu.C6.3 Third-order non-linear optical response in chalcogenide glasses: Measurement and evaluation (***Invited***) ***E. Romanova****, K. Chumakov, A. Mouskeftaras, S. Guizard, N. Abdel-Moneim, D. Furniss, A.B. Seddon, T.M. Benson*
14:50 Tu.C1.4 Spectrum-sliced elastic optical networking (***Invited***) ***H. Waldman****, R.C. Almeida Jr., K.D. Assis, R.C. Bortoletto*	14:50 Tu.C2.4 Generating versatile waveforms using single dual-drive modulator (***Invited***) *B. Dai, S. Shimizu,* ***Xu Wang****, N. Wada*	14:30 Tu.C3.4 Ultra high capacity PON systems (***Invited***) ***A. Teixeira****, G. Parca, A. Shahpari, J. Reis, R. Ferreira, A. Abdalla, M. Lima, V. Carrozzo, G. Tosi-Beleffi*	14:50 Tu.C4.4 The cost dependence between the grooming scheme, the node architecture and the traffic pattern in optical networks (***Invited***) ***R.M. Morais****, J. Pedro, P. Monteiro, A.N. Pinto*	14:50 Tu.C5.4 Investigations at nanoscale by using fluorescence in apertureless scanning near field microscopy (***Invited***) ***G.A. Stanciu****, D.E. Tranca, R. Hristu, C. Stoichita, S.G. Stanciu*	14:30 Tu.C6.4 Nd^{3+} doped phosphate glass optical fibre lasers (***Invited***) ***N.G. Boetti****, J. Lousteau, E. Mura, G.C. Scarpignato, D. Milanese*
15:10 Tu.C1.5 Flexible-sense optical transmission (***Invited***) *V. Rozental, G. Bruno, A. Soso, M. Camera,* ***D.A.A. Mello***	15:10 Tu.C2.5 Robustness to mechanical perturbations of centre-launching technique in multi-mode fibres for transparent optical interconnects ***A. Boletti****, P. Boffi, A. Gatto, P. Martelli, E. Centeno Nieves, M. Martinelli*	14:50 Tu.C3.5 COCONUT requirements for residential, business and outdoor scenarios ***G. Vall-llosera****, A. Rafel, E. Ciaramella, J. Prat*	15:10 Tu.C4.5 Performance comparison of optical channel formats to realize 400G data rates in transport networks under dynamic traffic (***Invited***) ***J. Pedro****, A. Eira, J. Pires*	15:10 Tu.C5.5 Detecting cancerous tissues in human body by means of fiber fluorescent spectroscopy (***Invited***) ***E. Bereś-Pawlik****, H. Sławska, Ł. Klonowski*	14:50 Tu.C6.5 Design of rare-earth doped microspheres lasers (***Invited***) *P. Bia, L. Mescia, O. Losito, M. De Sario, D. Ristic, M. Ferrari, G.C. Righini,* ***F. Prudenzano***
Coffee break (15:30 – 16:00)	**Coffee break** (15:30 – 16:00)	**Coffee break** (15:05 – 15:40)	**Coffee break** (15:30 – 16:00)	**Coffee break** (15:30 – 16:00)	**Coffee break** (15:10 – 15:40)
SESSION Tu.D1 **ICTON VII** *Chair:* **Burak Kantarci** **(16:00 Tuesday, June 25)**	**SESSION Tu.D2** **PICAW I** *Chair:* **Lech Wosinski** **(16:00 Tuesday, June 25)**	**SESSION Tu.D3** **Access II** *Chair:* **Leonid Kazovsky** **(15:40 Tuesday, June 25)**	**SESSION Tu.D4** **ISOND** *Chair:* **Milorad Cvijetic** **(16:00 Tuesday, June 25)**	**SESSION Tu.D5** **SWP VII** *Chair:* **Pavel Cheben** **(16:00 Tuesday, June 25)**	**SESSION Tu.D6** **Glasses II** *Chair:* **Slawomir Sujecki** **(15:40 Tuesday, June 25)**
16:00 Tu.D1.1 Dynamic deployment of virtual GMPLS-controlled elastic optical networks using a virtual network resource broker on the ADRENALINE testbed (***Invited***) ***R. Vilalta****, R. Muñoz, R. Casellas, R. Martínez*	16:00 Tu.D2.1 Photonic components for signal routing in optical networks on chip (***Invited***) *G. Calò,* ***V. Petruzzelli***	15:40 Tu.D3.1 A study of flexible bandwidth allocation in statistical OFDM-based PON (***Invited***) ***I.N. Cano****, X. Escayola, A. Peralta, V. Polo, M.C. Santos, J. Prat*	16:00 Tu.D4.1 An evolutionary spectrum assignment algorithm for elastic optical networks (***Invited***) ***R.C. Almeida Jr.****, R.A. Delgado, C.J.A. Bastos-Filho, D.A.R. Chaves, H.A. Pereira, J.F. Martins-Filho*	16:00 Tu.D5.1 High resolution Fourier-transform microspectroscopy based on spiral silicon waveguides (***Invited***) *A.V. Velasco,* ***M.L. Calvo****, P. Cheben, M. Florjańczyk, P.J. Bock, A. Delâge, J.H. Schmid, J. Lapointe, S. Janz, Dan-Xia Xu, M. Vachon*	15:40 Tu.D6.1 Te-Ge-Se thermally co-evaporated films: Elaboration, characterization and use for the manufacture of IR rib waveguides, basic elements of CO_2 microsensors (***Invited***) ***C. Vigreux****, M. Vu Thi, G. Maulion, R. Kribich, A. Pradel*
16:20 Tu.D1.2 Dynamic management of bursty traffic over multiple channels (***Invited***) ***A.K. Somani***	16:20 Tu.D2.2 Silicon CMOS photonics platform for enabling high-speed DQPSK transceivers (***Invited***) ***P. Sanchis****, M. Aamer, A. Brimont, A.M. Gutierrez, N. Sotiropoulos, H. de Waardt, D.J. Thomson, F.Y. Gardes, G.T. Reed, K. Ribaud, P. Grosse, J.M. Hartmann, J-M. Fedeli, D. Marris-Morini, E. Cassan, L. Vivien, D. Vermeulen, G. Roelkens, A. Hakansson*	16:00 Tu.D3.2 Dynamic bandwidth allocation with optimal wavelength switching in TWDM-PONs (***Invited***) ***A. Dixit****, B. Lannoo, D. Colle, M. Pickavet, P. Demeester*	16:20 Tu.D4.2 Flow controlled scalable optical packet switch for low latency flat data center network (***Invited***) ***N. Calabretta****, S. Di Lucente, Jun Luo, A. Rohit, K. Williams, H. Dorren*	16:20 Tu.D5.2 Optical Haar transform for 2D processing and compression (***Invited***) ***G. Parca****, P. Teixeira, C. Vicente, A. Teixeira*	16:00 Tu.D6.2 Active waveguides for Mid-IR (3–4 µm) wavelengths fabricated by femtosecond laser inscription in Dy^{3+} doped tellurite glass (***Invited***) ***T.T. Fernandez****, B.D.O. Richards, G. Jose, A. Jha, J. Hoyo, A. Ruiz De la Cruz, J. Solis*
16:40	16:40	16:20	16:40	16:40	16:20