



Symposium on Optical Interconnect in Data Centers

18-19 March 2014, Berlin, Germany

1st Optical Interconnect in Data Centers Symposium

The event is organized by **EPIC** and the EU project **PhoxTroT**



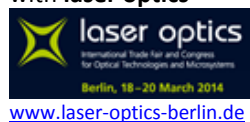
with the support of **IEEE CPMT** German Chapter and **ECO**



Sponsored by **ficonTEC**, **VERTILAS** and **Berlin Partner**



Held in conjunction with **laser optics**



The symposium is focused on *high-performance, low-energy and cost and small-size* optical interconnects across the different hierarchy levels in data center and high-performance computing systems: on-board, board-to-board and rack-to-rack.

Speakers and Session Chairs

- ★ Avinash Karanth Kodi, Ohio University, OH, United States
- ★ Bert Offrein, IBM Zurich, Switzerland
- ★ David Selviah, University College London, United Kingdom
- ★ Dieter Bimberg, TU Berlin, Germany
- ★ Dimitris Apostolopoulos, ICCS / NTUA, Greece
- ★ Dimitris Tsiokos, AUTH / CERTH, Greece
- ★ Elad Mentovich, Mellanox, Israel
- ★ Emmanouel Varvarigos, CTI 'Diophantus', Greece
- ★ Felix Betschon, vario-optics ag, Switzerland
- ★ Hideyuki Nasu, Furukawa, Japan
- ★ Ignazio Piacentini, PI miCos, Germany
- ★ Jeroen Duis, TE Connectivity, Netherlands
- ★ Jörg-Peter Elbers, ADVA Optical Networking, Germany
- ★ Katharine Schmidtke, Finisar, CA, United States
- ★ Kostas Katrinis, IBM Dublin, Ireland
- ★ Lars Brusberg, Fraunhofer IZM, Germany
- ★ Marika Immonen, TTM Mail Finland, Hong Kong
- ★ Manabu Yasukawa, Synergy Optsystems, Japan
- ★ Marc Duranton, CEA / HiPEAC, France
- ★ Mayank Singh, Sumitomo Bakelite, Japan
- ★ Michael Lebby, OneChip Photonics, Canada
- ★ Muhannad Bakir, Georgia Institute of Technology, GA, United States
- ★ Nikos Pleros, AUTH / CERTH, Greece
- ★ Peter De Dobbelaere, Luxtera, CA, United States
- ★ Richard Penty, University of Cambridge, United Kingdom
- ★ Richard Pitwon, Xyratex, United Kingdom
- ★ Shuki Benjamin, Compass EOS, Israel
- ★ Simon Jones, Dow Corning, United Kingdom
- ★ Takashi Shimizu, Fujitsu, Japan
- ★ Takehiro Hayashi, Hat Lab, Japan
- ★ Tolga Tekin, Fraunhofer IZM / TU Berlin, Germany
- ★ Ulrich Fischer-Hilchert, Harz University, Germany
- ★ William Whelan-Curtin, University of St Andrews, United Kingdom

Symposium Sessions

| | | |
|-------------------------|-------------|---------------------------------------|
| Tuesday 18 March 2014 | 8:50-11:00 | Data Centers |
| | 11:20-13:20 | Photonic Components |
| | 14:10-16:10 | Systems |
| | 16:30-18:55 | Optical Circuit Boards And Materials |
| | 19:00 | Symposium Dinner |
| Wednesday 19 March 2014 | 9:00-11:00 | Data Center And Network Architectures |
| | 11:20-13:20 | Embedded Optical Modules |
| | 14:10-16:30 | Route To Adoption |

Registration

www.epic-assoc.com/events

- Speakers: 125 EUR + VAT / Participants: 125 EUR + VAT
- Agenda, hotel, and logistics information will be sent directly to the participants

Symposium Programme

Tuesday 18 March 2014

- 8:50 **WELCOME**
by laser optics 2014 Supervisory Board, EPIC and PhoxTroT
- 9:00 **DATA CENTERS**
Session Chair: Richard Pitwon
Jörg-Peter Elbers, ADVA Optical Networking, Germany
Next-Generation Data Centers – Paving the Way to the Zettabyte Era
Bert Offrein, IBM Zurich, Switzerland
System-level integration aspects of silicon photonics
Takashi Shimizu, Fujitsu, Japan
Optical interconnect technology for high-bandwidth data connection in next-generation servers
Marc Durantou, CEA / HiPEAC, France
Context and expectations for photonics technologies in computing systems
Session ends with round table discussion
- 11:00 **Coffee Break**
- 11:20 **PHOTONIC COMPONENTS**
Session Chair: Dimitris Tsiokos
Michael Lebby, OneChip Photonics, Canada
InP integrated photonics for the datacenter
Dieter Bimberg, TU Berlin, Germany
Nanophotonics for future datacom networks
William Whelan-Curtin, University of St Andrews, United Kingdom
Photonic Crystals for Optical Interconnects
Ulrich Fischer-Hilchert, Harz University, Germany
WDM over POF - up to 40 Gbit/s
Session ends with round table discussion
- 13:20 **Lunch**
- 14:10 **SYSTEMS**
Session Chair: Dimitris Apostolopoulos
Richard Pitwon, Xyratex, United Kingdom
Electro-optically enabled data storage systems for exascale data centres

Muhannad Bakir, Georgia Institute of Technology, GA, United States

Advanced packaging for dense electrical and optical interconnected systems using silicon interposer

Peter De Dobbelaere, Luxtera, CA, United States

Silicon Photonics based single-mode optical interconnect for cloud datacenters

Shuki Benjamin, Compass EOS, Israel

A 1.3 Tb/s parallel optical link

Session ends with round table discussion

16:10 **Coffee Break**

16:30 **OPTICAL CIRCUIT BOARDS AND MATERIALS**

Session Chair: Richard Pitwon

Simon Jones, Dow Corning, United Kingdom

Developments in polymer waveguides to enable short link optical interconnect in next generation Data Centres

Marika Immonen, TTM Mail Finland, Hong Kong

Final title of the talk will be announced shortly

Lars Brusberg, Fraunhofer IZM, Germany

Electro-optical circuit boards with single- or multi-mode optical interconnects based on a glass panel gradient-index waveguide technology

Mayank Singh, Sumitomo Bakelite, Japan

High performance and high reliability polymer waveguides for optical interconnect

David Selviah, University College London, United Kingdom

Final title of the talk will be announced shortly

Session ends with round table discussion

19:00 **SYMPOSIUM DINNER**

Wednesday 19 March 2014

9:00 **DATA CENTER AND NETWORK ARCHITECTURES**

Session Chair: Emmanouel Varvarigos

Kostas Katrinis, IBM Dublin, Ireland

Final title of the talk will be announced shortly

Richard Penty, University of Cambridge, United Kingdom

Low Loss Bends for On-Board Polymer Interconnects

Avinash Karanth Kodi, Ohio University, OH, United States

Scalable 3D photonic interconnects for many-core architectures

Emmanouel Varvarigos, CTI 'Diophantus', Greece

Final title of the talk will be announced shortly

Session ends with round table discussion

11:00 **Coffee Break**

11:20 **EMBEDDED OPTICAL MODULES**

Session Chair: Tolga Tekin

Elad Mentovich, Mellanox, Israel

Final title of the talk will be announced shortly

Hideyuki Nasu, Furukawa, Japan

VCSEL-based parallel-optical modules

Jeroen Duis, TE Connectivity, Netherlands

Final title of the talk will be announced shortly

Katharine Schmidtke, Finisar, CA, United States

Parallel optics for Data Center Interconnect: Inter-rack, inter-board and inter-chip

Session ends with round table discussion

13:20 **Lunch**14:10 **ROUTE TO ADOPTION**

Session Chair: Richard Pitwon

Richard Pitwon, Xyratex, United Kingdom*International standardisation of optical circuit board technologies***Takehiro Hayashi**, Hat Lab, Japan*Standardization of EAF (encircled angular flux), the purpose and the measurement method***Manabu Yasukawa**, Synergy Optsystems, Japan*Development of high takt time wave guide optical tester***Felix Betschon**, vario-optics, Switzerland*From long reach to short reach and vice versa***Ignazio Piacentini**, PI miCos, Germany*The assembly / alignment bench towards full process automation*

Session ends with round table discussion

16:30 **END OF SYMPOSIUM**

Miscellaneous

CALL FOR POSTER PRESENTATIONS

The Technical Programme Committee encourages submission of original, relevant posters in any of the topic areas of the symposium. Authors should submit the posters via email by Friday, 7 March 2014. Authors selected for a poster presentation will be asked to produce and bring along a printed poster for display in the poster area at the symposium. Poster sessions will take place on 18 March 2014 during the breaks.

VISIT OF FRAUNHOFER IZM LABORATORIES ON THURSDAY 20 MARCH 2014

Fraunhofer Institute for Reliability and Microintegration (IZM) Lab-Tours will be available for limited number of symposium attendees on Thursday 20 March 2014 9:00-12:00. Tours will include visit of Wafer Level System Integration Clean Room, Embedding and Substrates Technology Clean Room and Optical Interconnection Technology Lab. Registration is mandatory.



General Information

Welcome Coffee - Onsite registration and Badge Pick-Up Hours

Tuesday 18 March 8:30 to 19:00

Wednesday 19 March 8:00 to 16:00

Symposium Registration

Includes admission to symposium sessions, poster sessions, and admission to laser optics 2014 Exhibition, symposium coffee breaks, symposium lunch breaks and symposium dinner.

Symposium Venue



The symposium will be held at the "Georg C. Marshall-House" of the Berlin Exhibition Grounds in Berlin, Germany in conjunction with *laser optics* which is Germany's top platform for state-of-the art technologies and applications of both optical technologies and microsystems technology. www.laser-optics-berlin.de

*Georg C.
Marshall
House*

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Supporters



Technical Programme Committee

- Dimitris Apostolopoulos, ICCS / NTUA, Greece
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- Nikos Pleros, AUTH / CERTH, Greece
- Richard Pitwon, Xyratex, United Kingdom
- Tolga Tekin, Fraunhofer IZM / TU Berlin, Germany

Organizing Committee

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- Carlos Lee, EPIC: carlos.lee@epic-assoc.com
- Klaus-Dieter Lang, TU Berlin / Fraunhofer IZM / IEEE CPMT



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PhoxTroT.eu is focusing on on-board, board-to-board and rack-to-rack optical interconnects. The goal of this large-scale EU research effort is the deployment of optimized technologies to tailor dedicated interconnect layers towards high-performance, low-energy and low-cost Data Center and High-Performance Computing Systems. A "mix & match" technology by synergizing the different fabrication platforms such as CMOS electronics, Si-photonics, polymers, glass, III-Vs, and plasmonics will enable generic building blocks (transmitters, modulators, receivers, switches, optochips, multi- and single-mode optical PCBs, chip- and board-to-board connectors) to extend the performance beyond Tb/s and to reduce the energy by more than 50%.



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