



# 1st Executive Forum on Silicon Photonics PROGRAM

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## Peking University

Zhiping (James) Zhou

*Professor*

*Zhiping (James) Zhou received his Ph.D. (EE) degree from Georgia Institute of Technology (GT), USA, in 1993. From 1993 to 2005, he was with the Microelectronics Research Center at GT, where he engaged research and development in the areas of nanotechnology; silicon photonics; ultra-fast optical communications; integrated optoelectronics; semiconductor devices and sensors. He is now a "Changjiang" Professor at Peking University, Beijing, China. He has been credited for over 500 technical papers, presentations, and patents.*

*He is a Fellow of OSA, SPIE, and IET. He serves as Honorary Director of Chinese Optical Society (COS) and Managing Director of Chinese Society for Optical Engineering (CSOE), the founding Editor-in-Chief of Photonics Research. He was founding Chair of IEEE Wuhan Section, 2007-2008, Director of IEEE Atlanta Section, 2001- 2003. He also chaired, co-chaired, and served on many program committees for various conferences of IEEE Photonics Society, OSA, SPIE, COS, and CSOE.*

## Silicon photonics in China

This talk will generally summarize the development of Silicon Photonics so far and suggest its next movement after the tipping point. Key issues on large scale integration and new applications will be discussed

## Yole Développement

Dr. Eric Mounier

*Fellow Analyst, Photonics, Sensing and Display Division*

*With almost 20 years of experience in MEMS, Sensors and Photonics applications, markets, and technology analyses, Eric Mounier, PhD provides deep industry insight into current and future trends. As a Fellow Analyst, Technology & Market, MEMS & Photonics, in the Photonics, Sensing & Display division, he is a daily contributor to the development of MEMS and Photonics activities at Yole Développement (Yole), with a large collection of market and technology reports as well as multiple custom consulting projects: business strategy, identification of investments or acquisition targets, due diligences (buy/sell side), market and technology analysis, cost modelling, technology scouting, etc.*

*Previously, Eric Mounier held R&D and Marketing positions at CEA Leti (France).*

*He has spoken in numerous international conferences and has authored or co-authored more than 100 papers.*

*Eric has a Semiconductor Engineering Degree and a Ph.-D in Optoelectronics from the National Polytechnic Institute of Grenoble (France).*

## **Silicon Photonics, beyond the tipping point !**

GAFAMs are today the driving force behind the deployment of Si photonics technology. They are currently setting up networks of interconnected data centers with local data centers at the nodes of the mesh. As a consequence, Silicon photonics is putting a lot of pressure on other PIC platforms, such as InP (the most widespread) and it is likely that InP, and other PIC platform players, could embark on acquisitions in the future to bring this technology in-house. But beyond DCI, there are other possible applications for Si photonics. 5G is the next large-volume application with Intel and Sicoya already well positioned. Lidars, for autonomous cars, as well as medical sensors could also benefit from the possibilities of integration and cost reduction of Si photonics. The supply chain is maturing as well with more and more foundries and startups involved in Si photonics. My talk will review the market forecast, applications and future trends for Si photonics.

### **Intel**

Richard Zhang

*Technical Sales Specialist for the Silicon Photonics Products Division*

*Mr. Richard Zhang joined Intel March 2017 as a Technical Sales Specialist for the Silicon Photonics Products Division. He has extensive technical and market experience in the fiber-optic communication and datacenter connectivity industries. Before Intel, Richard was the sales and market leader for APAC at Source Photonics, an optical component and transceiver technologies and manufacturing company. Prior to this role, Richard also led the sales and market division for their EMEA business and held several executive roles within the company. Richard holds an MBA from Business School of Fordham University in New York and a BS from Beijing University of Technology.*

## **Integrated Silicon Photonics for Future Data Center Applications**

The rapid growth in data center traffic is driving the need for increased performance and overall bandwidth of networking equipment, including optical interfaces and Ethernet switches, which are based on pluggable transceivers today. But looking just a few years ahead, bandwidth scalability challenges are looming in terms of density, cost, and power; challenges that require tighter integration of optics and networking silicon. We will review motivation for integration and the enabling technology elements, and discuss how co-packaged Silicon Photonics enables higher density, reduced power per bit, and ultimately the continued scalability of network bandwidth and performance.

### **Sicoya**

Sven Otte

*CEO*

*Sven Otte is the Chief Executive Officer and Co-Founder of Sicoya. Prior to Sicoya Sven was the Global Business Director of Optoelectronics at FCI. Before joining FCI he served as Global Vice President of Engineering at MergeOptics, Senior IC Design Engineer at Multilink Technologies and Senior System Architect at Santel Networks in Fremont, USA. Sven holds a Ph.D. in optical communications from the University of Kiel and authored several articles about electronic dispersion compensation for high speed optical transmission systems and Silicon Photonics technologies.*

## **Silicon Photonics in Data Communication and Beyond: From R&D to full production**

Silicon Photonics started as a research topic in the 90s and almost 30 years later the industry is approaching the tipping point where this technology becomes the mainstream technology in high speed data communication. However, the supply chain is not quite yet readily available today but a few leading companies have paved the path and successors have less burdens to overcome issues when trying to enter the business compared to where we stood a couple of years ago. Pure play Silicon Photonic foundry services are becoming available, wafer level test systems are established and standard packaging concepts exist. Sicoya is one of the leading companies and in this talk we will address the challenges that we had to overcome to scale from a research level to a full industrial production level. We will also highlight what are the current foundry issues and what killer applications are at the horizon that will drive the technology in the next couple of years.

## **System Plus Consulting**

Romain Fraux

*CEO*

*Romain Fraux is the CEO of System Plus Consulting (part of our Yole Group of companies), that focuses on Reverse Costing analysis of electronics, from semiconductor devices to electronic systems.*

*Supporting industrial companies in their development, Romain and his team are offering a complete range of services, costing tools and reports. They deliver in-depth production cost studies and estimate objective selling price of a product, all based on a detailed physical analysis of each component in System Plus Consulting laboratory.*

*Romain has been working for System Plus Consulting for more than 12 years and was previously the company's CTO.*

*He holds a bachelor's degree in Electrical Engineering from Heriot-Watt University of Edinburgh (Scotland), a master's degree in Microelectronics from the University of Nantes (France), France and a Master of Business Administration.*

## **Silicon Photonics Teardown and Cost Review: Case Study on Intel 1st Generation 100G transceivers**

In only a few years, Intel has become the number two supplier for silicon photonics-based optical transceivers. Intel has succeeded because it put a lot of effort into the bottleneck, which was integrating the laser chip through InP chiplet bonding followed by post processing. Intel introduced a silicon photonics Quad Small Form-factor Pluggable (QSFP) format transceiver that supports 100G communications in 2016. The company now ships a million units of this product per year into data centers. Intel's 400G products are expected to enter volume production in the second half of 2019. All these innovations have been enabled by Intel's first generation 100G series silicon photonics QSFP transceivers, featuring laser-on-chip integration.

Based on pictures extracted from teardown and physical analysis of Intel 100G PSM4 connector, the presentation will highlight the integration choices of Intel for the silicon photonic die, the TIA circuit, the Mach-Zehnder driver circuit, the MACOM circuit and the germanium photodiode.

## **Hewlett Packard Enterprise**

Ashkan Seyedi

*Senior Research Scientist*

*Ashkan received a dual Bachelor's in Electrical and Computer Engineering from the University of Missouri-Columbia and a Ph.D. from University of Southern California working on photonic crystal devices, high-speed nanowire photodetectors, efficient white LEDs and solar cells. While at Hewlett Packard Enterprise as a research scientist, he has been working on developing high-bandwidth, efficient optical interconnects for exascale and high performance computing applications.*

### **Advanced silicon photonics interconnects for high-performance computing applications**

There is no doubt that high-bandwidth optical interconnects play a critical role in tomorrow's data center and high-performance computing applications. In this talk, I will discuss what Hewlett Packard Enterprise is doing to enable a democratized, scalable, and co-packaged silicon photonics interconnect. I will cover our work on comb lasers, optical interposers, electronic ASIC design and fiber packaging.

## **Soitec**

Alain Delpy

*Business Development Manager Photonics and Imager*

*About Alain Delpy (Business Development Manager) is a graduate in electronic and business school. He has a long history with various electronic domains from IoT to power applications and spent 15 year at ST Microelectronics in close relationships with Nokia. He has a background with camera for mobile phones, X-ray applications and other sensing applications. He joined SOITEC in 2018. to enhance the SOI(Silicon on Isolator) road map associated to photonics application used in transceivers or optical I/Os. He is also active with Minalogic and EPIC eco system. Alain is also selecting the main possible partnerships for capital investment in Silicon Photonics.*

### **Why SOI substrates are the foundation of Silicon photonics devices**

Silicon-On-Insulator (SOI) substrates are used in many markets: Digital with FD-SOI, Radio-frequency with RFeSi and Specialty with Power-SOI. Photonics applications are using SOI substrate as a standard for its capability to pave a route for the light the integration of a unique refractive index contrast. This SOI surface is used to capture or to conduct the light in wave guides. Today, data centers are the key driver with the integration of transceivers offering a conversion from electrical to optical signal. The optical communication is challenged to improve power efficiency, bandwidth, distance, cost and size. Therefore we explain why SOI based optical wave guide is the solution to benefit of CMOS integration and capabilities of the semiconductor industry. The presentation recaps the key functions addressed by SOI substrates and their central roles in the various photonics markets enabling 400GbE and beyond a path for optical I/Os integration in addition to Lidar, bio-sensing and many other applications.

## Teem Photonics

Arnaud Rigny

*Head of Business Line - ioNext at Teem Photonics*

Arnaud Rigny is responsible of the ioNext Business Line for Teem Photonics. He has more than 20 years of experience in the fields of photonics and semiconductor. After a 10-year experience in research and development at Corning then in product line management at Alcatel Optronics, he joined Soitec as a manager of research and development projects before taking on commercial responsibilities in 2007. He graduated from the Télécom ParisTech engineering school and has a doctorate in optoelectronics from Télécom

### **Glass technology for smart silicon photonics fiber interface**

Ion exchange technology on glass enables the manufacturing of waveguides having properties close to optical fiber (low losses, mode size, polarization independence). The ioNext technology based on this principle enable low coupling loss fiber interface with silicon photonic components and pitch adaptation for compact fiber assembly. This functionality can be combined with other passive functions such as mirrors, combiners and filters to achieve a complete smart optical interface.