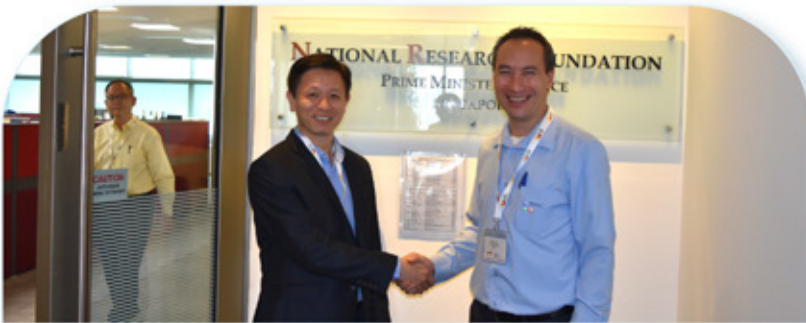


An EPIC look at Singapore's Photonics heart

The LUX Photonics Consortium played host to a delegation from the European Photonics Industry Consortium (EPIC) over 3.5 days in October.

It was a fruitful trip that saw seven EPIC companies, led by Director General Carlos Lee, and 20 LUX companies participate. Of these, eight LUX companies did a company introduction presentation.

Day 1 of the trip saw the EPIC delegation visit the National Research Foundation Singapore (NRF), which funds LUX. There, they were warmly welcomed by Mr Lim Tuang Liang, Executive Director of the NRF's Research, Innovation and Enterprise (RIE) Coordination Office. There was an introduction to the NRF, including an overview of Singapore's RIE Ecosystem.



EPIC Director General Carlos Lee (right) with Mr Lim Tuang Liang.

TPI Co-Director and LUX Chairman Prof Tjin Swee Chuan introduced the Consortium as a seamless bridge for private-public partnership and spoke about the various LUX initiatives, including technical seminars, photonics-topic Work Groups and the annual Photonics@SG conference. The day also saw the delegation visit NUS.

At the end of Day 1, delegates were rewarded with breath-taking views of the iconic Singapore skyline at a cocktail reception at the Level 57 atop the Marina Bay Sands (below photos).



Message from the Chairman/Co-director:

This will be the last issue of this newsletter for the year as we bid farewell to 2019 and welcome the new year 2020. This last quarter of the year had been a busy one for LUX/TPI no less, with a host of activities and events just concluded.

LUX had kick-started a series of workgroup discussions in September 2019 which garnered very good responses and support from faculty and industry members. Those who came contributed ideas for possible collaboration in the identified areas of Optical Sensors for Structural Health Monitoring, Fibre Laser Systems and Laser Assisted Manufacturing, and Silicon Photonics. Moving forward, the discussion meetings will be more focused to scope up collaborative proposals that will give our industry members a technological edge in this competitive environment.

In October 2019, LUX hosted the major event of the year, a three-and-a-half-day visit by the European Photonics Industry Consortium (EPIC) delegation led by Mr Carlos Lee, the Director General of EPIC, together with ten EPIC members. This is the bi-annual event following last year's LUX delegation to Berlin organised by EPIC. It was a good bilateral exchange for both consortium members that help open up collaborative business opportunities in Singapore and Europe. I would like to thank our members for actively participating, hosting and sponsoring some of the events to make it a fruitful one for our guests from Europe. The feedback from the EPIC delegation has been tremendous, and they are now planning a yearly delegation for their members to explore business opportunities in Singapore.

The Photonics Institute (TPI) celebrated its 5th Anniversary on 7th November 2019 in conjunction with Photonics@SG 2019 conference held in NTU Nanyang Executive Centre Auditorium. We were honoured to have Her Excellency Kara Owen, British High Commissioner to Singapore to grace the event, as well as NTU and University of Southampton Presidents speaking at the event. The conference proceeded with some fascinating talks from distinguished academics and insightful industry speakers from overseas and locally.

As we draw to the close of 2019, I would like to take this opportunity to wish everyone a Merry Christmas and a great and fruitful 2020 ahead!

Prof Tjin Swee Chuan
Chairman, LUX Photonics Consortium
Co-Director, The Photonics Institute





The bulk of Day 2 was spent at the Industrial Transformation Asia Pacific (ITAP), Asia-Pacific's leading trade event for Industry 4.0. The delegates attended the opening ceremony, including speeches by Mr Heng Swee Keat, Deputy Prime Minister and Minister for Finance, and Dr Ulrich A. Sante, Ambassador of the Federal Republic of Germany to Singapore. They then enjoyed a networking lunch at the LUX Pavilion and viewed the exhibits of five member companies (Eureka Robotics, OptoSigma, ST Electronics, Wavelength Opto-Electronic, WEO Corporation). The day concluded with a visit to LUX member and optics solutions company Moveon Technologies, hosted by CEO Mr Chee Teck Lee, for a company presentation and more networking (below photos).



On Day 3, the delegates made their way down to the Raffles City Tower office of LUX partner, the Singapore Economic Development Board (EDB). Presentations by both EDB and A*STAR there, coupled with the earlier visit to NRF, gave the delegation valuable insights into Singapore's trade and industry, as well as R&D and photonics-related industry landscape.



For the second half of the day, the delegation joined the 4th Qtr LUX Members Networking Event at NTU. The event was held in conjunction with the EPIC delegation visit. The EPIC delegates also toured TPI (below photos) and its state-of-the-art Fibre Fabrication Facility.

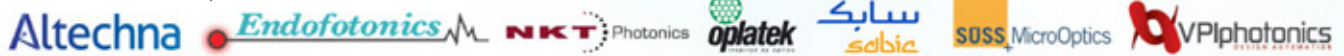


The final day of the programme, saw the delegation visited three LUX member companies. First stop at Denselight Semiconductors hosted by CTO Dr Lam Yee Loy and toured their facility for InP-based Sensing and Datacom applications. Second stop to Palomar Technologies (SE ASIA) hosted by Managing Director Mr Richard Hueners and a glimpse of the newly expanded Singapore Innovation Centre. Lastly, to Meridian Innovation hosted by Director of Engineering Dr Piotr Kropelnicki and a demonstration of their innovative, low cost and fast response thermal sensors.



EPIC Delegation to Singapore 21-24 October 2019

- 7 EPIC member companies



- 23 company/organization presentations (7 EPIC members + 11 LUX members + NRF, EDB, TPI, NUS, A*STAR)
- 13 networking sessions
- 11 LUX member companies presenting (including 4 companies visit)

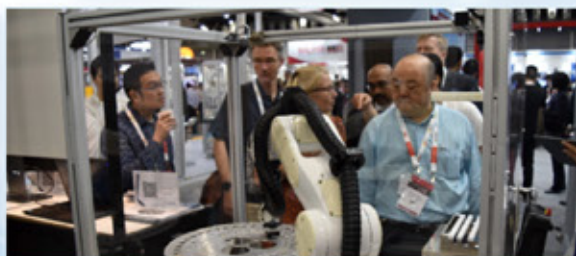
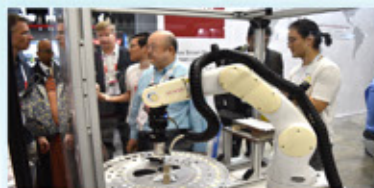


- 4 LUX member company visits



LUX Pavilion stands out at ITAP 2019

LUX Photonics Consortium participated at the second edition of Industrial Transformation Asia Pacific (ITAP) 2019, the leading trade event for Industry 4.0, held on 22-24 October at the Singapore Expo. Together with 5 LUX member companies Eureka Robotics, OptoSigma, ST Engineering, Wavelength Opto-Electronics and WEO Corporation, LUX Pavilion stands out at the event hall with customised and dedicated exhibition booth space plus intriguing robotic arm demos and product showcase by our member companies.



Ten more bright lights for LUX

Seven new Industry and three new Faculty members were welcomed to the LUX Photonics Consortium at the 3rd Qtr Members Networking Event at NTU Innovation Centre on 25 September.

At the event, LUX Chairman Prof Tjin Swee Chuan (right pictured) spoke about the Laser & Optics Joint Industry Sector Planning (JISP) Technology Roadmapping process, the Laser World of Photonics in Munich in which four LUX members exhibited, and the Photonics/Optics Landscape in Singapore for the domain of "Advanced Manufacturing & Engineering".



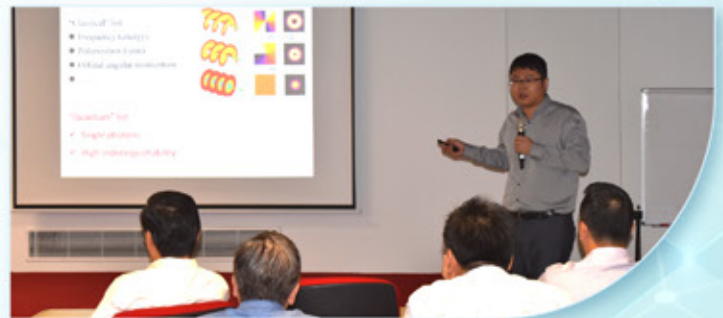
Asst Prof Ni Ran of NTU presented on "Dynamic hyperuniform materials - towards perfect photonic fluids".



NTU Assoc Prof Li Shuzhou discussed "Numerical simulations of materials with surface plasmon resonances".



Dr Andrew Ngo of A*STAR presented on "Advanced thermography technique for defects & faults detection".



New Faculty member Asst Prof Gao Weibo, of NTU, focused on "Single photon generation and relevant techniques".



SICK's Product Centre Asia Managing Director, Mr Jack Goh



STAR Technologies' VP of Engineering, Dr Jeffrey Lam



Advanced Micro Foundry's Business Development Manager, Mr Aashit Kamath



Polytec's Sales and Application Engineer, Mr Liu Yang

Aside from Asst Prof Gao, the other new Faculty members are NTU's Prof Yu Ting and A*STAR's Dr Bai Ping. The seven new Industry members are:



Advanced Micro Foundry, which specialises in customisable prototyping and volume wafer manufacturing services for Silicon Photonics integrated circuits.



Crystal-Optech, which has been listed on the Shenzhen Stock Exchange since September 2008 and specialises in the research, development and manufacturing of optical imaging, LED, micro display and reflective materials.



iLASER, a solutions provider focusing on Photonics Technologies and Digital Fabrication Solutions for Research and Industrial applications. The company offers different types of laser processing machines.



Polytec, which specialises in the technological fields of Vibrometry, Velocimetry, 3D Surface Metrology, Process Analytics, Image Processing and other optical systems.



SICK Sensor Intelligence. A leading sensor manufacturer in areas ranging from factory automation to logistics automation and process automation, the company has more than 50 subsidiaries and almost 10,000 employees worldwide.



STAR Technologies, which provides intellectual property, software, hardware, consumables, service and expertise to meet the requirements and challenges within the semiconductor industries.



Sunny Instruments Singapore, which designs and manufactures its own range of high-tech Metrology Instruments, including 3D CNC Vision Measurement Machine, Measuring Microscope and Laser Doppler Vibrometer.

High five for TPI at Photonics@SG 2019

About 150 attendees from 30 companies packed the NTU Nanyang Executive Centre Auditorium on 7 November for the Photonics@SG 2019 conference. Their aim: to hear from 13 speakers – all experts in their respective photonics domains – on the role that photonics can play in tackling global challenges. The speakers hailed from both academia (NTU, NUS, Singapore University of Technology and Design, A*STAR, The University of Sydney, University of Southampton) and industry (Photonics Leadership Group, Advanced Micro Foundry, Edmund Optics).

This year's edition of the annual conference, themed "Photonics: The Enabling Technology for Global Challenges", held extra significance as it also marked the fifth anniversary of The Photonics Institute.

Said Prof Tjin Swee Chuan (right pictured), TPI Co-Director and Chairman of the LUX Photonics Consortium, in his opening address: "When we launched TPI back in October 2014, it was the culmination of work spanning several years between NTU and the Optoelectronics Research Centre, which is well known for its expertise in fibre technology and understanding of photonics and its practical applications."

"In just five years, this unique consortium of equal partners has – with the support of institutions such as A*STAR and DSO National Laboratories – firmly established TPI as a world-leading centre in photonics technology research."



Prof Tjin Swee Chuan, TPI Co-Director and Chairman of LUX Photonics Consortium



Her Excellency Kara Owen, British High Commissioner to Singapore



Prof Subra Suresh, NTU President and Distinguished University Professor



Prof Mark Smith, President and Vice-Chancellor, University of Southampton

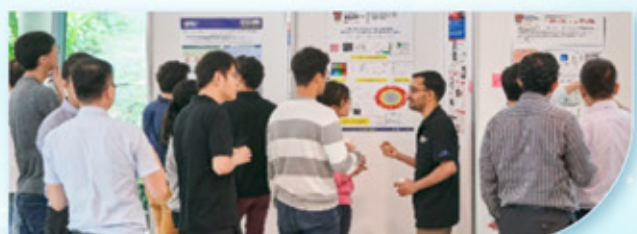
The event, jointly organised by TPI, LUX, and the University of Southampton Optoelectronics Research Centre in the UK, was graced by Guest of Honour, Her Excellency Kara Owen, British High Commissioner to Singapore, as well as Prof Subra Suresh, NTU President and Distinguished University Professor, and Prof Mark Smith, President and Vice-Chancellor, University of Southampton. Post-conference, the VIPs and invited speakers adjourned to the Conrad Centennial Singapore for a dinner held in their honour.



Guest of Honour, Her Excellency Kara Owen, British High Commissioner to Singapore flank by Prof Subra Suresh, NTU President and Prof Mark Smith, President and Vice-Chancellor, University of Southampton.



There were networking opportunities aplenty at Photonics@SG 2019 with 150 attendees from 30 companies.



TPI Centres exhibition gallery and posters presentation attracting conference attendees during break time.



Poster presentation Top 3 Award winners with the judges

Photonics@SG 2019 was sponsored by Palomar Technologies and DSO National Laboratories (Platinum sponsors) and II-VI and WEO Corporation (Gold sponsors). Both DSO and Palomar are second-time platinum sponsors.

Said Mr Rich Hueners, Vice President Global Sales & Marketing and Managing Director, Palomar Technologies (S.E. Asia) Pte Ltd: "We continue to participate as LUX members and sponsors because of the increased level of value and visibility that being part of LUX provides."

"The quality of the 2019 event set the bar very high for next year. The quality of attendees, the programme content and the speakers were excellent. The opportunity to hear from a range of experts across the spectrum of photonics was second to none."

"The organisers have demonstrated a real passion for the technology and a drive to deliver each member company increasing value for money. We will certainly be participating in 2020!"

The conference also featured captivating talks from distinguished academia speakers such as Prof Benjamin Eggleton from University of Sydney, Prof Sir David Payne and Prof Graham Reed from University of Southampton, Prof Nikolay Zheludev from NTU/University of Southampton, Prof Wang Qijie and Prof Hilmi Volkan Demir from NTU, Assoc Prof Dawn Tan from SUTD, Dr James Grieve from NUS, Dr Arseniy Kuznetsov from A*STAR.



Prof Benjamin Eggleton, University of Sydney



Prof Sir David Payne, University of Southampton



Prof Graham Reed, University of Southampton



Prof Nikolay Zheludev, NTU/University of Southampton



Prof Wang Qijie, NTU



Prof Hilmi Volkan Demir, NTU



Assoc Prof Dawn Tan, SUTD



Dr James Grieve, NUS



Dr Arseniy Kuznetsov, A*STAR



Dr John Lincoln, CEO, Photonics Leadership Group, UK



Dr John Yong, Co-Lead, Lasers & Optics Joint Industry Sector Planning (JISP), A*STAR

Invited industry speakers also shared the limelight with their interesting insights on both global and local photonics landscape and challenges, they were Dr John Lincoln from Photonics Leadership Group, UK; Dr John Yong from A*STAR; Dr Li Chao from Advanced Micro Foundry; Mr Rene Weber from Edmund Optics Singapore.



Dr Li Chao, Integration Technology Manager, Advanced Micro Foundry



Mr Rene Weber, General Manager, Edmund Optics Singapore



LUX kick-starts Work Groups

The first LUX Work Group Meetings took place in September and saw participation from LUX faculty and industry members, A*STAR researchers, as well as invited guests from industry and the Singapore Economic Development Board, National Research Foundation Singapore and Enterprise Singapore.

These Work Groups had earlier been mooted by LUX Chairman Prof Tjin Swee Chuan as a follow-up from discussion from Lasers & Optics Joint Industry Sector Planning (JISP) and a means to brainstorm project ideas that can be submitted for government funding under the Industry Alignment Fund (IAF), and position LUX companies and IHLs for RIE2025.

The topic on "Optical Sensors for Structural Health Monitoring" was held on 5th September at NTU followed by "Fiber Laser Systems and Laser Assisted Manufacturing" held on 17th September and topic on "Silicon Photonics" held on 20th September. LUX also jointly co-organised with A*STAR IMRE, on the topic of "Flat Optics" on 19th November at A*STAR IMRE. The fifth topic on "Food Security Technologies" will be conducted at a later date.



Industry News

Phaos Technology X SIGMAKOKI = OptoNano

Advanced microscopy startup and LUX member Phaos Technology Pte Ltd are teaming up to co-develop OptoNano, a new optical design that offers nano-scale imaging capability in ambient air and works in non-contact mode to solve the characterisation challenges for biology, chemistry, semiconductor and other industries.

OptoNano uses microsphere to upgrade the magnification of microscopes by up to four times using miniature glass spheres, and does so at a fraction of the cost of other solutions.

Phaos' Director and Chairman Prof Hong Minghui and SIGMAKOKI's President & CEO Mr. Yosuke Kondo signed the agreement on 4 October and plan to launch OptoNano 200 in February at Photonics West 2020.

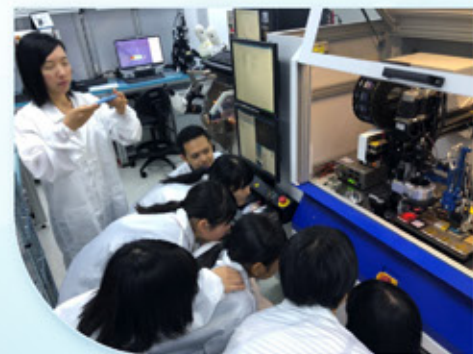


Palomar Technologies expanded its Singapore Innovation Centre

In early 2019, Palomar launched its expanded clean room facility at its Singapore Innovation Center. Answering the needs of customers who require high accuracy die attach and wire bond assembly for live parts in a clean room environment, they enlarged the size of their demo center and transformed it into a Class 10k-100k clean room.

Given that Palomar is first and foremost an equipment supplier and process expert, they were to design their Innovation Center in Singapore in such a way as to support their customers' low-volume prototyping needs and also help their customers later when they wanted to off-ramp to higher volume production.

Being part of the Lux Consortium and having opportunities to demonstrate its capabilities with the member companies of sister organizations like EPIC provides a tangible foundation to spread the



message of advanced photonics and packaging right here in Singapore – this is not just for local companies but for any company looking to do this specialized work in Singapore.

Wavelength Opto-Electronics HMLV Optical Workshop

On the 27th November 2019, Wavelength Opto-Electronics launched the Singapore's first high-mix low-volume (HMLV) optical workshop – Optics Rapid Prototyping (ORP) workshop. ORP is working closely with A*STAR SIMTech to create machines that are automated, and be able to eliminate as much human error as possible for optics manufacturing and inspection.

One of the main focus of ORP workshop is producing high-mix low volume optics for prototype projects that are very fast paced, require fast turnover time and optics with excellent quality. The workshop enables Wavelength Opto-Electronics to reach out to global customers and provide efficient support, with a targeted lead time of 2 weeks.

ORP has also acquired valuable staffs that have many years of experience with optics to facilitate and meet the stringent quality that are required by customers and to ensure customers' satisfaction.



Shimadzu Asia Pacific 30th Anniversary Ceremony

Shimadzu Asia Pacific hosted our 30th anniversary ceremony on 12 November 2019, in Singapore.

The ceremony was graced by the Ambassador of Japan to Singapore, His Excellency Jun Yamazaki. During the ceremony, prominent regional partners shared experiences of their collaborations with Shimadzu. We are very grateful and appreciate having partners who have continued to support us through thick and thin since 1989. Over the years, we have emerged from being just a regional sales office to becoming a global centre for innovation in marketing, application solutions and technical support, etc.

A fast-paced growth of business in the region has seen the opening of subsidiaries in India, Malaysia and Philippines, with application specialists, as well as technical and sales engineers. We work closely with a wide and carefully selected network of local distributors, spreading across 18 countries in the region.

Shimadzu Corporation, found in 1875 in Kyoto, Japan, is a manufacturer of both analytical and medical instruments. For more details, please visit www.shimadzu.com.sg.



A new dawn for DenseLight

DenseLight Semiconductor Technology (Shanghai) Co., Ltd has acquired homegrown photonics integration technology company DenseLight Semiconductors from POET Technologies Inc. for US\$26 million.

This has several positive implications for DenseLight Semiconductors, a LUX industry member. For one, the support of its new shareholders will provide the company with more resources, allowing it to enhance its capabilities, recruit more talent and expand its participation in the photonics value chain through further investments in Singapore and China. At the same time, there will be stability with DenseLight's management remaining unchanged, and DenseLight and POET continuing to maintain a relationship under a preferred supply and strategic cooperation agreement.

Said Rajan Rajgopal, President and CEO of DenseLight Semiconductors, "Over the years, we have been working hard to realise our vision of becoming a global leader in providing innovative integrated photonics solutions that enable our customers to excel and win in the sensing and data communications markets. The support of our new shareholders brings us another step closer to realising this vision."



Ellipsiz buys 51% stake in LUX member AXIS-TEC

Precision engineering player and LUX industry member AXIS-TEC is now 51% owned by mainboard-listed Ellipsiz, a leading engineering and service solutions provider that serves customers across the semiconductor and electronics manufacturing industries in Asia.

AXIS-TEC, a leader in Advanced Technology Test Equipment manufacturing was locally established in 2004. The company has mastered to evolve into sub-nano precision engineering to enhance its core competence through persistent innovation. To position AXIS-TEC for the next technological break thought, they have acquired new skills and knowledge to develop the assembly, testing and measurement of Photonics and Optical Communication products.

Said Vincent Ong, Managing Director of AXIS-TEC, "With the recent JV with Ellipsiz, a Singapore Public listed company, this will provide a springboard to expand its footprint globally with new markets in a reduced timeframe. Both parties coming together to combine their synergy; product and market presence, providing a very efficient and progressive collaboration to maximize our strength. This elevate AXIS-TEC to a new level and enable us be part of the engine growth driver in the Silicon Photonics market."