

Networking session at Coherent Singapore office

Participants of the LUX Photonics Consortium 2019 2nd Quarter Members Networking Event on 15th May got to go behind the scenes at Coherent Singapore, where the event was held.



More than 70 attendees toured the Kallang office of the Palo Alto-based company, one of the world's leading photonics manufacturers and innovators and which specialises in industrial lasers and laser systems for laser cutting, laser welding and laser drilling. Members were given the rare opportunity to tour Coherent's facility as part of the highlights of the event.

The event saw Dr Tiaw Kay Siang, Deputy Director, Programmes, at the National Research Foundation Singapore share about the Industry Alignment Fund (IAF) scheme and the governance, criteria and application process.

Dr Tiaw (pictured below) discussed the IAF-Industry Collaboration Project (ICP) and IAF-Pre-Positioning (PP). The former looks to support public research performers in strategic R&D projects with industry by applying and commercialising public sector research capabilities, IPs and technologies towards industry-relevant challenges. Proposals will be assessed primarily on their potential economic impact.



Meanwhile, the IAF-PP aims to develop industry-ready capabilities and integrated and multidisciplinary programmes with early industry involvement. Submissions will be assessed on their potential to contribute to the growth of new sectors and catalyse new activities in existing sectors.

Another key difference is that upfront commitment from industry partner is required for the IAF-ICP.

In his address, LUX Chairman Tjin Swee Chuan proposed the formation of Work Groups in relation to the IAF-ICP and IAF-PP. Four topics were mooted: Optical Sensors for Structural Health Monitoring; Food Security Technologies; Fiber Laser Systems and Laser Assisted Manufacturing; and Silicon Photonics.

Message from the Chairman/Co-director:

This year has been an exciting year for the Photonics community. There has been a lot of interests from our government agencies to grow the lasers and optics industry in Singapore and LUX Photonics Consortium is well positioned to provide the inputs from the academia and the industry. The visit by Deputy Prime Minister, Mr Heng Swee Keat to LUX in February this year has helped ricochet LUX into the forefront. DPM Heng highlighted LUX and two of our company members as examples of how academia and industry can work together to bridge the gap between research and product innovation in his 2019 Budget Speech.

Over the past 1.5 years, LUX has also participated in the Lasers and Optics Joint Industry Sector Planning (JISP) exercise, co-led by EDB and ASTAR with LUX as a supporting partner, to help chart the national roadmap for this industry. The objective is to develop a roadmap on Lasers & Optics for Singapore, and formulate programmes to further develop these capabilities within Singapore's Institute of Higher Learnings (IHL) in collaboration with the industry.

In June, together with EDB, ASTAR and Enterprise Singapore, we attended the LASER World of Photonics in Munich. During the trip, we met up with a number of senior executives from ten major Laser/Optics companies and collected invaluable feedbacks on our Lasers and Optics JISP technology roadmap. Collectively, we have identified 4 key strategic focus areas where we have significant local expertise as well as market opportunities. They are 1) Flat optics and meta-lenses, 2) Fibre lasers, 3) Imaging system and metrology, 4) Functional coating for optics. This was shared with our members at the last networking session.

To position our companies and IHLs for RIE 2025, LUX has initiated work group discussions to brainstorm project ideas that we can submit for government funding. Four workgroups have been formed to date, namely the optical sensor for Structural Health Monitoring, Fibre laser and laser assisted manufacturing, Silicon photonics and Food security technologies. I encourage our company and faculty members to active participate in one of these workgroups.

Coming up in October, we will host a delegation from European Photonics Industry Consortium (EPIC) and organize a LUX Photonics Consortium exhibition pavilion at the Industrial Transformation Asia Pacific (ITAP) in the week of 21st - 24th October. Next, Photonics@SG, the annual conference jointly organized by The Photonics Institute (TPI) and LUX, will be held on 7th November at NTU NEC Auditorium.

We look forward to your participation in these activities that we have planned for the last quarter of the year.

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

As a starting point, Prof Tjin (pictured right) asked the audience to look into these questions for the respective areas: what is lacking at the current moment, what research capability (IPs, technology) has been generated in Singapore, and what are the hurdles if existing technology were to be “commercialised” or brought to practice?



The networking session also saw company presentations from WEO Corporation, Precision Laser Solutions, PHAOS Technology/OptoSigma, Coherent and Transcestial Technologies.



Coherent Singapore is “ASIA Manufacturing Centre” of Coherent, Inc, with headquarters in the heart of Silicon Valley, California, and offices spanning the globe. Coherent is a world leading supplier of laser and photonics-based solutions to a broad range of commercial and scientific research customers.



OptoSigma Southeast Asia Pte Ltd is a global supplier of quality Laser Components and Application Systems. “OptoSigma” is the global brand which aims to provide quality solutions and contributes to our society with “Light”. Our wide range of Application Systems has been offered to R&D and applications of measurement, inspection, evaluation & analysis in semiconductor, FPD & other industries.



Phaos Technology Pte Ltd is a deep-tech startup based in Singapore, focusing on technical development of advanced optical instrumentation technologies. Spinning off from National University of Singapore, Professor Hong Minghui and his team has a vision to push these disruptive optical technologies beyond research industry, and into mass consumer market for every day’s use.



Precision Laser Solutions Pte Ltd is a high-tech enterprise incorporated in Singapore. The company has developed high precision laser micro-processing automation equipment, turn-key laser remanufacturing equipment, multi-axis robotic automation flexible production lines, and automatic quality control and vision inspection equipment for high-end industrial applications



Transcestial is developing a wireless communication network that is 10x faster than anything to come before. This is achieved by harnessing light to transfer & relay data at up to 100 Gbps within a network. Currently, Transcestial is using an on-ground version of this laser communication technology to provide state-of-the-art, fiber-like ultra-high bandwidth wireless backhaul to telecoms and enterprises.

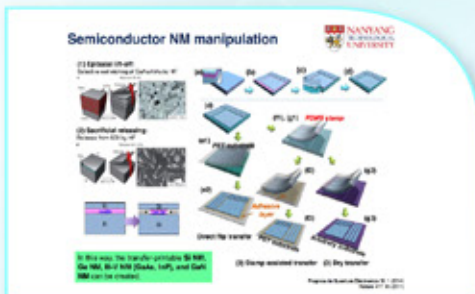


WEO Corporation is a manufacturer of High Precision Optical components and Opto-Mechanical assemblies with Head Office in Singapore. Our Business covers a wide range of optics and optical for industries used, including scientific instrumentation, medical devices and optical imaging products. Equipped with efficient production machineries and metrology equipment, WEO is capable of supporting customers from the stage of prototyping, qualifying to volume production.

Tech Talks by LUX Faculty members

Tech Talk 1 | Light sources for next generation ocular imaging

Prof Leopold Schmetterer (pictured right) discussed optical coherence tomography (OCT) imaging including its principles (time-domain, spectrometer-based and swept-source), role of coherence length, and limitations such as limited penetration depth and sensitive to scattering. He also touched on photoacoustic imaging.

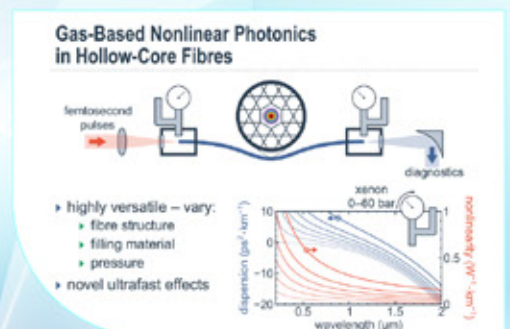


Tech Talk 2 | Free-standing single crystalline nanomembranes for high performance ultracompact optoelectronic applications

In his session, Asst Prof Kim Munho said that semiconductor nanomembranes (NMs) provide a new way of using conventional materials for electronic/photonic devices such as flexible transistors and flexible optical sensors; and discussed semiconductor NM manipulation. He also discussed potential applications including flexible electronics and flexible displays.

Tech Talk 3 | Novel Ultrafast Light Sources in Gas-Filled Hollow-Core Fibres

Asst Prof Chang Wonkeun spoke about hollow-core fibres offering the best of free-space optics and fibre optics. These advantages include: super-broad transmission window, high power transmission, small dispersion/nonlinear effects, diffraction-less propagation and uninterrupted guidance around obstacles. He shared that hollow-core fibres can guide high-power, vacuum-UV and mid-IR beams, and hollow-core fibre-based devices can allow for enhanced ultrafast light-matter interactions. Potential applications such as light source for Deep UV applications and spectroscopy.



TPI makes waves at CLEO®/Europe – EQEC

Two TPI and NTU faculty members presented at the prestigious 2019 Conference on Lasers & Electro-Optics/Europe and the European Quantum Electronics Conference (CLEO®/Europe – EQEC), held in conjunction with the LASER World of PHOTONICS 2019. The conference is Europe’s largest on photonics and related research fields.

Asst Prof Chang Wonkeun’s researcher presented his paper on “Effect of Initial Chirp on Soliton Pulse Compression in the Ionization Regime”. His group investigated the effect in a gas-filled hollow-core fiber and found that a positively-chirped pump undergoes a stronger effect of the ionization caused by the enhanced compression. The compressed high power ultrashort pulses can be widely applied in fields including biology, medicine and material processing. Further, the pulse compression process can generate ultraviolet dispersive wave in deep and vacuum UV range – these light sources are invaluable in the study of light-matter interaction and Ultrafast Ultraviolet Spectroscopy.

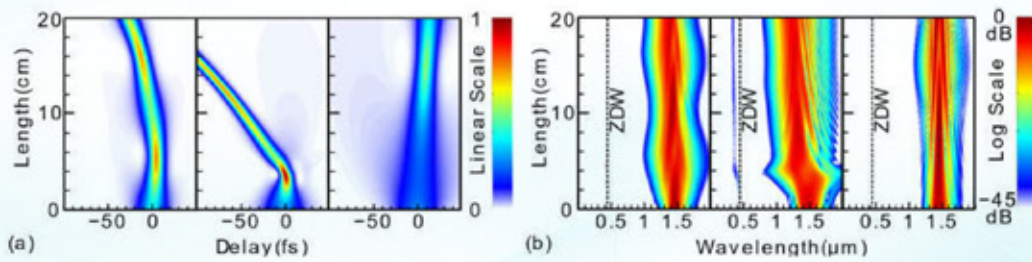


Figure 1. (a) Temporal and (b) spectral evolutions of an initially un-chirped, positively-chirped and negatively-chirped pump (respectively from left to right) propagating in an argon-filled hollow-core fiber. The dashed line denoted ZDW is the zero-dispersion wavelength where the dispersion is normal (anomalous) to its (right)-hand side.

Asst Prof Yoo Seongwoo and his research group presented three papers. In “Tunable Mode-locked Fiber Laser in 1750-1870nm by Bending Normal Dispersion Thulium-doped Fiber as A Distribution Filter”, the group reported a tunable mode-locked fiber laser in the 1750-1870nm region by incorporating a normal dispersion thulium-doped fiber (NDTF), with the tunability of lasing wavelength achieved by bending NDTF as a distributed long-wavelength filter. The achieved tunable ultrafast laser has applications in bio-imaging such as three photon generation for deep tissue penetration.

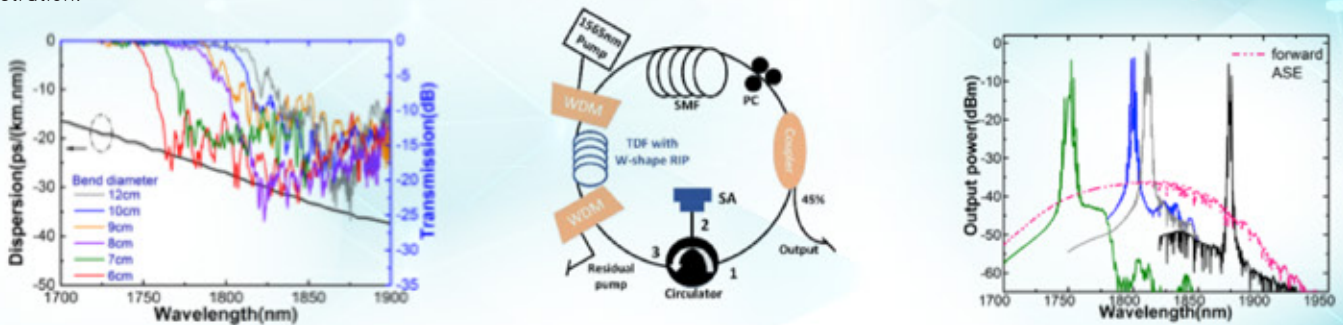


Figure 2. (a) the dispersion curve of Thulium-doped Fiber (TDF) with a W-type refractive index profile (RIP) and its measured transmission curve at different bending diameters, (b) the schematic of tunable mode-locked fiber laser [SA: saturable absorber, PC: polarization controller, SMF: single mode fiber] (c) the measured spectra of mode-locked soliton pulses centered at 1750nm, 1800nm, 1810nm and 1880nm, with corresponding bend diameter of 7, 10, 12, and 20 cm respectively. All the spectra are measured by optical spectrum analyzer with resolution of 0.5nm.

In the second paper, “Photodarkening Suppression in Highly Yb-doped Aluminophosphosilicate Fiber by Addition of Cerium”, Asst Prof Yoo’s group presented the fabrication of photodarkening (PD) suppressed, high absorption, low background loss, step index large-mode-area fiber for high power lasers. Ultrafast laser requires a gain medium with high absorption and long term stability. Extremely low PD is achieved by realizing Cerium co-doping to equimolar Al:P fiber with very high (0.5mol%) Yb2O3 concentration. PD loss as low as 7dB/m was observed in a core pumped PD set up due to the addition of Cerium to Yb-Al-P co-doped core.

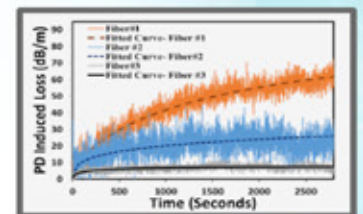


Figure 3. Detrimental photodarkening is significantly reduced in the developed fiber.

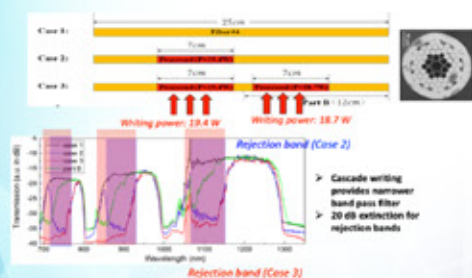


Figure 4. Writing on Hollow core fiber can create in-line filter

Finally, in “Structural writing on an antiresonant hollow core fiber”, the group sees new opportunity of inventing hollow core fiber devices following recent progress in hollow core fiber technology. Structural writing on an in-house hollow-core antiresonant fiber using electric arc pulses has been demonstrated to influence modal interaction in the hollow core fiber.

Industry News

Six million reasons for Meridian Innovation to celebrate



LUX industry member Meridian Innovation Pte Ltd, a fabless semiconductor startup incorporated in Singapore and developer of cost-effective and high-performance thermal sensors, has secured US\$6 million in its latest round of financing.

Excelpoint's investment arm, PlanetSpark, and SEEDS Capital participated in this round alongside existing investor Creative Technology Ltd. To date, Meridian has raised more than US\$10 million in funding as it seeks to further accelerate market penetration in emerging

markets for low-cost thermal sensors. These markets include Smart Appliances, Internet of Things devices, Advanced Driver-Assistance Systems, Artificial Intelligence-assisted heat failure analysers and security, as well as medical & safety products.

"Meridian is honored to have Creative, Excelpoint and SEEDS Capital as investors. We are also excited and privileged to work with such visionaries who are willing to back such disruptive technology with their bold commitment", said Hock Leow, CEO and Co-Founder of Meridian Innovation.

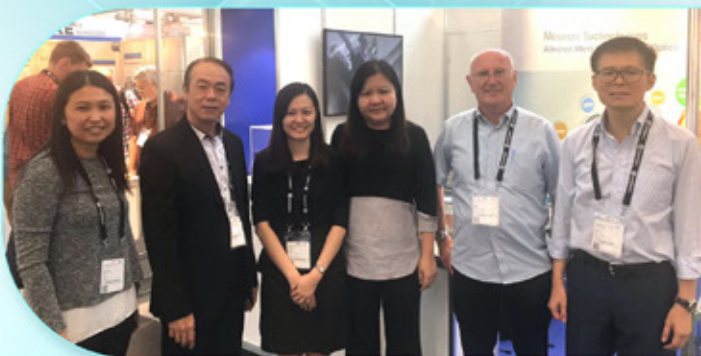
LASER-sharp focus from LUX at the Laser World of Photonics 2019

A delegation from LUX Photonics Consortium made the over 20,000km round-trip to Munich, Germany in June to take part in the world's leading trade fair for photonics.

LUX Chairman and TPI Co-Director Prof Tjin Swee Chuan and LUX Programme Director Soo Choi Pheng were joined by colleagues from the Singapore Economic Development Board, ASTAR and Enterprise Singapore at the LASER World of PHOTONICS 2019. They met up with a number of senior executives from eleven major Laser/Optics companies

and collected invaluable feedbacks on our Lasers and Optics JISP technology roadmap. These companies are Edmund Optics, Jenoptik, II-VI, Gooch & Housego, Excelitas Technologies, Amplitude, Trumpf, Leoni, Coherent, Heraeus and NKT Photonics.

LUX industry members Moveon, PHAOS Technology, OptoSigma, DenseLight Semiconductors and WEO Corporation had booths at the event, which saw over 34,000 visitors.



(from left) LUX Programme Director Dr Soo and Moveon CEO Mr Chee Teck Lee; Moveon Operation Director Ms Shania Chew (third from right), Mr Ho Chi Bao, Director, Advanced Manufacturing, Enterprise Singapore (right).

Moveon, which covers the design, prototyping and volume production of optics, exhibited prototypes and production technologies that will enable cost-effective production of Diffractive Optics Elements (DOEs), Micro & Meso optics and Structured Light products. These technologies can be applied to the likes of Light Detection and Ranging (LIDAR), spectroscopy, thermal imaging, medical diagnostics and microfluidics.

Moveon sees an opportunity for optics and photonics to support a world increasingly dependent on big data, by ensuring sensors and data transfers perform optimally. The company said that the four-day exhibition "has facilitated its reach to a global audience while offering insights into the latest technologies that would, in turn, contribute to new ideas and vision for future developments".

PHAOS Technology & OptoSigma



PHAOS Technology and OptoSigma's parent company SIGMAKOKI jointly participated at the LASER World of PHOTONICS, showcasing the OptoNano product prototype.

Supported by the National Research Foundation's Competitive Research Programme, the two companies had co-developed this 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.

Over the course of the event, around 2,400 people – mostly from academic institutions, electronics and semiconductor industries, optics and photonics manufacturers and distributors, and microscope companies – visited the booth, with many visitors complimenting the new technology's great potential for scientific research and industrial applications.

Phaos Chairman Prof Hong Minghui and President & CEO Yosuke Kondo also took the opportunity to discuss the future development of the Nanoscope while in Munich.



(middle four, from Left), Prof Hong, Dr Soo, Prof Tjin, Mr Ho, and Mr Kondo.

WEO Corporation



WEO Sales Director Donald Ng (second from left) with colleagues.

This was the third time WEO Corporation – a manufacturer of high-precision quality components for scientific and medical applications and precision components for imaging and commercial applications – was participating in the LASER World of PHOTONICS.

The company sees its participation as an opportunity to create brand awareness, promote its new products, technologies and capabilities to new and existing customers, as well as understand ongoing developments in the Photonics industry. It has seen its sales activities increase as a result of its participation.

DenseLight Semiconductors



DenseLight's Dr Lam, Mr Sankaran and Ms Englaterr (second, third and sixth from right) and EQ Photonics colleagues.

DenseLight participated alongside its European Channel Partner, EQ Photonics. The company was represented by Chief Technology Officer Dr Lam Yeeloy, Vice President Sales & Marketing Mr Soma Sankaran, and Sales Manager Ms Maricris Englater.

Mr Sankaran said: "We had prearranged meetings with a number of customers, who were keen to talk about our state-of-the-art Indium Phosphide (InP) technology, specifically in the sensing field. We've noticed that an increasing number of customers in the sensing world are also looking at photonic integration, to enable them to go into new markets like Internet-of-Things, and DenseLight had some very interesting and fruitful discussions on how we could help them get there."

"It was my first LASER World of PHOTONICS in Germany, and it was quite interesting to see the variety of companies participating at the show. We also met up with some of DenseLight's China customers who had booths at the show. It was good to catch up with them and to link their end market requirements to the products that we supply."

Local Conferences and Exhibitions

Upcoming Events...

Industrial Transformation Asia-Pacific, ITAP 2019, 22-24 OCT 2019, Singapore Expo

Visit LUX Pavilion at booth 2H21, Hall 2

Participating members:



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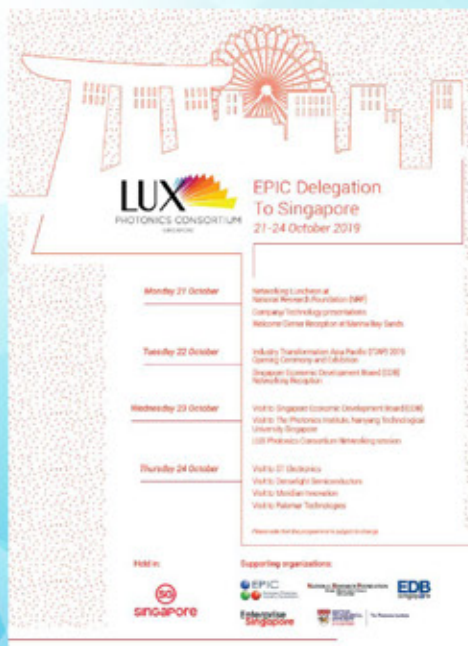
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Visit us at Booth 2H21, Hall 2

European Photonics Industry Consortium (EPIC) Delegation to Singapore, 21 – 24 October 2019

Programme Highlights

- 10+ European Photonics Companies Delegates coming to Singapore.
- 3.5 days of Program with multiple networking sessions.
- 10-min pitching session for LUX members to grab.
- Special Invitation to attend the ITAP Opening Ceremony.
- Visit LUX members - Denselight, Meridian Innovation, Palomar Technologies, Singapore Technologies.
- Visit to The Photonics Institute (TPI), NTU.
- LUX Photonics Consortium Quarterly networking session.

Annual Photonics Conference co-organised by LUX and TPI with the theme - Photonics: The Enabling Technology for Global Challenges



Date: 7 November 2019, Thursday | Time: 8.30am to 5.30pm | Venue: Nanyang Executive Centre Auditorium, NTU

Guest-of-Honour:

Her Excellency Kara Owen, British High Commissioner to Singapore

Distinguish Guests:

Professor Subra Suresh, President, Nanyang Technological University (NTU), Singapore

Professor Mark Smith, President and Vice-Chancellor, University of Southampton, United Kingdom

Plenary speaker:

Professor Benjamin J Eggleton, University of Sydney

Industry speaker:

Dr John Lincoln, Photonics Leadership Group, United Kingdom

Academic speakers:

Prof Sir David Payne FRS, Optoelectronic Research Centre (ORC), University of Southampton

Prof Nikolay Zheludev FRS, The Photonics Institute (TPI), Nanyang Technological University / Optoelectronic Research Centre (ORC), University of Southampton

Prof Graham Reed FEng, Optoelectronic Research Centre (ORC), University of Southampton

Prof Wang Qijie, The Photonics Institute (TPI), Nanyang Technological University

Assoc Prof Dawn Tan, Singapore University of Technology & Design

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