FPPGAs: Knocking on Integrated Photonics Doors

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Editor’s Column
NICOLAS FONTAINE

Summer seems to have blown by so fast—it’s already the October newsletter! This newsletter is packed with member content. Nicholas Wong interviews the first IEEE Photonics Society chapter in Colombia. This chapter is entirely led by women and they just held their inaugural event for the International Day of Light. Arti Agrawal writes about her experience in a type of conference that is held outside and open to the public. Nikhil Ranjan Das describes how photonic can be used for some ecological problems. Enjoy!

The research highlight, Field Programmable Photonic Gate Arrays, is from Daniel Pérez and José Capmany from ITEAM Research Institute in Valencia, Spain. They describe how to build complex programmable and reconfigurable photonic devices for computing. Their field-programmable photonic gate array can produce operations such as a Hadamard matrix transform and a tritter operation. Although still in the early phases, the future may hold much larger FPGA similar to the electronic equivalents.

Each year, the IEEE Summer Topicals produces 5-6 topical meetings in the hottest topics, also normally in a hot place, like this year in Fort Lauderdale, Florida. The topics gather the world experts to present their research and also to discuss future directions. I had asked the topi- cal chairs to write a short summary of each topic to share in this newsletter.

I want to emphasize that we want to hear news from you! Students, young professionals, and experienced members can inquire about submitting an article! Don’t be shy, and please contact me, the staff, or any of the associate editors if you are interested to contribute no matter how new you are to the society. As always, I hope you enjoy reading the articles!

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Hope you are enjoying your Spring in Southern Hemisphere and Fall in Northern Hemisphere! Time is passing incredibly fast and this is my penultimate President’s column as my term will end on 31st Dec 2019. I will reflect on my full-term as President in the next issue.

During my business travels, I have been promoting the Society and making people aware of the importance of being part of the community and engaging with professional societies. Response has been positive and many photonics members now are starting new chapters in various parts of the world, in particular student chapters at several international institutions. Engaging students in our profession is important for the future of our Photonics and Optics field. This provides opportunities for students to develop leadership skills and network with the photonics community. It is key that we as a Society help guide our innovators of tomorrow.

Due to excellent efforts at various levels of the Society, Society membership has grown by 6%, which is pleasing to see that the hard work of staff and volunteers is paying off. During my travels, many people have expressed their desire to be more engaged in the Society activities including conferences and publications. If you are interested in getting involved in the Society, please go to Society webpage, under ‘Who We Are’ heading, go to ‘Volunteer’ section for more information.

You can also sign-up for our speaker database. Members and potential volunteers can actively sign up and be called upon to serve within their technical and/or professional subject areas. Chairs and volunteer leaders use this database to recruit for invited talks, keynotes, panels, councils and various volunteer positions.

In regards to publications, the Photonics Section of IEEE Access, the organization’s cross-discipline open-access journal, is now active. So, while submitting your manuscripts to IEEE Access, please choose the IEEE Photonics Society Section. This way experts in your field are managing the review process of your manuscript. Hopefully, this will help improve the quality of the feedback you receive from reviewers. Good constructive critique of our papers will only help improve the science and clarity of the paper.

Though globally there is a lot of research activity in quantum information science and technology, IEEE doesn’t have any journals specifically covering this field. In view of this, IEEE is launching a new open access journal, called Transactions on Quantum Engineering (TQE), and multiple IEEE societies are involved in this journal’s inception, including the IEEE Photonics Society. TQE will start accepting manuscript submissions in 2020. Please be on the lookout, if you are working in the field of quantum science and technologies.

At the time of writing this column, we are getting ready for our September Board of Governors (BoG) meeting series in San Antonio, TX. BoG is discussing many developments, including our conference portfolio strategy to serve our members and community better, our publications portfolio and how we can meet our member benefit needs better, etc. Outcomes of these discussions will be covered in my next column.

With warm greetings,
Chennupati Jagadish
Australian National University, Canberra
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Is integrated photonics following the same evolution paths as integrated electronics? Several published academic and market studies strongly suggest that this is so. Starting from the design of basic standalone components and devices, the trend has been followed by the development of small and medium scale integrated chips and the dominance of application-specific circuits. Increasing requirements in terms of complexity and flexibility dictated an evolution of integrated electronics towards microprocessors and more general programmable devices of which the Field Programmable Gate Array is a paradigmatic example. In photonics we expect the same trend towards programmable circuits to be followed. The Field Programmable Photonic Gate Array [1] that we describe here is a potential candidate.

Introduction
Microelectronics has become one of the pillars of digital economics in the early XXI century [2]–[4]. The famous Law formulated by Gordon Moore in 1965, which dictates that the number of transistors integrated per unit surface area in a chip would double after each two years, has stopped being fulfilled in the present decade and this will result in a potential physical limitation of electronic systems to process information at the ever increasing speed and bandwidth figures required by current and emerging applications [5]. A particularly appealing direction to overcome the demise of Moore’s law is to develop on-chip ICT systems based on the cooperative use of electronics (for digital processing) and photonics (for analog processing) leveraging on the best of the two complementary worlds. In a similar way to electronics, where the initial phase of Application-Specific Integrated Circuits (ASICs) was followed by the advent of programmable electronic circuits [3], with Field Programmable Gate Arrays (FPGAs) [4] and Digital Signal processors (DSPs), we expect that general-purpose programmable photonics will play a key role in the future development of flexible integrated chips incorporating both electronics and photonic parts.

Our previous work on programmable photonics carried within the framework of the ERC Advanced Grant ERC-ADG-2016-741415 UMWPCHIP, has allowed us to lay the foundations for the first technical stages of a novel revolutionary concept, the Field Programmable Photonic Gate Array (FPPGA).

The FPPGA has a similar rationale as the FPGA in electronics: A common hardware is designed to provide several resources that can be employed to implement different functionalities by means of programming. However, the FPPGA is different from the FPGA in several fundamental aspects.

Figure 1. Examples of irreversible AND (a) and XOR (b) gates and of a reversible SWAP gate (after [6]).
The FPPGA hardware is based on digital electronics that employs elementary irreversible gates for bit processing using Boolean logic [6]. These gates are characterized by the fact that the number of input ports (or FAN-IN) is 2 while the number of output ports of FAN-OUT is 1. Figures 1(a) and 1(b) show some basic examples of these gates, which are characterized by their so-called truth tables. The term irreversible reflects the fact that the input cannot be deduced from the output unambiguously. By cascading thousands of these gates, one can build extremely complex combinatorial and sequential Boolean circuits.

The FPPGA hardware on the contrary is based on analog reversible gates, which feature the same number of input and output ports and are characterized as well by truth tables [6], [7]. For example, Figure 1(c) shows the example of a SWAP or Pauli X gate. However, in this case, the input state can be deduced from the gate output as the gate operation can also be described by a unitary matrix transformation \( U \). If \( I \) and \( O \) denote respectively the input and output vectors, then \( O = U I \), hence \( I = U^{-1} O \), but since \( U \) is unitary its inverse is given by the Hermitian conjugate. The FPPGA hardware does not carry digital logic operations rather, it exploits optical interference in the 2 x 2 reversible gates to perform very high-speed analog operations acting over the phase and amplitudes of optical signals in a controlled environment provided by the chip’s reduced footprint.

Since integrated photonic circuits for classical signal processing applications handle analog signals, it makes sense to consider the use of reversible gates as a basic building block to implement complex circuit structures.

**Field Programmable Photonic Gate Array Core Design**

The high-level concept of a FPPGA core is shown in Figure 2(a), [1]. It consists of a set of Programmable Photonics Analog Blocks (PPABs) and a set of Reconfigurable Photonic Interconnects (RPIs) implemented by means of an array of integrated photonic waveguides fabricated on a photonic chip substrate. PPABs are 2 input/2 output tunable photonic components described by a 2 x 2 unitary matrix and capable of independently setting amplitude and phase relationships between the input and output signals. PPABs can be implemented by means of 3-dB Mach Zehnder Interferometers (MZIs) or tunable directional couplers (TDCs) and can be operated either as a crossbar switch or as an intermediate power splitting coupler.

Our preliminary underpinning work [1] has shown that FPPGA cores can be built using integrated photonic waveguide meshes [8]–[10], as an isomorphism can be established between the RPI+PPAB units and the mesh basic unit elements. Figure 2(b) shows, for example, a high-level FPPGA design, the correspondence between the RPI+PPAB unit and the basic unit element of a hexagonal waveguide mesh and its actual implementation using a 7-cell hexagonal waveguide mesh in Silicon photonics.

**Further Design Considerations**

Although fundamental, the implementation of the FPPGA core is just the first step of a multi-stage process leading to a fully functional FPPGA device. Its complete implementation involves embedding the core in a hardware structure as shown in Figure 2(c) providing suitable input/output ports and high-performance blocks (HPBs) and the development of the required software to: a) automate and optimize its design, b) program the device operation, and c) track and control its performance against undesired fluctuations and deviations in the bias settings.

The most general type of programmable devices consists of an array of uncommitted elements that can be interconnected according to the user’s specifications and configured for a wide variety of applications. An FPPGA combines the programmability of the most basic reconfigurable photonic integrated circuits in a scalable interconnection structure, allowing programmable circuits with much higher processing density. Thus, processing complexity comes from the interconnectivity.

The left part of Figure 3 shows the main steps of the design flow process, which we now describe. The starting point for the design flow is the initial application entry or circuit configuration to be implemented. The specifications are then processed to optimize the area and performance of the final
circuit. Then, specifications are transformed into a compatible circuit of FPPGA processing blocks. This process known as 

technology mapping optimizes attributes such as delay, performance, accumulated loss or number of blocks. The technology mapping phase transforms the optimized network into a circuit that consists of a restricted set of circuit elements (FPPGA processing blocks). This is done selecting a set from the available PPABs and specifying how these will be interconnected. This interconnection step implies the setting of several RPI elements physically connecting the selected PPABs. This determines the total number of processing blocks (PPABs and RPIs) to be activated by programming. In a second stage, the processing block configurations (i.e., types of PPABs and RPIs) are chosen and performance calculation and design verification are carried out. This can be done either physically by feeding all the necessary configuration data to the programming units to configure the final chip or, more commonly, by iteratively employing accurate models of the FPPGA in the software plane.

The next step assigns each processing block to a specific location in the FPPGA core including, as well, the choice of the processing units that route the input signals to the core to the input/s of the programmed circuit and the output/s of the programmed circuit to the core outputs. Note that in contrast to FPGAs [3], [4], the proposed structure does not physically differentiate between processing blocks and interconnection resources. From the aforementioned description, it can be appreciated that the FPPGA device involves considering not only the physical hardware of the photonic and control electronic tier, but also a software layer (see right part of Figure 3).

Similarly to modern FPGA families, FPPGAs can include, as mentioned above, peripheral high-performance blocks to expand its capabilities to include higher-level functionality fixed into the chip. This is shown schematically in Figure 2(c). Having these common functions embedded into the chip reduces the area required and gives those functions increased performance compared to building them from primitives. Moreover, some of them are impossible to be obtained by a discretized version of basic processing blocks. Examples of these include high-dispersive elements, generic modulation and photo detection subsystems, optical amplifiers and source subsystems, as well as high-performance filtering structures to cite a few.

Preliminary Experimental Results

Figure 4 shows the programming (a), equivalent circuit (b) as well as measured modulus (c) and phase (d) of the transfer function for an unbalanced (by 4 x 975 μm) Mach-Zehnder interferometer implemented using a FPPGA silicon photonics core shown in Figure 2(b). Note that two PPABs implement the functionality of tunable couplers K1 and K2. In fact, the experimental results show different spectra corresponding to different values of K1 and K2. The free spectral range corresponds to the path unbalance. Figure 5 shows the results corresponding to a 3 x 3 MIMO interferometer programmed to implement a 3 x 3 splitter (ritter) or a DFT. In this case, there is enough room left in the FPPGA to accommodate a second independent circuit (a Hadamard gate), which we also programmed to show simultaneous circuit implementation.

Advantages of the FPPGA Approach

FPPGAs bring several advantages for the implementation of programmable photonic circuits: a) suitable programming will enable the FPPGAs to emulate any multiple-input/multiple-output photonic circuit. Furthermore, one or more independent photonic circuits can be implemented in several parts of the same single FPPGA hardware, b) as they are based on replicating the fabrication of common hardware architectures, FPPGAs (like FPGAs), will bring substantial advantages in terms of cost reductions, especially in non recurring engineering (NRE) costs and economies of scale, as well as process optimization and power consumption minimization, c) FPPGAs developed on a CMOS-compatible Silicon Photonics platform open the path for chips where electronics and photonics can work synergistically, exploiting the best of each technology, d) FPPGAs also have the potential for optimization and lowering of fabrication costs and development cycles of ASPICs, by leveraging on their potential to emulate them prior to their fabrication.

Figure 3. (a) Main steps involved in the design flow of a FPPGA device. (b) FPPGA soft and hard tiers. (c) Expanded layout including peripheral high-performance blocks, electronics, RF and control tiers.
Figure 4. Programming (a), equivalent circuit (b), as well as measured modulus (c) and phase (d) of the transfer function for an unbalanced (by 4 x 975 μm) Mach-Zehnder interferometer. The different curves in (c) and (d) correspond to different values of $K_1$ and $K_2$.

Figure 5. Programming (a), equivalent circuits (b) and measured bar chart (@1580 nm) and modulus of the transfer functions of a (c) 2 x 2 MIMO interferometer implementing a Hadamard gate and (d) a 3 x 3 MIMO interferometer implementing a tritter operation.
Discussion and Conclusions

Is it the right time for developing FPPGAs? Does this approach make sense in photonics?

FPGAs were introduced in 1984 by Xilinx [11]–[12], a company founded by Ross Freeman, James Barnet and Bernie Voderschmitt. The process involving the proposal of the FPGA and its subsequent patenting followed after a period of 40 years where electronics experienced two notable ground breaking milestones shown in Figure 6: the invention of the transistor by Shockley, Bardeen and Brattain in 1947 and the proposal of the first integrated monolithic circuits by Kilby and Noyce in 1959 that enabled the emergence of an era of around 20 years where Application-Specific Integrated Circuits (ASICs) dominated the research and commercial areas of electronics. The origin of programmable electronics can be traced back to the late sixties according to T.E. Reid [13], who points out that by that time, Noyce was worried about the rapid proliferation of different integrated circuits, each designed for its own special purpose. Looking ahead, Noyce saw that the solution to proliferation of special-purpose integrated circuits would be the development of general-purpose chips that could be manufactured in huge quantities and adapted (“programmed”) for specific applications. Nevertheless and despite the fact that during this period the first microprocessors were started to be developed, the proposal for a more general programmable device with applications beyond mere computing would need to wait for almost 20 years more.

The path in integrated photonics, shown as well in Figure 6, suggests a parallel evolution to that of electronics, suggesting that we might be at the right point to consider the development of FPPGAs.

References

News

IEEE Update of the International Roadmap for Devices and Systems (IRDS) Sets Course for Computer and Electronics Industry Growth

Roadmap projects technology requirements for advancing the global computing and electronics ecosystem.

IEEE announced the release of the updated IEEE International Roadmap for Devices and Systems (IRDS). The IRDS identifies industry indicators and trends to quantify technology and system requirements. These include defining requirements for mobile, Internet of Things (IoT), communications-networks, automotive and computing. The IRDS aims to provide stakeholders from academia, manufacturing, supply, and research a clear outline for a more coordinated approach regarding the development of electronic devices and systems.

“To reflect the continuously changing ecosystem of the electronics industry, the IRDS updates continuously with new trends,” said Paolo A. Gargini, chairman of IRDS. The updated IRDS includes new information on cryogenic electronics and quantum information processing, added benchmarks for applications, and supplemental information and metrics from the Moore Moore team. In addition, there’s a newly released summary from Beyond CMOS, and updates for emerging devices, outside systems connectivity technology, factory integration (including smart manufacturing and security topics), metrology, and yield enhancement. Market drivers for medical devices and a new automotive market drivers report are also included.

“The IRDS continues to lead as the go-to reference for researchers, developers and technologists around the world by providing a comprehensive overview of the computer and electronics industry’s trajectory,” said IEEE Fellow Thomas M. Conte, co-chair, IEEE Rebooting Computing Initiative, vice-chair of IRDS, and professor, Georgia Institute of Technology. “The updated IRDS builds upon 16-years of projecting technology needs for the evolving semiconductor and computer industries.”

IRDS partners with regional roadmaps in Europe and Japan. There are memorandums of understanding (MoUs) with the NanoElectronics Roadmap for Europe: Identification and Dissemination (NEREID, Horizon 2020), of the SiNANO Institute in Europe, and with the Systems and Devices Roadmap committee of Japan (SDRJ) of the Japan Society of Applied Physics.

“The IRDS represents a global effort needed for future computing systems covering many different applications. These worldwide road-mapping activities will allow our community to identify and overcome emerging challenges in this field and to speed-up technology innovation that can drive the development of future markets,” said Francis Balestra, member, Governing Board of the SiNANO Institute, director of research, The French National Center for Scientific Research (CNRS) and vice president of Grenoble Institute of Technology.

“The IRDS addresses a wide range of domains and includes invaluable input from global stakeholders who are committed to advancing the computing ecosystem with IoT edge and cyber-physical system (CPS) devices,” said Yoshihiro Hayashi, IRC and chairman of SDRJ, and visiting professor, Faculty of Science and Technology, Keio University.

The updated IRDS can be downloaded by visiting the IRDS home page and joining the IRDS Technical Community. The IRDS is an IEEE Standards Association (IEEE SA) Industry Connections (IC) Program sponsored by the IEEE Rebooting Computing (IEEE RC) Initiative, a program of IEEE Future Directions.

To learn more, visit: www.IRDS.ieee.org
Careers and Awards

IEEE Photonics Society Congratulates Our 2019 Award Recipients

The Photonics Society Joint Awards Committee serves as the evaluation and selection committee for our four Society Awards; Aron Kessel Award, Engineering Achievement Award, Quantum Electronics Award, and the William Streiffer Scientific Achievement Award.

The 2019 Award recipients were honored during the Awards Banquet being held at the 2019 IEEE Photonics Conference at the Hilton Palacio del Rio, San Antonio, Texas, USA, September 30, 2019.

The Aron Kessel Award recognizes those individuals who have made important contributions to opto-electronic device technology. The device technology cited is to have had a significant impact on their applications in major practical systems.

The 2019 Aron Kessel Award recipient is Luke J. Mawst, "for contributions to novel materials growth, fabrication and device design of semiconductor diode lasers."

LUKE J. MAWST was born in Chicago, IL, in 1959. He received the B.S. degree in engineering physics and the M.S. and Ph.D. degrees in electrical engineering from the University of Illinois at Urbana-Champaign in 1982, 1984, and 1987, respectively. His dissertation research involved the development of index-guided semiconductor lasers and laser arrays grown by MOCVD. He joined TRW, Inc., Redondo Beach, CA, in 1987, where he was a senior scientist in the research center, engaged in the design and development of semiconductor lasers using MOCVD crystal growth. He is the co-inventor of the Resonant Optical Waveguide (ROW) antiguided array and has contributed to its development as a practical source of high coherent power, for which he received the TRW Group Level Chairman’s award. He developed a novel single-mode edge-emitting laser structure, the ARROW laser, as a source for coupling high powers into fibers. He became a Faculty member in the Electrical and Computer Engineering Department at the University of Wisconsin-Madison in 1996. He is currently a Professor in the Electrical and Computer Engineering Department at the University of Wisconsin-Madison, where his research interests are in the area of novel III/V compound semiconductor materials and devices; including vertical cavity surface emitters (VCSELs), active photonic lattice structures, dilute-nitride-bismide lasers, quantum dot lasers, lasers employing metamorphic buffer layers, and quantum cascade lasers (QCLs). He is a co-founder of Intraband LLC, a start-up company in Madison, Wisconsin aimed at commercializing high power QCLs. In 2017 he was awarded the UW-Madison Vilas Associates Award. Prof. Mawst has authored or co-authored more than 250 technical papers, holds 26 patents, and is a Fellow of IEEE.

The IEEE Photonics Society Engineering Achievement Award recognizes an exceptional engineering contribution, which has had a significant impact on the development of laser or electro-optic technology or the commercial application of technology within the past 10 years.

The 2019 Engineering Achievement Award honorees are Holger Schmidt and Aaron Hawkins, “for the invention and development of optofluidics waveguides and their applications, in particular commercialization for biomedical diagnostics.”

HOLGER SCHMIDT received the Ph.D. degree in electrical and computer engineering from UC Santa Barbara and served as a Postdoctoral Fellow at M.I.T. He is the Narinder Kapany Chair of Optoelectronics and Professor of Electrical and Computer Engineering at UC Santa Cruz. He also serves as the Associate Dean for Research in the Baskin School of Engineering. His research covers a broad range in photonics and integrated optics, including optofluidic devices, atom photonics, nano-magneto-optics and spintronic devices. He has authored more than 400 publications, several book chapters, and co-edited the CRC Handbook of Optofluidics. He is a Fellow of the IEEE and the Optical Society of America, and received an NSF Career Award and a Keck Futures Nanotechnology Award.

AARON HAWKINS received a B.S. degree from Caltech and a Ph.D. degree from the University of California, Santa Barbara. He was a Co-founder of Terabit Technology and an engineer at CIENA and Intel. He is currently a Professor with the Electrical and Computer Engineering Department, Brigham Young University, doing research in optofluidics, integrated optics, and MEMs. He has authored or co-authored over 400 technical publications and is a Fellow of the IEEE and the OSA. He has served as the Editor-in-Chief for the IEEE Journal of Quantum Electronics and currently serves as the IEEE Photonic Society’s VP of Publications.

The Quantum Electronics Award honors an individual for outstanding technical contributions to quantum electronics in fundamentals; applications or both. The award may be for a single contribution or for a distinguished series of contributions over a long period of time.

The 2019 Quantum Electronics Award is presented to Professor Luigi Lugiato, “for outstanding contributions to quantum
Michal Lipson Awarded the IEEE Photonics Award

Michal Lipson is the Eugene Higgins Professor of Electrical Engineering with Columbia University in New York City. Her groundbreaking research established critical building blocks in the field of silicon photonics. The technology, which uses optical rays to transfer data among computer chips, is now considered to be one of the most promising directions for solving major bottlenecks in microelectronics. Among the first to realize the power of using silicon as an optical medium and the potential of using photons to detect, process, and transmit information more efficiently than electrical signals, she has been at the forefront of developing a key technology for data communications. Professor Lipson’s demonstration of the first ring-resonator-based modulator and efficient waveguide-fiber couplers paved the way for the development of on-chip optical interconnects.

In addition, her development of silicon slot waveguides allows nanoscale subwavelength light confinement in lossless dielectric structures well beyond the traditional diffraction limit. She has validated the use of slot waveguides for optical manipulation and on-chip transport on nanoparticles and biomolecules, which carries enormous importance for biomedical applications. An IEEE and Photonics Society Fellow, Lipson is the inventor of over 30 issued patents and has co-authored more than 200 scientific publications, which have collectively been cited more than 35,000 times, making her one of the most highly cited researchers in modern physics.

The IEEE Photonics Award, sponsored by the IEEE Photonics Society, recognizes outstanding achievements in photonics. Professor Lipson is honored “for pioneering contributions to silicon photonics.”
The IEEE Photonics Society established the Graduate Student Fellowship Program to provide Graduate Fellowships to ten outstanding Photonics Society student members pursuing graduate education within the Photonics Society field of interest. Applicants are normally in their penultimate year of study and must be a Photonics Society student member. Recipients are apportioned geographically in approximate proportion to the numbers of student members in each of the main geographical regions (Americas, Europe/Mid-East/Africa, Asia/Pacific).

The presentation will be made during the Awards Ceremony at the 2019 IEEE Photonics Conference at the Hilton Palacio del Rio Hotel, San Antonio, Texas, USA on Monday September 30, 2019.

The IEEE Photonics Society is proud to present the 2018 Graduate Student Fellows.

Harshil Dave – University of Illinois Urbana-Champaign
Eslam Elfiky – McGill University
Tengfei Hao – Chinese Academy of Sciences
Peicheng Liao – University of Southern California
Md Ghulam Saber – McGill University
Zarina Sadrieva – St. Petersburg National University of ITMO
Jianyang Shi – Fudan University
Xingyuan Xu – Swinburne University of Technology
Xuebing Zhang – Eindhoven University of Technology
Sha Zhu – Chinese Academy of Sciences

HARSHIL DAVE received a B.S. in physics from Rutgers University, New Jersey in 2014 and M.S. in Electrical Engineering from University of Illinois at Urbana-Champaign in 2017. He is currently working towards a Ph.D. degree in electrical engineering at the University of Illinois at Urbana-Champaign. His main research interests are design, fabrication, and high-speed modulation of phased photonic crystal VCSEL arrays. Harshil is a student member of IEEE Photonics Society and Optical Society of America.

ESLAM ELFIKY received the M.Sc. and B.Sc. degrees from Alexandria University, Alexandria, Egypt, in 2014 and 2010, respectively. He is currently working toward his Ph.D. degree under the supervision of Prof. David Plant at the Photonic Systems Group, McGill University, Montreal, QC, Canada. He has published more than 65 journal and conference papers. His current research interests include silicon photonic devices and circuits, digital signal processing for high-speed long-haul and short-reach optical communications, and passive optical networks.

TENGFEI HAO received the B.Eng degree in electronic science and technology from the University of Electronic Science and Technology of China, Chengdu, China, in 2015. He is currently working toward the Ph.D. degree at the Institute of Semiconductors, Chinese Academy of Sciences, Beijing, China. He has authored more than ten papers in peer-reviewed journals. His research interests include photonic generation of microwave signals and photonics based microwave measurement.

PEICHENG LIAO received the B.Eng. in Optical Engineering from Zhejiang University and the M.Eng. in Electrical Engineering from McGill University. He is currently a Ph.D. Candidate at University of Southern California. His research interests include optical communication and networks, optical signal processing, photonic integrated circuits, and optical frequency comb based applications. He has authored and coauthored about 90 peer-reviewed journal and conference papers. He also serves as the reviewer for more than 12 journals.

Md GHULAM SABER received the Bachelor’s and Master’s degrees in Electrical and Electronic Engineering from Islamic University of Technology (IUT), Bangladesh, in 2013 and 2015, respectively. He is currently working towards the Ph.D. degree in the Photonic Systems Group under the supervision of Prof. David V. Plant at McGill University, Montreal, QC, Canada and. He received the R. H. Tomlinson Doctoral Fellowship from McGill University, the Quebec Merit Fellowship for Foreign Students (FRQNT) and the SPIE Optics and Photonics Education Scholarship. His research interest includes silicon photonics, plasmonics and short-reach optical communications.

ZARINA SADRIEVA is a PhD student at ITMO University. The topic of her research is bound states in the continuum in photonics resonators. She will defend in January 2020.

Beginning from my early childhood, I have been interested in technologies and electronics. In high school, I chose physics and chemistry as my specialization. Talking about the experience that made me interested in photonics, I should admit I was not satisfied with...
the insufficient information given in Science lessons. I needed to have all things explained thoroughly and completely. So I used to study by myself. At the university, I chose optics as the widest area for theory and application. During the bachelor program, I was exploring waveguides formed by a glass poling. In 2015, I defended the master thesis at Academic University, the novel top university in Russia, headed by Zhores Alferov, the winner of the 2000 Nobel Prize in Physics. My master thesis was devoted to mode spectra of whispering gallery modes resonators, namely, microdisks, microrings, and race track resonators.

JIANYANG SHI received a bachelor’s degree from Fudan University in 2014. From 2014 to 2019, he was studying for a Ph.D. degree from the Information Science and Technology Department at Fudan University and received the degree in June. His general research interests are in the area of high-speed visible light communication, high-speed optical IM/DD fiber commutation, and digital signal processing. In particular, his current research focuses on channel noise recovery and its applications, deep learning, and fiber network architecture. He has author and co-author more than 50 peer-reviewed technical journal and international conference papers. He is the first author of 9 journal papers and 9 conference papers, including 2 papers in Journal of Lightwave Technology, 1 paper in Optics Express, 1 paper in Photonic Technology Letters, 5 papers in OFC and 2 papers in ECOC. He is also an active reviewer of some IEEE Journals, such as Journal of Lightwave Technology (JLT), Optics Express (OE), Photonic Technology Letters (PTL), Photonics Journal (PJ) and IEEE Access. As a secondary inventor, applied for 5 US patents, two of which have been authorized, two of which have been issued.

XINGYUAN XU (S’17) received the B.Eng. degree from University of Electronic Science and Technology of China in 2014 and the M.S. degree from Beijing University of Posts and Telecommunications in 2017. He is currently working toward the Ph.D. degree at Swinburne University of Technology, Australia (May 2017–May 2020), under the supervision of Professor David J. Moss. His current research interests include microcombs, artificial neural networks and high-speed signal processing. He has published 15 journal papers, with 10 as the first author.

XUEBING ZHANG is currently a Ph.D. candidate supervised by Prof. Ton Koonen and Dr. Zizheng Cao, from the Electro-Optical Communications Group, Eindhoven University of Technology (TU/e), Eindhoven, The Netherlands. He is working for the project of GRAVITY-Zwaartekracht ECO Research Centre for Integrated Nanophotonics. His research is aiming to design and realize photonic integrated circuits as a means to create dynamically reconfigurable indoor access points for a low-cost indoor optical network, and beam-steering techniques for short-range wide-band low-power radio- and optical-wireless connections. So far, he has published 7 journal papers and international conference papers as the first-author. He is also an inventor of a US granted patent.

SHA ZHU is a PhD candidate in the Institute of Semiconductors, Chinese Academy of Sciences (China). She is conducting research in the Microwave Optoelectronics research group of the Optoelectronics Research and Design Center, under the guidance of Professor Wei Li. Based on microwave photonics, her current research focuses on the generation, transmission and processing of microwave signals as well as optical fiber communication. She has published nine first author papers in peer-reviewed journals including six Optics Letters. In the future, she will research the arbitrary waveform generation technology and strive to propose reconfigurable and real-time updateable arbitrary waveform generation schemes.

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Call for Nominations: IEEE Technical Field Awards and Eric Herz Staff Award

Nominations are due 15 January annually for the IEEE Technical Field Awards (TFA) and the IEEE Eric Herz Outstanding Staff Member Award. IEEE TFAs are awarded for contributions to or leadership in a specific field of interest of the IEEE and are among the highest awards presented on behalf of the IEEE Board of Directors. The IEEE Herz Award recognizes sustained contributions by a present or past full-time staff member of the IEEE with at least ten years of service.

All IEEE members are encouraged to submit a nomination for a worthy candidate within their technical fields. Nomination guidelines, award-specific criteria, and components of a nomination form can be downloaded from https://www.ieee.org/about/awards/information.html and http://www.ieee.org/about/awards/recognitions/recognitions_herz.html. All nominations must be submitted through the online nomination portal.

Since 1917, the IEEE Awards Program has paid tribute to technical professionals whose exceptional achievements and outstanding contributions have made a lasting impact on technology, society, the engineering profession, and humanity. By this means, the image and prestige of the organization, its members, and the profession are all enhanced.

For more information visit www.ieee.org/awards or e-mail awards@ieee.org.
Membership

Women in Photonics Establish First Society Technical Chapter in Colombia

By Nicholas H. L. Wong, Associate Editor, IEEE Photonics Society News.

Colombia recently launched its first IEEE Photonics Society chapter, an effort led entirely by women. We spoke to Associate Professor Mónica Andrea Rico Martínez, Director of the Telsaf Research Group at the Catholic University of Colombia, who spearheaded the initiative.

Q: Please Tell Us a Little About Yourself, Including How You Got Involved in the IEEE Photonics Society.

Mónica: I am telecommunication engineer and recently I got my Ph.D. degree from the National University of Colombia. I knew about the IEEE Photonics Society from an internship I did at the Technical University of Colombia.

Inaugural event of the new chapter, celebrating the International Day of Light, 2019.

PHOTO CREDIT: MÓNICA ANDREA RICO MARTINEZ/CATHOLIC UNIVERSITY OF COLOMBIA

Inaugural event of the new chapter, celebrating the International Day of Light, 2019.
of Denmark with Idelfonso Tafur Monroy, where I got involved with topics related to microwave photonics. In 2017, I won a grant to attend and assist at the IEEE Photonics Conference (IPC) for the first time, where I fell in love with photonics and all the applications. Then, I began to think about my country and always desired to make known all the things that we can do with photonics and to contribute to the development of this field there.

Q: Please Tell Us About Your Chapter and How It Was Established.

Mónica: In January of this year, I started working at the Catholic University of Colombia. Here, they have an engineering program in electronics and telecommunications. In this program, they only have 30 women. So I got the women’s mailing list, wrote to them, and then met with 10 girls who answered my email. At the meeting, I explained about the IEEE and the Photonics Society, and also showed them some applications of photonics that we can do here. All were very interested. I told them that we could organize an event to celebrate the International Day of Light as our first activity. They all helped me to organize the activity and that was the hallmark of the creation of the first IEEE Photonics Society student chapter in Colombia. At the same time, I wrote to Lauren Mecum, whom I had met earlier at IPC, about how we could start the new chapter. She gave me her full support and also shared details about student chapter grants. After going through all the administrative procedures, our chapter was formalized on July 12, 2019, as the first in Colombia.

Q: What Event Did You Organize in Celebration of the International Day of Light?

Mónica: On May 16, 2019, the Catholic University of Colombia, together with the Pontificia Javeriana University, in commemoration of the International Day of Light, carried out a theoretical-experimental optical metrology event where we showed the intensive use of both optical characterization techniques and the metrological magnitudes that characterize light to the attendants.

Likewise, attendees were trained in some relevant, advanced and innovative topics of light science and engineering such as RF-optical networks, photonic crystals and connected lighting. The event had the participation of the Thin Films and Nanophotonics research group and its researchers Juan Carlos Salcedo (IEEE Photonics Society Senior Member) and Luis Camilo Jimenez from Javeriana University, as well as the high frequency system and telecommunications Telsaf research group with myself. The event closed with a demonstration of Philips Lighting and its lecturer Andrés Sánchez Escobar.
In August 2019, Sydney’s inaugural “Soapbox Science” event took place at the Circular Quay, with the backdrop of the world famous Sydney Opera House and Sydney Harbour Bridge. The event showcased the amazing and varied research that is carried out in Sydney, and Australia, to the general public. The aim of the event was to encourage more people to engage with STEMM (Science, Technology, Engineering, Math and Medicine) subjects and topics. A select number of researchers served as speakers to discuss topics such as: Optics; Machine Learning; Quantum Control; Forensic Science; Microbiology; Biotechnology; Geochemistry; etc.

This was science busking as I had never seen before or experienced. I’ve heard umpteen lectures and talks (given my own fair share) by amazing speakers, but almost all of these have been in a lecture hall or conference. An open air, open to all science event was a first for me as attendee and participant. Needless to say I was quite nervous, serving as a speaker.

The first hour was spent setting up, photo-ops and videos. After that every hour there were 4 speakers, each on their soapbox, engaging with the public. It was thrilling to see people stop, do a double take and then come and listen! The range of topics was so large and diverse that I spent 2 hours listening (and forgot I was nervous about my talk in the 3rd hour). The talks were all pitched at a level that no matter your knowledge, or lack thereof, everyone could get the gist. The talks were also interactive and fun, so I soon lost track of time.

When my hour finally came (I realized I was frozen by the wind), but really keen to have my chance. It was so cool to stand on the box and hail people and literally try and attract the attention of a passersby. I started...
my talk and every few minutes new people would join, and some leave. So, I had to without repeating everything engage the newcomers and get them up to speed. There were lots of questions and my favorite was “Does the photon have a shadow?” I didn’t know the answer and it gave me something to think about.

I was even told a joke about light by a member of the public: “A photon checks into a hotel. The bellboy asks if he has luggage and the photon replies: No, I am travelling light!”

There were people of all ages, sizes and stripes who came: toddlers, children, adults, men and women, tourists, Sydney siders. One elderly gentleman even had a camping chair and attended the entire 3 hours hearing each speaker one after the other! Several people (most minus camping chairs) stayed for 2 hours or so. It was rewarding to see their interest and how much they engaged with us. I am so glad we took our science outside the classroom, outside the lab, out into the open, to the people where it should have a space.

What I realized in giving the talk and interaction was that the questions asked would often lead me to bits of optics that I rarely talk about, or other areas of science and physics, such as astrophysics, particle physics and biomedical engineering. In doing that and stepping outside my everyday work boundaries, I got to relive the breadth of physics and optics that I do know beyond modelling. It was exhilarating to revisit that and fall in love again with physics again.

If you get the chance, do stand on a (metaphorical or actual) soapbox and talk about your science to people… it is an incredible experience.

To learn more about Sydney’s inaugural Soapbox Science event, visit: www.soapboxscience.org/soapbox-science-2019-sydney

For this year’s schedule of Soapbox Science events, visit: www.soapboxscience.org/this-year

If you want to bring a Science Soapbox event to your city in 2020, find out how to become a Local Organizer with this short video: https://bit.ly/2m2QG39
Pride in Photonics & Physics: Celebrating a Spectrum of Research

As our members may have read in past issues, this year the IEEE Photonics Society formed a Diversity Oversight Committee to address and support the diverse needs of its diverse membership. The Committee believes that the lack of diversity in engineering and physics contributes to a loss of talent and potential innovation in the field. The more the organization understands of its community, the more it can address. Every member brings a diverse set of experiences, whether personal and/or scientific. The goal is to include more voices to shape the direction of the Society’s present and future programs.

Over the years the Society’s Women in Photonics and Multicultural Outreach groups have held a variety of well-received programs to encourage inclusion. This year the Society has taken broader steps to reach the LGBT+ community as well.

Earlier this year the IEEE Photonics Society supported a “LGBT+ STEMinar” led by the Institute of Physics (IOP), Royal Astronomical Society and Royal Society of Chemistry in London, UK. The Society provided diversity and inclusion travel grants to student members to attend. The founders of the conference, LGBTSTEM, say, “The conference was designed for people who work or study in STEM subjects and identify as LGBT. We aim to use the day to showcase work from diverse fields and to encourage collaborations. We also welcome those who may not identify as LGBT but wish to discover and support the work that LGBT people are doing.”

LGBTSTEM created the STEMinar in an effort to encourage a more welcoming environment for LGBT+ people in STEM and support inclusivity. Unfortunately, research has shown that anti-LGBT bias is particularly evident in STEM-related fields, in comparison to other professional settings. For example, a 2016 climate survey from the American Physical Society (APS) revealed that, in the previous year, one fifth of LGBT physicists had experienced exclusion, intimidation or harassment in the workplace, with students and trans-physicists facing the most hostility, and women experiencing this behavior at three times the rate of men.

Later in 2019, the Society also supported a “Pride in Photonics: LGBTQ+ & Allies Workshop”, chaired by Arti Agrawal and Niamh Kavanagh, at the Conference of Lasers and Electro-Optics (CLEO) in San Jose, CA. The aim for this workshop was to provide a safe space and welcoming atmosphere for technical dissemination and an environment to discuss best practices in LGBTQ+ equality, diversity and inclusion. Discussions were also conducted to address ‘safe space’ learning in the academic setting.

Over fifty LGBTQ+ members and allies were present at the workshop. The attendees inclusively heard talks on: “Opening a New Window for Communications”; “CCD- Thermoreflectance Applications in Microthermal Characterization”; “OUT in STEM: Intersectional LGBTQ Inclusion”; “Numerical Modelling in Photonics”; “Multi-resonant Plasmonic Nanoparticles for Enhanced Light-Matter Interactions”; “Nonlinear Optics and My Nonlinear Life”.

JC Salevan, Research Analyst at Yale University, served as a guest speaker, providing an informative talk on “Strategies to Palpably Improve LGBTQ+ Climate in STEM, from Small to Large Scales”. They explained how improving climate for LGBT+ in STEM means working on several scales: personal interactions; group dynamics; department culture; and institutional policies.

The personal, overarching questions posed during the discussion were all one could relate to: “How can I treat my colleagues and peers with respect? What about my students, my supervisors, my employees?”, and, “Am I really being as supportive as I think I am?”

Salevan explained that checking one’s personal assumptions goes a long way for serving as an LGBT+ ally. Examples include: not assuming pronouns, gender, or orientation based on...
presentation; really listening when peers or students tell you what they need to better their environment; doing active work to change your habits and behaviors; providing support and advocating in less-than-welcoming environments; simply putting an LGBT+ sticker on your office door to show ally support.

Students and postdocs also are often at the whims of their professors and instructors, so there can be high stakes for coming out as LGBT+. In a secondary advising setting, Salevan explained that attending and supporting mentoring groups for LGBT+ students can help foster better connections.

For more research, information and details on how you can volunteer or serve as an ally in the LGBT+ community, refer to the following resource links below.

- LGBT+Physicists: www.lgbtphysicists.org
- LGBT+ Inclusivity in Physics and Astronomy: www.arxiv.org/abs/1804.08406
- NOGLSTP: www.noglstp.org
- oSTEM: www.OSTEM.org
- House of STEM: www.HouseofSTEM.org

An innovative outreach program was organized on the ‘Role of Photonics for betterment of Lives and Environments of Sundarbans’. The mangrove forest of Sundarbans is one of the largest such forests in the world. This place sees the confluence of sweet-water rivers in the saltwater Bay of Bengal. Sundarbans is famous for ‘Royal Bengal Tiger’ and is the only mangrove habitat in the world for such species. The livelihood of a large number of people in surrounding areas depends on fishing in Sundarbans rivers, collecting honeys from dense forests, etc. The place is an excellent example of ecological processes. But, the ecological balance is at threat due to several mischievous activities such as illegal poaching of animals, cutting of trees, pollution of river water, etc. An Extempore speech competition was organized on a motor boat in Sundarbans area to identify how Photonics can address this grave concern of ecological threat. Members and volunteers of the Chapters participated in this Chair-initiative program. There were 5(five) topics for the extempore speech: (a) Laser and Detector, save Sundarbans Tiger, (b) Photonics and Conservation of Sundarbans Mangroves, (c) Optical Fibers, pollution of Sundarbans rivers, (d) Do Photonics, catch sea-fish and (e) Solar Cell and Motor Vessel. Each of the nine participants was given a topic to speak on after a planning time of 5 minutes. The edited version of the extracts from the speech in those topics are briefly given below in the following paragraphs.

(a) Tiger is an integral part of the Sundarbans ecosystem. As per recent statistics, more than 50% of world tiger population is in India, and the alarming statistics is 97% of world tiger perished in last 100 years. Sundarbans is no exception, where the number of tigers is now a little more than 100. So, there is need to save tigers from their disease and different types of destroying activities for ecological balance. Among the several techniques, we mention here how lasers and detectors may be used for detection of intruders, hunters, and also for monitoring the movements of tigers. One approach is to use combinations of multiple lasers and detectors, which may be installed around the fence or within the forest. Light from a laser is directed towards a detector/sensor located at a long distance, and when an intruder/hunter enters/crosses a certain region and break the laser-to-detector light path, then there will be a signal generated. This may be an alarm to scare the hunter or intruder, or can be a signal, which may be sent wireless to authorities to follow or monitor. Infrared operation of lasers and detectors are suitable for its invisible nature. Cameras made of infrared detectors may be installed at selected places to cover the areas of importance, and can be used to take thermal image of its coverage area and can be recorded/ seen on a CCTV for surveillance. This not only helps to detect hunters, but also to detect movement of tigers. Laser beams can also be used to scan a certain area and the reflected light from the objects are detected using detectors. The image seen on the monitor screen can also identify the type of objects, thus reducing the chances of false alarm. Thus, laser and detector can be used to save Sundarbans tigers.

(b) Sundarbans mangroves protect the coastal lands from impact of sea-waves of Bay of Bengal. These are flood buffers

Participants busy in preparation.
and also help in stabilizing the climate. But, there has been a great threat to the mangroves largely due to man-made activities. The trees here are often treated as unproductive and so cleared to make agricultural land, human settlements, tourist developments, Participants busy in preparation. aquaculture, etc. These are used for fuel, construction, and industry-products. Pesticides, and other toxic man-made chemicals carried by river steams can kill animals living in mangrove area and oil pollution can stop the breathing of mangrove trees. Measures should be taken at various levels and in various forms for conservation of mangroves. Let us see how photonics can help in mangrove conservation. Laser scanning and detectors can be used to get a image map of the mangrove area. Here, LIDAR (light detection and ranging) based imagery can be done from unmanned aerial vehicles (such as, Drones). LIDAR illuminates a target with a laser and analyzes the reflected light to make measurements to give precise estimates. Based on this information, appropriate actions can be taken, such as planting of trees at places with reduced density of mangroves. The system can also be used to track poachers, illegal harvesting, etc. and appropriate measures can be taken. Laser based land leveling can also be done over a certain period to detect erosion of land causing destruction of trees and accordingly restoration of levels can be made. Thus, photonics can help in conservation of Sundarbans mangroves.

(c) Sundarbans rivers are the habitats of many aquatic creatures. Many such creatures die due to polluted water caused by man-made and industrial wastes. Heavy metal pollution is one such source of pollution. The common sources of these heavy metals are pipes, batteries, smelters, toys, paints etc. Water is carrier of these toxic elements. Optical fibers can be used as sensors to detect such pollution. In an approach, some portion of the cladding of optical fiber is etched and submerged in heavy metal aqueous solution. A spectrum is sent through the fiber and due to attachment of heavy metals directly to the core, the output spectrum is shifted and such a sensor once calibrated can be used to detect the presence as well as concentration of heavy metals in water. If the concentration is at alarming level, then proper precautions may be taken and/or appropriate Govt. orders/steps may be implemented to stop further pollution. At the same time, proper chemical treatment may be done on localized basis to remove pollutants from river water. Thus, optical fiber can be used for detection of pollution of Sundarbans rivers for necessary follow-up actions. (d) The Sundarbans area is very famous for its fishing market, and this is intimately associated with the livelihood of people — fishermen and consumers of fish. But, nowadays, supply is not enough to meet the increasing demand of the fish market of Kolkata. Firstly, the fishermen usually catch fish only at dawn, and no fishing can be done at night. Here, photonics brings the solution to do fishing also at night with the help of LED boats. These boats consist of LEDs on its under surface. The color of LED is usually taken as white or green (as it scatters less). The fish usually cannot detect all colors of light, but can detect the color contrast/ intensity in their surroundings. Green light penetrates deep in water and zooplankton are attracted to this light and quickly swim to the surface towards the boat-LEDs. Some small fishes (such as shrimp) chase the zooplankton (a food). Also, big (usually predatory) fishes can sense the water vibration caused by swim of small fishes and chase towards their prey. So, if in the dark LED boats are used, the fishes are misled by the light to approach towards boat and get caught by the fishermen. Secondly, while using fishing nets to catch fish, certain aquatic animals and birds also get caught in the net and die. In such cases, the fishing nets can be fitted with tiny green LED lights which are not detected by
fish, but are visible to other aquatic animals and birds. Thus, fishing can be done without causing harm to other animals in the Sundarbans ecosystem. Besides, LED systems are environment-friendly and do not disturb the ecological system. Lastly, the fishermen can use polarized glasses in order to avoid the glare during the daytime. Government can provide such costly glasses to poor fishermen considering the huge economy from fishing in Sundarbans rivers.

(e) A motor vessel is a large boat propelled by an internal combustion engine, usually a diesel engine. The motor room in the boat is a large fraction of the boat-weight. It creates unpleasant engine noise and vibration, causes pollution of water and surroundings through emission of poisonous smoke. A better alternative to this Diesel engine may be the use of solar panel driven motor boat. Solar cell has the advantage that electricity is generated from solar energy which is a renewable energy, so pollution free and causes no greenhouse gases to be emitted after installation. This electricity can be used to power an electric motor boat similar to electric car, and can also help to lit the motor vessel. Installation of solar panels on the roof of the motor boat increases the surface area of solar absorption to generate increased amount of electricity. In addition, use of solar panel assembly for generating electricity reduces the weight of the motor vessel to carry more passengers and a standby generator. Besides this, the immense heating of the roof is also prevented which leads to a cozy environment for the motor vessel drivers. Thirdly, excepting the one-time installation cost, the running cost of electricity generation becomes very cheap and the electricity can be stored for conditions when solar power becomes insufficient/unavailable. Solar cells having a long life and good durability, the necessity of replacement is also reduced.

The extempore speeches were judged, and the top three performers (1st-Piyali Mukherjee, 2nd-Samanti Das, 3rd-Suman Dey) were awarded. The innovative nature of the program for a noble cause was highly enjoyable and appreciated by everyone.

Participants: Madhusudan Mishra, Piyali Mukherjee, Shreerupa Biswas, Himangshu Karan, Soumyadip Das, Mouhanti Bandyopadhyay, Suman Dey, Shroddha Makhpadhyay and Samanti Das.

(Compiled and Edited by Prof. N.R. Das)

Some Resources Consulted
the IPA World Congress, within IEEE Photonics Society symposiums and at SPIE Photonics West. At the 17th International Photodynamic Association World Congress in Boston, Massachusetts, Mallidi was recently recognized with a 2019 Early Investigator Award, alongside peer Girgis Obaid. She has also been a key player in developing and evaluating low cost photodynamic therapy along with collaborators from Aligarh Muslim University, Massachusetts General Hospital, University College London and University of Massachusetts, Boston that won the 2019 Team Award for Advancing PDT in Rising Nations at the 17th International Photodynamic Association World Congress in Boston, Massachusetts.

Mallidi’s students and colleagues describe her as a hands-on, passionate and committed mentor. Her mentee’s have won Best poster and presentation awards, travel awards at local and international conferences. Mallidi is also involved in outreach activities, particularly with elementary schools in her hometown Belmont, MA where she regularly organizes demo events to teach young kids about light and sound and how they can be used to visualize what is inside the body. Mallidi also participates in the Tufts University Biomedical Engineering Research Scholars program where she teaches a class and conducts laboratory session for high school students on advanced imaging technologies. In her spare time, Mallidi enjoys dancing and playing with her daughter, cooking, travelling, gardening and photography.
Next-Generation Engineers Find Their Niche at the IEEE TryEngineering Summer Institute

More Than 150 Students Learned About STEM Topics, Including Optics and Photonics.

High school senior Jonathan Mesidor loves to take electronics apart, see how they work, and put them back together again. Middle schooler Jacqueline Pena Gomez likes to find solutions to real-world problems such as making travel safer. Both explored disciplines such as aerospace engineering, civil engineering, and electrical engineering as participants in the IEEE TryEngineering Summer Institute, held from 7 to 20 July at Vaughn College of Aeronautics and Technology in Queens, N.Y.

The program introduces students in grades 8 through 12 to the fields of engineering and technology during a two-week-long, on-campus, residential program held at three U.S. universities. The IEEE-designed curriculum includes team-based, hands-on design projects, guest speakers, academic preparation tips, and field trips.

There were 41 other students who attended the session at Vaughn with Mesidor and Gomez. A total of 155 students participated in all of the sessions, which were also held at Texas A&M University in College Station and the University of California, Riverside.

Student Experiences

Mesidor is a student at Northeast High School in Philadelphia. “As a youngster, I began taking everything apart,” he says. “My dad would help me by finding an old, remote-controlled car and then buy the same one new so I could disassemble them and compare the cars’ parts. Then I would repair the old, broken one.”

His uncle, an electrical engineer, further piqued his interest in engineering by introducing Mesidor to Ohm’s law, which deals with the relationship between voltage and current in an ideal conductor, and encouraged him to focus his studies on math. Mesidor’s teachers also inspired him to pursue engineering as a career. John Danihel, the high school’s physics and AP research teacher, taught Mesidor about kinetic energy. His social studies teacher, Andrew Adams, was the one who told him about the IEEE program.

As soon as he heard about the summer institute, Mesidor knew it would be a great place to learn more about mechatronic interdisciplinary engineering. He has a wide variety of interests, encompassing both mechanical engineering and electrical engineering, as well as physics and the history of technology.

Mesidor says the hands-on project he liked best was building a drone.

“I really liked soldering the battery, lights, and motor together,” he says. “They held together well, unlike how I used to rig them before I learned how to solder.”

Learning to code was another project. “I learned things here that we don’t have the chance to study in school—or even in the engineering club I participate in,” he says. “I also learned to communicate better, work in groups, and interact with people I never met before. We helped each other out.”

At just 13 years old, Gomez knows her career path will be in the science, technology, engineering, and math fields, helping to solve real-world problems such as burglary by securing hotel room door handles using a fingerprint. She’s a member of the coding club and other STEM-related programs offered by her school, Red Bank Middle School in New Jersey, but she wanted to learn more. Gomez’s science teacher, Kristen Maiello, told her about the IEEE program, and her parents encouraged her to attend.

“TryEngineering sounded like the best way to do that.”

She really enjoyed learning 3D printing and being able to keep the projects the students made.

“I know more about 3D printing and circuits, and I learned about coding and how to apply all of these skills,” she says.
“When I go back to school in September, I will be more advanced than the other students.”

She values working with students of different ages and backgrounds, noting, “Teamwork was encouraged on all the projects. The interpersonal skills I learned will help me in college and in my career.”

Meet the Teachers

Just as enthusiastic about the summer institute and the impressive students participating were Branded Camp Services executive director Douglas Murphy, IEEE’s partner responsible for running the camps, and Program Director Antonio Del Valle, an adjunct professor at John Jay College, in New York City. Both volunteered as teachers for the camp.

In the classroom, the students worked together in small groups, supervised by Del Valle and other engineers who also volunteered.

“The summer institute keeps the sparks of curiosity going and fans the flames for new ideas,” Del Valle says. “Here, students learn how to problem-solve and troubleshoot, as well as gain insight on what it is like to study engineering in a college atmosphere.”

Students explored how science affects the world around us in a fun, hands-on environment with like-minded peers, according to Del Valle.

Scholarships Available

Donations to the IEEE Foundation, IEEE’s charitable partner, helped provide need-based scholarships for 30 students to attend. Awards are based on demonstrated financial need, a student essay, and two letters of recommendation. Financial support came from individuals, organizations, and 12 IEEE societies and councils, which helped make attending the program a reality for students with varying socioeconomic backgrounds. Several recipients said that because of their family’s financial situation, attending this “eye-opening” and “life-changing” program would not have been possible without the scholarship.

“The scholarship program created a powerful opportunity for students to try on a new future,” Murphy says. They got to study engineering at the high-level, and explore possible career options as well as experience life on a college campus. The best part of the fully immersive experience were the possibilities that opened up the moment they stepped on campus.

“From very humble beginnings, these students are forever changed and are now headed down new paths. I am thrilled and humbled to be part of this endeavor and look forward to the expansion of the program to even more students.”

For information on how to donate to the scholarship program, contact the IEEE Foundation at donate@ieee.org. For more information and to learn about volunteering, visit the program website or contact Burt Dicht, director of student and academic educational programs with IEEE Educational Activities, at b.dicht@ieee.org or +1 732 981 3419.

Scholarships for the TryEngineering Summer Institute are funded by donations to the IEEE Foundation’s Realize the Full Potential of IEEE Campaign. The IEEE Photonics Society was a lead sponsor of the campaign, providing scholarship funding for three students to attend.

Press release credit and photos given to IEEE TryEngineering Summer Institute and IEEE The Institute.
Member Spotlight

Kithinji Muriungi

IBM Digital—Nation Africa Intern, Graduate of Moi University, Kenya.

Kithinji Muriungi is an IBM Digital—Nation Africa Intern, who leads technical events at universities across East Africa and Africa at large. He has collaborated with partners in facilitating IBM Certified Trainings, i.e. seminars, boot-camps, summer schools and workshops, at universities, such as Moi University and Makerere University, in Uganda. Through this work, he has worked closely on the promotion of D-NA (Digital Nation Africa) on several platforms since its launch.

Apart from the in-person trainings he has conducted, which have impacted 100s of students, Muriungi has actively facilitated online training courses that have impacted 1000s especially in African countries, like Kenya, Uganda, Nigeria, and Rwanda.

As a graduate of Moi University, Kenya, in Electrical and Electronics Engineering, Muriungi also served as a NOC Engineer Intern with Safaricom PLC. There he gained his interests and hands-on experience with photonics, working with 2G, 3G and 4G networks.

Muriungi was recently honored with the Larry K. Wilson Regional Student Volunteer Award (2019). The purpose of this award is to recognize, annually, in each Region of the IEEE, one student member for their extraordinary accomplishments association-wide. It is sponsored by the IEEE Member and Geographic Activities (MGA) Board.

He also was recognized with the IEEE Volunteer Achievement Award in 2018 from the Kenya Section for his exceptional performance as an IEEE local volunteer. He received this honor for serving as Country Lead for IEEEExtreme, a global challenge in which teams of IEEE student members compete in a 24-hour time span against each other to solve a set of programming problems.

Additionally, Muriungi represented the IEEE Photonics Society at the 2019 International Day of Light Opening Ceremony, entitled “Illuminating Education” in Trieste, Italy.

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Conferences

IEEE Photonics Society Conference Calendar

2019 Optical Fiber Communications Conference and Exhibition (OFC)
San Diego Convention Center
San Diego, CA USA
Mar 3, 2019 - Mar 7, 2019
www.ofcconference.org

Conference on Lasers and Electro-Optics 2019 (CLEO)
San Jose Convention Center
San Jose, CA
May 5 2019 –May 10, 2019
www.cleoconference.org

2019 IEEE Optical Interconnects Conference (OI)
Hilton Santa Fe Historic Plaza
Santa Fe, NM USA
Apr 24, 2019 - Apr 26, 2019
www.ieee-oi.org

2019 IEEE Photonics Society Summer Topical Meeting Series (SUM)
The Westin Fort Lauderdale Beach Resort
Fort Lauderdale, FL USA
Jul 8, 2019 - Jul 10, 2019
www.sum-ieee.org

2019 IEEE Research and Applications of Photonics in Defense Conference (RAPID)
Hilton Sandestin Beach Golf Resort & Spa
Miramar Beach, FL USA
Aug 19, 2019 - Aug 21, 2019
www.ieee-rapid.org

16th International Conference on Group IV Photonics (GFP)
Hilton Singapore
Singapore
Aug 28, 2019 – August 30, 2019
www.ieee-gfp.org

2019 IEEE Photonics Conference (IPC)
Hilton Palacio Del Rio
San Antonio, TX USA
Sep 29, 2019 - Oct 3, 2019
www.ieee-ipc.org

2019 IEEE Avionics and Vehicle Fiber-Optics and Photonics Conference (AVFOP)
The Westin Arlington
Arlington, VA USA
Nov 5, 2019 - Nov 6, 2019
www.ieee-avfop.org

For more information, visit: www.photonicsociety.org/conferences
IEEE Summer Topicals Conference Recap: Technical & Professional Development Highlights

Each summer, the IEEE Summer Topicals (SUM) Conference brings together the world’s experts in numerous photonics hot topics for 3-days of intense talks, discussions, and networking. Each year the topics change, bringing new people into the IEEE Photonics Society. To ensure the conference is also highly relevant, the organizers pilot new professional development events and the location changes to a new exciting summer venues. Numerous IEEE Women in Photonics travel grants were awarded to ensure that students and young professionals can attend the conference.

The professional development events included a Mentor Match, Lab Automation Hackathon and a brand new, Peer Review Workshop. In the Peer Review Workshop, discussions were had on the paper writing process, from how to outline a paper, write it, respond to reviewers. Editors of journals led many smaller breakout groups in a fire-side chat style to encourage one-on-one conversations.

The conference consisted of six diverse topics a poster session and numerous tutorials with over 200 attendees. More often than not, each technical session typically lasted 10-15 minutes longer than scheduled, which is unheard of at larger conferences, due to deep discussions that developed during the talks.

The format of the Lab Automation Hackathon consisted of 8 demonstration tables. Each table was staffed by an expert at a particular aspect of lab automation, ranging from simple remote control of optical instrumentation, data processing and photonic design simulations, all the way to full lab automation. Students and professionals of all levels were encouraged to visit each table over lunch to learn and share their secret tips and tricks developed over the years.

Furthermore, this year in beautiful Fort Lauderdale the meeting hosted a poster session for students and young professional participants. The two first-prize poster winners were presented to: Siying Peng, Stanford University, for “GeSn Mid-infrared Nanophotonic Resonant Absorbers” and Sajad Saghaye Polkou, University of Central Florida—CREOL, for “Integrated Photonic Outcoupling Array for Imaging-based Beam Steering”.

To capture the full excitement of the varying conference topics, each topical chair wrote a short summary of their meeting below.

Photonics in Artificial Intelligence

AI is one of the emerging topics. AI encompasses many technologies, such as machine learning, cloud computing and big data. It overlaps considerably with photonics and integrated Si materials and photonics. Photonics is enabling artificial intelligence (AI). Combination of photonics and AI for photonics-enabled applications is an exciting new prospect. With current rapid development of new photonic materials and devices, many AI based devices and systems, like robots, autonomous driving, unmanned autonomous vehicles (UAVs), and drones, rely heavily on photonic sensors, photonic networks and telecommunications to realize practical and smart functionality. Photonics applied to AI has become a more important topic today.

For the session of Photonics in Artificial Intelligence, we have a list of renowned invited and keynote speakers around the world, such as ‘Advances in Neuromorphic Silicon Photonics’ from Prof. Paul Prucnal at Princeton University; ‘Transfer learning for nanophotonics’ from Prof. Min Qiu at Westlake University; ‘Multi Tone Continuous Wave Lidar’ from Prof. Ozdal Boyraz at University of California, Irvine; ‘Intelligent and integrated photonic devices’ from Prof. Alex Yasha Yi at University of Michigan; ‘High Performance Metasurface Flat Optics: from Components to Systems’ from Prof. Federico Capasso at Harvard University; ‘Diffractive Optical Neural Networks’ from Prof. Aydogan Ozcan at University of California, LA; ‘High-speed Visible Light Communication Based on Machine Learning’ from Prof. Nan Chi at Fudan University; ‘Visible diode lasers for smart lighting and high data rate visible light communications’ from Boon S. Ooi at King Abdullah University of Science and Technology; ‘Monolithically Integrated 3D Silicon Photonics’ from Prof. Joyce Poon at University of Toronto; and ‘Smart Visible Light Communication and Ranging System Using High-speed Stereo Cameras’ from Prof. Takaya Yamazato at Nagoya University.

Conference goals are two fold, one is to let our photonics community to be aware of this emerging direction, the other is to provide a platform for both photonics and AI communities to discuss some future directions which will need experts in both areas to work together. Topics covered include: Integrated smart photonic materials and devices, From Night Vision to LiDAR: An Automotive Perspective; LiDAR Approaches and the Demands on Optical Components; A Realistic Assessment of Optics for Self-driving Vehicles; Optical Technologies for Autonomy in Realistic Weather; Photonics for Robot Sensing; Photonics for Smart and Big Data. For this session, which is trying to bridge the understanding between the photonics community and AI community, we also encourage graduate students to learn this emerging opportunity.

Programmable Photonics

“Programmable photonics” is an emerging field of photonics where light is manipulated on a very granular scale using software control. While some concepts date back several decades to adaptive optics, the continuing scaling of photonic integrated circuit technology (especially silicon photonics), spatial light modulators and electronic control has triggered a rapid evolution into software-controlled manipulation of light. Recent demonstrations of programmable photonics for quantum information processing, photonic neural networks and mode multiplexing showed that the time was ripe for a dedicated workshop on this topic.
The 2019 IEEE Summer Topical Meetings provided the perfect setting.

In programmable photonics, specialized photonic components are replaced by more generic elements that can be adjusted using electronics and software. This way, the photonic system can perform multiple functions, or it can adapt itself to changing conditions. In free-space optics, lenses, mirrors and phase plates are replaced by spatial light modulators, making it possible to separate different spatial modes, for instance in a multimode communication link or sensor system. But the full potential of programmable photonics emerges once we exploit photonic integrated circuits. With the large-scale integration potential of silicon photonics, it now becomes possible to integrate thousands of optical elements on a chip. While today this technology is mostly used to make dedicated application-specific circuits, programmable photonics takes advantage of mesh architectures that implement generic circuits that contain a large number of electro-optic elements to control the flow of light. Essentially, it creates the photonic equivalent of a field-programmable gate array (FPGA), as compared to application-specific integrated circuits (ASIC).

At the IEEE Summer Topical Meeting in Fort Lauderdale, we gathered, for the first time, the pioneers in this new field from all over the world to put both state-of-the-art developments and upcoming challenges on the table. This gave rise to many lively discussions, and for the attending students it provided an invaluable opportunity to get a feeling of where this field is going. Prof. Wim Bogaerts, Ghent University—imec, kicked off the conference with a birds-eye overview of the field, after which Prof. David Miller, Stanford, brought everyone up to speed with the basic concepts of configurable photonic circuits and how they can be configured with simple algorithms. Prof. Peter Wilson, University of Bath, built the bridge to the electronics world, where programmable circuits are already well-established. Because some of the key applications of programmable photonics are quantum information processing (QIP) and accelerators for artificial intelligence (AI), joint sessions between these topics were featured. Prof. Ian Walmsley, Imperial College, showed in his keynote how these programmable mesh architectures can be utilized as quantum gates. 6 invited speakers, including Prof. Volker Sorger, George Washington University and Dr. Alex Tait, NIST, showed how the field of AI and programmable photonic circuits are becoming intertwined.

Programmable photonics brings an entirely new set of scientific and engineering challenges and opportunities to the world of photonics. Prof. Bogaerts, Prof. Jose Capmany, Polytechnical University of Valencia, and Dr. Michael Hochberg, Elenion, all explained how generic multifunctional chips could change the economic model of photonic integrated circuits, and speed up the development cycle of new photonic functionality. Moving to ever larger circuits demands ever more efficient photonic building blocks such as phase shifters and tunable couplers, and Prof. Niels Quack, EPFL, showed how this could be accomplished with technologies such as photonic MEMS, while Dr. Stefan Abel, IBM-Zurich, made a case for the integration of efficient electro-optic materials such as BTO. Large-scale circuits need efficient electrical control as well as software layers for configuration. Prof. Andrea Peer Review Workshop breakout discussion with young to mid-year professionals as well as senior members and top reviewers in the field.

October 2019
Melloni, Politecnico di Milano, showed how multiple layers of control can work together in a self-configuring circuit. Prof. Dirk Englund, MIT, kept the audience engaged until the final minutes of the conference with a closing keynote, showing us where this new technology can lead us in the field of quantum optics. Overall, the meeting showed an exciting emerging field with a broad range of new applications, concepts and opportunities, and brought these together for a very stimulating and exciting few days.

Next Generation High Speed Access Networks for New Emerging Services

As we are moving to the next-generation of access networks for new emerging services, which new technologies are driving the next round of innovations? What new features are needed? What are the top research priorities in next-gen optical access networks? Academia experts and industry researchers from around the globe convened this July at IEEE SUM Topical Meeting 2019 to discuss, exchange ideas and share views on the technologies that will shape the future of access networks.

Over the course of three days, a total of 26 invited and two contributing talks have tried to answer these questions. Topics included coherent optics for access networks; enabling technologies like optical amplification, FEC, and burst-mode TIAs for next-gen high speed PON as well as 5G Transport Access Networks and mobile X-haul in access. Low-latency and converged access, photonics technologies for integrated fiber-wireless access, network planning, virtualization and Security for Next Gen access networks were presented and discussed also.

The sessions were full of debates and interactions. Experts and researchers during this three-day meeting discussed the new requirements for access network for emerging services, such as 5G mobile X haul, edge computing, AR/VR, and UHD video distribution. These new services combined with...
stringent requirements like low latency, flexibility, security and scalability are transforming the need for future access networks. For instance, ultra-low latency transmission is increasingly gaining importance in access networks for emerging time critical services. Enabling technologies including advanced modulation formats, digital signal processing, coherent detection, FEC and optical amplification technologies are becoming increasingly important for high-speed access network. Network virtualization, and more intelligent operation and resilience in access networks, also gain more and more interest.

Besides the good impression left by the beautiful beach in Ft. Lauderdale, we’ve received lots of positive feedback from the attendees. They believed the meeting provided a good platform for interacting and discussing how the next generation access network will look like by bringing together researchers and experts from diverse fields in an intimate, networking environment.

Physics and Applications of Semiconductor Laser Dynamics

The Physics and Applications of Semiconductor Laser Dynamics (PASLD) track at SUM 2019 was co-chaired by Profs. F. Grillot, from Télécom ParisTech (France), F.-Y. Lin from the National Tsing-Hua University (Taiwan), S.-C. Chan, from the City University of Hong-Kong (China), and M. Sciamanna from CentraleSupélec (France).

The track covered new research topics and state-of-the-art developments in the areas of semiconductor lasers, nonlinear dynamics, ultrafast dynamics, and related photonic devices including quantum dot and dash semiconductor materials, vertical-cavity surface-emitting lasers, mode-locking, frequency combs, micro-resonator, nanolasers, random lasers as well as quantum cascade emitters.

Indeed, today, the rich physics behind this field of research is of growing interests for plethora of applications including but not limited to optical communications, defense and security, optical computing, optics-based information security, and optical storage.

The PASLD topics took attendees through the most trending topics of the exciting research field with 7 keynotes, 18 invited and 5 contributed speakers coming from all over the world. The hope was to present PASLD as a source of inspiration for many scientists working in the field of nonlinear dynamics of photonic devices.

Cartoon

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October 2019
IEEE British and Irish Conference on Optics and Photonics (IEEE BICOP 2019)

Preliminary Call for Papers, Sponsors and Exhibitors

Looking to present your work at a unique conference that brings together academia and industry like no other? Want to share your products and introduce your company? Want to find a new partner to collaborate with? IEEE BICOP 2019 is for you!

Following the tremendous success of the inaugural IEEE British and Irish Conference on Optics and Photonics (IEEE BICOP 2018), we are happy and proud to announce the second edition in London this December. With participation from speakers, authors and industry members from UK to as far as India and Japan last year, we are putting together yet another influential and fantastic line-up of speakers for this year’s BICOP.

This year’s conference covers a broad range of optics and photonics applications, including but not limited to, Automotive Technologies, Communication, Defence and Security, Image Processing, Information Storage, Lasers, Medical Photonics, Optical Engineering, Optical Trapping, Optics and Photonics in AI, Organic Photonics, Photonic Integrated Circuits, Quantum Science, Semiconductor technologies, Sensors, etc.

Key Conference Details

Dates: 11–13 December 2019
Venue: IET London, Savoy Place (2 Savoy Pl, London WC2R 0BL)

Important Deadlines

Submission: 1st November 2019 (4-pg article)
Early Bird Registration: 15th November 2019 (Registration available until Conference)

All the information regarding the 2018 edition of BICOP, and submissions, registrations and speakers for this year is available on the conference website (https://ieeebicop.com).

For sponsorship and/or exhibition inquiries, and any other conference related queries, please contact the conference’s Publicity and Public Relations Chair, Akhil Kallepalli (akhilkallepalli@ieee.org).
IEEE Photonics Society Co-Sponsored Events
2019

SBFoton IOPC
7-9 October
2019 SBFoton International Optics and Photonics Conference
Sao Paulo, Brazil
https://www.sbfoton.org.br

MWP
7-10 October
2019 International Topical Meeting on Microwave Photonics
Ottawa, ON Canada
www.site.uottawa.ca/~jpyao/MWP2019

ACP
2-5 November
2019 Asia Communications and Photonics Conference
Chengdu, China
www.acpconf.org

ICIST
4-6 November
2019 International Conference on Information Science and Communications Technologies
Tashkent, Uzbekistan
www.icisct2019.org

MOC
17-20 November
2019 24th Microoptics Conference
Toyama, Japan
http://www.moc2019.com

HPD
9-10 October
2019 IEEE High Power Diode Lasers and Systems
Coventry, United Kingdom
www.hpdl.org

WRAP
13-14 December
2019 Workshop on Recent Advances in Photonics
Guwahatai, India
www.wrap2019.com
Publications

Announcement of an IEEE / OSA
Journal of Optical Communications and Networking
Special Issue on:
Open Optical Networks

Applications enabled by both 5G radio access and cloud computing are expected to drive a dramatic increase in IP data traffic over the next few years. Backbone networks, unlike their access counterparts, already carry massive amounts of data traffic and will thus need to be upgraded with new technologies that can push their transport capacity to unprecedented levels. Telecom network operators will aim to maximally exploit their existing fiber infrastructure to optimize their returns on CAPEX. A synergistic parallel effort will be required to enable multi-vendor interoperable networks that are compatible with these technologies. Similar to ongoing optical multi-vendor interoperability efforts such as the Telecom Infra Project (TIP) and the Open ROADM MSA, such collaborative initiatives will pave the way to multi-vendor interoperability demonstrations and standards for open optical networks, incorporating either partial or total disaggregation. Ultimately these efforts will lead to data model abstractions, interfaces, and implementation of software-defined networking (SDN) solutions that are suitable for future technologies.

The special issue is targeted at the latest proposals and results in open optical networks (OONs) including, but not limited to, the following topics:

- Data transport abstraction through quality of transmission (QoT) estimation, including associated open data structures and open APIs
- Modeling and simulation of open optical systems (may include the presence of legacy channels, non-data services, etc.)
- OONs for data-center interconnect vs. metro networks vs. long-haul networks
- Telemetry and failure recovery, including machine-learning-aided (ML-A) solutions for OONs
- Routing and spectrum assignment for OONs, including ML-A solutions
- Network planning tools for OONs
- Physical-layer-aware network orchestration
- Control and management of OONs, including the use of machine learning
- Open software-defined networks, based on, for example, OpenConfig or Open ROADM specifications, and ONOS, ODL, TAPI or other SDN operating systems
- Techno-economic analysis of OONs at network layers 0 and 1
- Multi-vendor interoperability and OON demonstrations
- Partially vs. totally disaggregated multivendor OON solutions

Submissions to the special issue should be prepared according to the usual standards for the Journal of Optical Communications and Networking and will undergo the normal peer review process. Manuscripts must be uploaded through OSA’s online submission system (https://www.osapublishing.org/jocn/journal/jocn/author.cfm) specifying from the Feature Issue drop-down menu that the manuscript is for the issue on Open Optical Networks.

Guest Editors: Vittorio Curri (Lead Guest Editor, Politecnico di Torino, Italy), Andrea Fumagalli (The University of Texas at Dallas, USA), Seiki Kuwabara (NTT, Japan), Victor Lopez (Telefonica, Spain), Antonio Napoli (Infinera, Germany), Lynn Nelson (AT&T, USA)

Important Dates:
Submission Deadline: 8 October 2019
Publication: Q2 2020
Preliminary Call for Papers

Announcing an Issue of the IEEE
JOURNAL OF SELECTED TOPICS IN QUANTUM ELECTRONICS on

Programmable Photonics

Submission Deadline: December 1, 2019
Hard Copy Publication: September/October 2020

The IEEE Journal of Selected Topics in Quantum Electronics (JSTQE) invites manuscript submissions in the area of Programmable Photonics (PP) featuring state-of-the-art reconfigurable optical devices:

- Programmable photonic circuits
- Integrated microwave photonic circuits
- Phase-change photonic devices
- Optomechanically tunable components
- Low-temperature programmable optics
- Reconfigurable electro-optical devices
- Heterogeneous integration with active materials
- Tunable quantum photonic systems
- Adaptive 2D-3D photonic components
- All-optical programmable photonic circuits
- Erasable integrated optic components
- Programmable photonics for quantum technologies
- Reconfigurable metasurfaces
- Thermo-optic devices and materials
- Piezoelectric tunable devices
- Acousto-optic tunable devices
- Reconfigurable waveguide arrays
- Multipurpose optical circuits
- Field-programmable photonic devices
- Microwave and optical oscillators
- Machine learning photonics
- Training of photonic neural network
- Wavefront shaping
- Programmable multimode devices
- Energy efficient tunable devices
- Large-scale photonic circuits
- MEMS-based tunable circuits
- Topological photonics

Related topics not included in the list above are also welcomed. The Primary Guest Editor for this issue is David Marpaung, University of Twente, the Netherlands. The Guest Editors of the issue are Radan Slavik, ORC Southampton, UK, Leimeng Zhuang, IMEC, USA, and Wolfram Pernice, University of Muenster, Germany.

Unedited preprints of accepted manuscripts are normally posted online on IEEE Xplore within 1 week of the final files being uploaded by the author(s) on ScholarOne Manuscripts. Posted preprints have digital object identifiers (DOIs) assigned to them and are fully citable. Once available, the preprints are replaced by final copy-edited and XML-tagged versions of manuscripts on IEEE Xplore. This usually occurs well before the hardcopy publication date. These final versions have article numbers assigned to them to accelerate the online publication; the same article numbers are used for the print versions of JSTQE.

For inquiries, please contact:
IEEE Photonics Society JSTQE Editorial Office - Chin Tan Lutz (Phone: 732-465-5813, Email: c.tanlutz@ieee.org)

The following documents are required during the mandatory online submission at: http://mc.manuscriptcentral.com/jstqe-pho.
1) PDF or MS Word manuscript (double column format, up to 12 pages for an invited paper, up to 8 pages for a contributed paper). Manuscripts over the standard page limit will have an overlength charge of $220.00 per page imposed. Biographies of all authors are mandatory, photographs are optional. See the Tools for Authors link: www.ieee.org/web/publications/authors/transjl/index.html.
2) MS Word document with full contact information for all authors as indicated below:
Last name (Family name), First name, Suffix (Dr./Prof./Ms./Mr.), Affiliation, Department, Address, Telephone, Facsimile, Email.

JSTQE uses the iThenticate software to detect instances of overlapping and similar text in submitted manuscripts and previously published papers. Authors should ensure that relevant previously published papers are cited and that instances of similarity are justified by clearly stating the distinction between a submitted paper and previous publications.

Call for Papers

Announcing an Issue of the IEEE JOURNAL OF SELECTED TOPICS IN QUANTUM ELECTRONICS on Photonics for Synthetic Dimension and Topological Insulators

Submission Deadline: February 1, 2020
Hard Copy Publication: November/December 2020

The IEEE Journal of Selected Topics in Quantum Electronics (JSTQE) invites manuscript submissions in the area of Photonics for Synthetic dimension and topological insulators submissions in the area of topological photonics and of optoelectronic devices whose operation relies on topological features:

- analogue quantum Hall systems
- analogue quantum spin Hall systems
- Floquet topological insulators
- topological pumps
- honeycomb lattices and Dirac points
- three-dimensional Weyl systems
- synthetic dimensions and high-dimensional photonics
- non-Hermitian topological photonics
- gyromagnetic photonic crystals
- topological metamaterials
- spin-orbit coupling for light
- exciton-polariton systems in microcavities
- topological matters based on cavity- and circuit-QED
- topological nonlinear optical systems
- topological optical solitons and vortices -optical-nonlinearity-induced topological phase transitions
- optical isolators and robust transport
- angular-momentum- and frequency-multiplexing
- topological lasers
- valleytronics
- quantum interference of topological edges
- Photonic molecules

The Primary Guest Editor for this issue is Lorenzo Pavesi, University of Trento, Italy. The Guest Editors of the issue are Iacopo Carusotto, CNR Trento, Italy; Zheng-Wei Zhou, USTC, China; Oded Zilberberg, ETH Zurich.

Unedited preprints of accepted manuscripts are normally posted online on IEEE Xplore within 1 week of the final files being uploaded by the author(s) on ScholarOne Manuscripts. Posted preprints have digital object identifiers (DOIs) assigned to them and are fully citable. Once available, the preprints are replaced by final copy-edited and XML-tagged versions of manuscripts on IEEE Xplore. This usually occurs well before the hardcopy publication date. These final versions have article numbers assigned to them to accelerate the online publication; the same article numbers are used for the print versions of JSTQE.

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The following documents are required during the mandatory online submission at: http://mc.manuscriptcentral.com/jstqe-pho.

1) PDF or MS Word manuscript (double column format, up to 12 pages for an invited paper, up to 8 pages for a contributed paper). Manuscripts over the standard page limit will have an overlength charge of $220.00 per page imposed. Biographies of all authors are mandatory, photographs are optional. See the Tools for Authors link: www.ieee.org/web/publications/authors/transjnl/index.html.

2) MS Word document with full contact information for all authors as indicated below:
Last name (Family name), First name, Suffix (Dr./Prof./Ms./Mr.), Affiliation, Department, Address, Telephone, Facsimile, Email.

JSTQE uses the iThenticate software to detect instances of overlapping and similar text in submitted manuscripts and previously published papers. Authors should ensure that relevant previously published papers are cited and that instances of similarity are justified by clearly stating the distinction between a submitted paper and previous publications.
The IEEE Journal of Selected Topics in Quantum Electronics (JSTQE) invites manuscript submissions in Photonic Antennas. Early attempts in developing Photonic Antennas can be traced back to the 1990’s with the design and fabrication of micrometer-scale infrared and visible light antennas. From that time on, interest in this emerging research field has expanded rapidly, with growing sophistication of designs enabled by advancements in the micro and nanofabrication technology. In the last ten years or so, Photonic Antennas have become a very dynamic field of research in the broad area of photonics, both theoretically and experimentally. This has led to remarkable progress in the understanding of resonant optical micro and nanostructures with potential for formidable impact on a wide range of applications, from high-rate wireless communications and optical signal processing to molecular sensing and nonlinear effects enhancement. This special issue focuses on the recent progress of Photonic Antennas and trends in developing leading-edge fundamental concepts and novel applications.

**Fundamental topics of interest include (but are not limited to):**
- Phased Arrays
- Metasurfaces
- Tunability
- Reconfigurability
- All-dielectric structures
- Plasmonic design
- Nonlinear effects
- Novel materials
- Fabrication, theory, and modeling.

**Application areas of interest include (but are not limited to):**
- High-rate communications
- Light detection and ranging
- Three-dimensional holography
- THz technology
- Sensing
- Photovoltaics
- Optical processing
- Security
- Biotechnology

The Primary Guest Editor for this issue is Hugo E Hernandez-Figueroa, University of Campinas (UNICAMP), Brazil. The Guest Editors are: Jennifer Dionne, Stanford University, USA; Mona Jarrahi, UCLA, USA; Andrey E Miroshnichenko, University of New South Wales, Australia.

The deadline for submission of manuscripts is April 1, 2020. Hardcopy publication of the issue is scheduled for January/February 2021.

Unedited preprints of accepted manuscripts are normally posted online on IEEE Xplore within 1 week of the final files being uploaded by the author(s) on ScholarOne Manuscripts. Posted preprints have digital object identifiers (DOIs) assigned to them and are fully citable. Once available, the preprints are replaced by final copy-edited and XML-tagged versions of manuscripts on IEEE Xplore. This usually occurs well before the hardcopy publication date. These final versions have article numbers assigned to them to accelerate the online publication; the same article numbers are used for the print versions of JSTQE.

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1) PDF or MS Word manuscript (double column format, up to 12 pages for an invited paper, up to 8 pages for a contributed paper). Manuscripts over the standard page limit will have an overlength charge of $220.00 per page imposed. Biographies of all authors are mandatory during submission of manuscript, photographs are optional. See the Tools for Authors link: [www.ieee.org/web/publications/authors/transjnl/index.html](http://www.ieee.org/web/publications/authors/transjnl/index.html).

JSTQE uses the iThenticate software to detect instances of overlapping and similar text in submitted manuscripts and previously published papers. Authors should ensure that relevant previously published papers are cited and that instances of similarity are justified by clearly stating the distinction between a submitted paper and previous publications.
Call for Papers

Announcing an Issue of the IEEE
JOURNAL OF SELECTED TOPICS IN QUANTUM ELECTRONICS on
Optical Signal Processing

Submission Deadline: June 1, 2020
Hard Copy Publication: March/April 2021

The IEEE Journal of Selected Topics in Quantum Electronics (JSTQE) invites manuscript submissions in Optical Signal Processing. The field of Optical Signal Processing is very broad and multidisciplinary, incorporating areas from materials, device design, and fabrication; system demonstration; and mathematical tools. Linear and nonlinear techniques are used extensively for applications ranging from optical communications, RF communications, quantum communications and processing, to ultrafast science and biophotonics. The IEEE Journal of Selected Topics in Quantum Electronics invites manuscript submissions in the area of Optical Signal Processing. The purpose of this issue of JSTQE is to highlight the recent progress and trends in developing leading-edge optical signal processing technologies and techniques. Areas of interest include (but are not limited to):

- Broadband, high-efficiency nonlinear devices
  - Photonic integrated circuits, e.g., with structural nonlinear enhancement or mixed linear and nonlinear elements, for optical signal processing
  - Semiconductor devices, including semiconductor optical amplifiers and sources
  - Nonlinear material platforms for optical signal processing
  - Highly nonlinear fibers

- Systems applications and demonstrations
  - Linear and nonlinear optical signal processing techniques for communications and information processing (optical, RF, and quantum)
  - Optical switching technologies, concepts, and techniques

- Mathematical tools
  - Time-frequency techniques
  - Fourier techniques
  - Neuromorphic computing and deep learning applied to optical signal processing

The Primary Guest Editor for this issue is Lawrence Chen, McGill University, Canada. The Guest Editors are: Bill Corcoran, Monash University, Australia; Amy Foster, Johns Hopkins University, USA; Leif Oxenløwe, DTU, Denmark; Chester Shu, Chinese University of Hong Kong, Hong Kong.

The deadline for submission of manuscripts is June 1, 2020. Hardcopy publication of the issue is scheduled for March/April 2021.

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- *Summer Schools, Graduate Student Fellowships, Young Professional Workshops,* and *Student Outreach Ambassador* programs to encourage careers in photonics and introduce young minds and undergrads to light-based sciences.

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- *Chapter Challenges, Educational Seed Grants, Distinguished Lecturers,* and *Women in Photonics* events to improve public and consumer awareness about the impacts of light as well as address issues of gender balance in STEM.

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Photonics Society shall advance the interests of its members and the laser, optoelectronics, and photonics professional community by:
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