Engineering Structured Light from Lasers

Also Inside:

• Meet the Newly Elected Members of the Board of Governors 2019–2021
• Hot Topics at the IEEE Photonics Conference
• IEEE Photonics Society at the National Society of Black Physicists' Conference
REFLECTOMETERS FOR DEVICE CHARACTERIZATION

Optical Coherence Domain Reflectometer

**OCDR-1000**

**KEY SPECS**
- Spatial Resolution: 10 µm
- Sensitivity: −90 dB (−95 dB typical)
- RL Dynamic Range: 80 dB
- Measurement Range: 600 mm
- Built-in SLD

**ADVANTAGES**
- Large Dynamic Range
- Easy Data Interpretation
- Low Cost

Good for characterization of devices with low to high reflectivity. Strong reflections in the measurement range do not affect peaks from weaker reflections.

**EXAMPLE**
56Gbps QSFP+ (Silicon Photonics Integrated Circuit)

Device with some higher reflectivity features- both devices detect the more prominent features, but the OCDR clearly detects some lower reflectivity peaks that are hidden by phase noise in the OFDR plot.

Polarization Analyzing Optical Frequency Domain Reflectometer

**OFDR-1000A**

**KEY SPECS**
- Spatial Resolution: 10 µm
- Sensitivity: −130 dB
- RL Dynamic Range: 70 dB
- Measurement Range: 100 m
- Requires External Tunable Laser

**ADVANTAGES**
- High Sensitivity
- Long Range
- Birefringence/Stress/Strain Characterization

Good for accurate length determinations and detection of ultra low reflectivity features. Strong reflections in the measurement range can cause laser phase noise, which can obscure weaker reflections.

**EXAMPLE**
Single Stage Isolator (Input)

Device with weak reflections- OFDR is able to detect some lower reflectivity features not evident in the OCDR plot.
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Editor’s Column

NICOLAS FONTAINE

Happy 2019! I’m excited to work with the newsletter associate editors and Photonics Society staff to bring more research highlights and news about your photonic activities into the newsletter. We also welcome a new Associate Editor, Ivana Gasulla, from the ITEAM research institute of Valencia, Spain to help procure material from Southern Europe.

The Get to Know Your Photonics Society Leadership features the outgoing VP of conferences, Martin Dawson and his job was to lead the conference council. For me, conferences are the most important events for networking, to learn about new research and for outreach. I tend to learn much more attending a few talks at a conference followed by in-depth discussions with the speakers over reading several journal papers. The conference council members strategically determine which conferences the IEEE Photonics Society co-sponsors and/or runs. Martin’s done a great job over the last few years and will be succeeded by Perry Shum from 2019 onwards.

Speaking of conferences, the Photonics Society is always happy to work with the student experience at conferences through its various activities held during conferences. This issue includes articles about the open source lab automation hackathon events at the IEEE Photonics Society Conference (IPC) and the Asian Communications and Photonics Conference (ACP). We also ran a very successful mentor match program at ACP. A new event at IPC was the student volunteers who acted as “scribes.” These scribes took notes of the hot discussions of several sessions which are compiled into an article. Additionally, IEEE Photonics Society ran several outreach events at the National Black Physicists’ Conference.

The research highlights article describes ways to use and generate structured light and is from Andrew Forbes team from the University of Witwatersrand in South Africa. Structured light involves manipulating and or controlling the spatial amplitude, phase, and polarization across the spatial dimension. With advancements in spatial light phase modulators, it is now straightforward to programmatically generate very complex beams. These beams find numerous uses including optical trapping, optical communications, and imaging.

I want to emphasize that we want to hear news from you! We always need volunteers to provide short articles, especially news from your local photonic outreach activities and groundbreaking research results. 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 in contributing, no matter how new you are to the society. As always, I hope you enjoy reading the articles!
I hope all in our community had a wonderful holiday season and we wish you and your families a Happy New Year.

Let me start with some good news. At the end of 2018, the U.S. National Quantum Initiative was approved by both houses of congress and the President has signed the legislation. This is great news for the quantum science and technology community in the United States and the IEEE Photonics Society and its sister societies, academic groups and industry as a whole, who have championed this legislation forward. This is a good example of how as a community we can advance emerging science and technology and get support from our local governments.

The IEEE Photonics Society also welcomes newly elected Board of Governors members, Meredith Hutchinson, Stephen Ralph, Masatoshi Suzuki, and Jianping Yao, and new Vice-President for Technical Activities, Leslie Ann Rusch, Vice-President for Conferences, Perry Shum, and President-Elect, Carmen Menoni, to the leadership team.

In regards IEEE Technical Activities Board (TAB) news, meetings were held in Vancouver in November 2018. Our Society publications were reviewed by the Periodical Review and Advisory Committee (PRAC). Overall our periodicals (IEEE Photonics Journal, IEEE Photonics Technology Letters, IEEE Journal of Quantum Electronics, IEEE Journal of Selected Topics in Quantum Electronics and IEEE/OSA Journal of Lightwave Technology) received positive reviews from the committee. The only subject raised was the need for enhanced diversity in our editorial board with increased participation from diverse groups, including geography, gender, industry and government.

One of the topics discussed at the TAB meeting was an “Accelerated Open Access—Plan S” proposed by European Union: Horizon 2020 to eliminate gold open access for subscription journals. This has a huge impact on various societies. However, the IEEE Photonics Society is in good shape to adopt such a plan due to having the open access IEEE Photonics Journal in place, which allows direct open access authors to submit their work. Some members of the photonics community have strong views that we should oppose Plan S, whereas some members are of the stance that Plan S is inevitable and the Society should be prepared for this.

As for developments in Membership and Outreach, IEEE membership has grown 3.2% while membership of the Societies has grown 1.9%. In order to encourage more IEEE members to join the IEEE Photonics Society, we have reduced our membership fee from $37 USD to $20 USD, and $17 USD for students to $10 USD.

Try Engineering Summer Camps have been designed to support pre-university students has been inspiring engineering as a choice for their future studies and career. Many students from underprivileged communities are supported with scholarships and the IEEE Photonics Society has decided to cover the sponsorship of a student to attend this summer camp. TAB also approved a Young Professional Award and the IEEE Photonics Society has agreed to support this award with a $15K USD contribution over six years.

Furthermore, IEEE Entrepreneurship Initiative is supporting and nurturing entrepreneurs association-wide. Entrepreneurship is important for our industry and technology development. I am glad IEEE has taken this initiative on and the IEEE Photonics Society has formed a new Industry Engagement Committee to advocate for our specific community.

I have been traveling quite a bit and attended OPTIC 2018 in Tainan, AIP Congress/ACOFT/COMMAD 2018 in Perth, Photonics 2018 in New Delhi and Facets of Photonics 2018 in Pune. It is nice to see that the photonics field is growing globally and our Society has the potential to engage with new potential members in new regions. As part of globalization strategy, our Society has signed new Sister Society Agreements in 2018 with the Australian Optical Society, Brazilian Photonics Society, Taiwanese Photonics Society, and is working with other sister-societies to develop programs of mutual interest.

In closing, I look forward to an aspiring year ahead and urge members to take on new resolutions, including serving your community with altruism and through continued volunteerism.

With warm greetings
Chennupati Jagadish
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Research Highlights

Engineering Structured Light from Lasers

Andrew Forbes, School of Physics, University of the Witwatersrand, Private Bag X3, Johannesburg 2050, South Africa.

It recent years it has become possible to exercise tremendous control over light’s spatial profile, the “pattern of light”, tailoring it to produce spatially variant polarization states, exotic phase structures and customized intensity profiles. These advances have been driven by both fundamental science as well as engineering applications, and made possible by an extensive “toolkit” available to us, allowing on-demand and real-time structuring of light towards a particular end [1]. Examples are numerous and diverse, and include radially polarized vector beams for increased resolution in microscopes, orbital angular momentum phase vortices for a larger alphabet in quantum information, flat-top intensity beams for uniform drilling in laser processing of materials, and full spatial mode control in optical communication with space-division multiplexing. The ideas stem from the venerable topic of laser beam shaping: rather than use the light from your laser as is, why not tailor it for a particular application? In this context, even single plane intensity shapes are forms of structured light, e.g., heads-up holographic displays and structured illumination for 3D digital holography.

Most structured light fields are created external to the laser using a variety of approaches [2], [3]. These include tailoring light by dynamic phase using spatial light modulators or diffractive optics, by geometric phase using liquid crystals or meta-surfaces, by refractive optics including aspheres and freeform optics, and less common these days by pure amplitude masking. With these approaches, it is possible to shape the phase, polarization and intensity of light, sometimes simultaneously. There are some limitations, notably in efficiency, power handling and wavelength, but for the most part the versatility makes these approaches extraordinarily powerful (see Figure 1 for a graphical summary).

Structuring light internal to the source, say a laser, is somewhat less advanced and still an emerging research field, despite the fact that lasers have been around for more than half a century. Initially the general consensus was that all laser modes in Fabry-Pérot cavities would be plane waves, but soon this was dispelled, revealing the importance of diffraction in mode selection. A “textbook view” of lasers would explain it as follows: a random optical field of spontaneous emission bounces back and forth inside the cavity until such time as the loss equals the gain, at which point lasing starts. On each pass, the intra-cavity optical elements (their function and geometry) as well as diffraction serve to tailor the spatial structure of the mode. Since loss and gain are spatial mode dependent, each possible mode has a different possibility to lase. If the gain is equal for all modes, then the lowest loss mode lases first, followed by the next lowest loss mode and so on. This idea was exploited in early approaches to intra-cavity mode selection, first done with Hermite-Gaussian (HGnm) modes by carefully positioning wires inside the laser at the zero field positions of the HG function: the desired HG mode would then experience low loss—the wire not affecting the round-trip transmission as it crosses a zero in the field—while all other modes would have a high loss—they would have a large loss (wire) at places where there should be light. For example, a wire across the middle of the mirror would prohibit a Gaussian beam from lasing but not the HG01 mode.

Following this seminal work on mode selection by amplitude [4], researchers in the early 1990s introduced a phase-only mode selection approach (see [5] for an historical review). In this method, the desired beam is specified at the output coupler (OC), let’s say a flat-top intensity beam for laser materials processing. To design a laser resonator to produce this by phase-only modulation, one notes that a mode of the cavity must repeat after each round trip. That is, if it is a flat-top beam at the OC, then this structure must reappear after each complete pass, with only a global phase change allowed. With this in mind, one can adopt the following simple 3-step recipe to design a laser for an arbitrary mode:

1) select the desired mode at the OC end;
2) propagate it backwards to the rear mirror of the resonator and extract the phase of the resulting beam;
3) programme the mirror to have the conjugate of this phase.

Figure 1. Structuring light. (a) Structured light may be created external to the cavity by transforming one beam into another. This optical transformation may be implemented in many ways, e.g., by amplitude, geometric phase, diffractive optics or digital holograms, shown from left to right, respectively. (b) Alternatively, the laser can be engineered to deliver the desired mode directly by using custom intra-cavity mirrors, with some examples of structured light from the source shown in (c).
One can immediately see what will happen: the desired mode travels to the rear of the cavity, accumulating some phase change. After reflection off the rear mirror, our custom phase mirror, the beam will acquire the conjugate of the phase it accumulated on its first pass; by the reciprocity of light, on the return pass back to the OC this phase will unwind to return the beam back to what it was. Of course, it will do this for every round trip, and hence by definition is a resonant mode of the cavity. This recipe works very well except for particular classes of modes, notably the Hermite-Gaussian and Laguerre-Gaussian (LG) modes. The reason for this is a little subtle. The wavefront of such beams becomes curved after some propagation, but the radius of curvature is not order dependent, that is, the curvature for a low-order LG mode is the same as for a high-order LG mode. Thus, the conjugate phase mirror works equally well for all modes in this set and consequently returns all modal possibilities. Some addition tricks are needed to discriminate the LG modes to lase only on the desired one, say to produce controlled orbital angular momentum beams as the output [6], [7].

Although we have seen many advances in custom lasers over the past few decades [5]–[8], the approaches to structuring light inside laser cavities are still based on certain prevailing paradigms. One such paradigm is that the eigenmode of a laser resonator must “be the same” everywhere in the cavity except for some small diffraction effects due to propagation from one mirror to the other. That is, if you have a Gaussian beam at the back mirror then you will also have a Gaussian beam at the front mirror, perhaps with a change in size due to propagation. The simple recipe outlined in the aforementioned paragraph assumed this. We now understand that it is possible to have mode M1 at one end of the cavity that transforms into mode M2 at the other end, but still repeating to each after every round trip. The design approach for this is not as simple as the three-step recipe described earlier, and the resonator becomes more complicated, requiring two custom mirrors rather than one, but the design freedom opens exciting opportunities. This has profound implications for the development of high-brightness lasers: lasers with both high energy and excellent beam quality, requirements for long distance communication and tight focusing for cutting and welding metals. For example, one can design the resonator to have a flat-top beam at the gain end for maximum energy extraction (as if a multimode beam was oscillating) while having a Gaussian beam at the OC end for delivery of this energy in a low divergence, high quality beam [9]. The potential applications are enticing; for instance, high-power slab lasers, or high-power diode lasers, which have notoriously poor beam quality, could now be designed to output a Gaussian beam. Another prevalent paradigm is that the desired mode at some position within the laser must repeat after each round trip in amplitude and phase, except for an overall loss or gain factor. This too has been dispelled, resulting in the first observation of fractal light from lasers, shown in Figure 2, where the cavity mode images into itself after each pass to create structure at many dimensions: structured light within structured light [10].

Breaking our paradigms has seen the emergence of many exotic lasers for producing structured light at the source, including orbital angular momentum, Airy, Bessel, vector, Poincare Sphere, fractal and flat-top beams, to name but a few. Equal to the choice of structured beam is that of how to implementation the solution, with lasers demonstrated using spatial light modulators, liquid crystals, meta-surfaces, diffractive/refractive optics and adaptive optics. And this is only with conventional Fabry-Pérot resonators (Figure 3). Nowadays, micro and nano-structured lasers are possible by exploiting plasmonic excitations, offering a plethora of laser geometries from which to study structured light.

Despite the exciting advances, there still remain outstanding issues that require further applied research. First, many implementations are limited in their power handling capability so that only low power structured light has been created. The use of new materials, including meta-surfaces, could overcome this in the future. Second, the design approaches discussed here all successfully converge to produce the desired mode, but without commenting on what the competing modes might be. Thus, in many cases the final design is not practical because many unwanted modes are able to lase too. Generic design approaches that compensate for this do not at present exist, so the process always involves an element of trial and error; perhaps this may be overcome in the future by the incorporation of artificial intelligence, with the numerical algorithm learning by example which solution spaces to ignore? Third, the cost and complexity of solutions as well as the sensitivity of the laser to extra
losses and element alignment are equally important engineering issues to resolve, requiring system-wide considerations in the design and implementation. Finally, the impact of the gain is often ignored in such designs, yet herein lies an exciting opportunity to tailor loss and gain for maximum mode discrimination. Intriguingly, this might be done by shaping the pump light (assuming an optically excited laser medium) thereby shaping the spatial gain profile: in essence, using externally created structured light to engineer structured light from lasers.

Author Biography
Andrew is a Distinguished Professor within the School of Physics at the University of the Witwatersrand (South Africa) where he runs a group working on Structured Light (www.structuredlight.org). He is a Fellow of OSA and SPIE, and a member of the South African Academy of Science.

References
Get to Know Your Photonics Society Leadership

Martin Dawson—Outgoing VP Conferences (2016–2018)

**What is Your Current Professional Job?**
I actually have two jobs. I’m a professor and the director of research at the University of Strathclyde’s Institute of Photonics, which I helped establish over 20 years ago. In 2012 we had the opportunity to create the UK’s first Fraunhofer research centre, which is also located at Strathclyde, and I direct this Centre in parallel with my university role. Fraunhofer provides professional R&D services to support industry, in our case in photonics. Combining these roles is a very exciting challenge: overseeing photonics research from the laboratory bench through to industrial exploitation.

**What Role Does Your VP Conferences Position Play for IPS?**
The VP Conferences organises and convenes the Society’s Conference Council, which oversees and monitors the health, operations and strategy of our portfolio of conferences, reporting to the Board of Governors. Conferences are a very important part of the service IPS provides to its members and the wider photonics community, so this role is a significant one—our monthly Conference Council phone calls discuss IPC, Summer Topicals, RAPID, CLEO, OFC, Group IV Photonics, Optical Interconnects, International Semiconductor Laser Conference, AVFOP, etc., and we are also regularly requested to provide technical co-sponsorship for conferences and meetings around the world which complement our core portfolio.

**What Challenges Do You Face in Your Role?**
As you can see above, IPS is engaged with a wide portfolio of conferences and meetings, and our list of technically co-sponsored meetings continues to grow. We need to monitor these conferences from a financial point of view and also in terms of their continued relevance, paper submission and presentation statistics, venues, and attendance numbers. Occasionally there are opportunities to co-locate meetings and this needs to be considered. Sometimes a new conference may be added such as the RAPID conference that was introduced in 2018 and this requires extensive consultation and debate. We need to oversee a process which identifies volunteers to play senior roles in the organisation of several of these meetings. We also need to engage with issues linked to the Society’s Publications and Technical Affairs. In handling these extensive responsibilities we are given tremendous help by the Society’s staff.

**What Do You Want to Accomplish in Your Role This Year?**
Sadly I’m just coming to the end of my term as VP Conferences, which followed my serving on the Program Chairs’ Committee for IPC. At this point, we are transitioning to my successor Perry Shum and I am trying to help make this as smooth a handover as possible. I look back on several accomplishments this year of which I think we can be proud: the successful launch of RAPID, continuing to develop and expand IPC, introduction of a Conference Vice Chair role for IPC, the introduction of a new Quantum Photonics topic committee, the continued growth of Summer Topicals, etc. Of course these are achievements not only of Conference Council but also of the very enthusiastic volunteers involved and the Society staff who support these meetings.

**Why Photonics? What was Your “Photonics Moment”?**
When I was a student in the early 1980s our field was generally referred to as Optics. I’d originally been considering a PhD in infrared balloon astronomy, but I visited the laser group at my university, Imperial College in London, and fell under the spell of lasers—I can still remember the instant impact of seeing CW mode-locked dye lasers in the lab. My PhD, supervised by Wilson Sibbett and supported by Roy Taylor, was an eclectic mix of solid state, dye and semiconductor lasers with nonlinear optics, and these topics keep recurring and reconfiguring as my career has developed, linking with microfabrication. It’s a very exciting field to be in.

**What About Our Society’s Mission and Work Really Motivates You?**
As time goes on, I’m more and more focussed on the support and framework our Society gives to young professionals. I know that, if they are supported and encouraged appropriately, they will be the future backbone of our Society and may regard IPS as their ‘professional home’ throughout their careers. A major part of the enjoyment of the VP Conferences role is to witness at first-hand how our conferences can support these young professionals in their career development. I’m also very interested in innovation, the process by which research gets translated into new products and services: I am very pleased to see the Society’s plans for further engagement with Industry and Standards and I would like to help with this.

**What Specific Assets do You Bring to the Table as VP Conferences?**
I hope that colleagues would think I’m a dedicated and committed volunteer—I certainly try to do my best. I think carefully about the responsibilities of the role and try to come up with new ideas to promote the success and development of our
conferences and our Society in general. I also try to be careful to solicit inputs from as wide a stakeholder group as possible and then to help draw these views towards a consensus.

How Would You Advise Members Who Want to Become More Involved in the Society?
I first became involved—with encouragement from John Marsh and Alan Miller—through service to the then newly-formed Scottish Chapter (of what was then IEEE/LEOS), which I served successively as Secretary, Vice-Chair, Chair and Past Chair. The Society’s Chapters provide a great and graduated way to build up experience in service and voluntary work. Also, it is worth trying to target one or two conferences that you commit to attending regularly: this is a good way to become recognised by your peers in a topic area and it can lead in time to being drawn into organising special symposia or serving on a technical committee. This is what happened to me: I first attended the IEEE/LEOS meeting in 1993 and bit by bit I started to pick up jobs to do. It has been well said that volunteering is addictive and once you start it just keeps going!

Tell Us Something Fun About Yourself
When I get the chance, I’m a keen hill walker and long distance walker. At one time or another I’ve walked many of the UK’s long distance footpaths, including the Pennine Way, Offa’s Dyke, Coast to Coast, Pembrokeshire Coast path, South Downs Way… I hope my wife and I can do more of this now our son is away at university.
News

Eighth UNESCO Medals for Contributions to the Development of Nanoscience and Nanotechnologies

The medals are awarded each year by UNESCO to prominent scientists and organizations that advance science and technology in the spirit of UNESCO’s priorities.

This past November, ten eminent scientists, including IEEE Photonics Society President Jagadish Chennupati, and scientific institutions received the UNESCO Medals for contributions to the development of nanoscience and nanotechnologies during a ceremony held at UNESCO headquarters, Paris. The medals are awarded each year by the Director-General of UNESCO to prominent scientists, public figures and organizations that contributed to the development of nanoscience and nanotechnologies in the spirit of UNESCO’s priorities.

The fields of nanoscience and nanotechnology have been developing for just a few decades, but they now contribute to the economy of all countries and almost every human life.

“Today, we meet to celebrate exceptional scientists and practitioners from around the world, who are pushing back the frontiers of scientific knowledge of what lies beyond our world and to transform our lives for the benefit of all”, said Miguel Clusener-Godt, Director of UNESCO’s Division of Ecological and Earth Sciences. “They impact electronics and computing, medicine, materials and manufacturing, energy and transportation… Nanoscience and nanotechnology have the potential to foster new developments in science, technology and innovation via the dissemination of new knowledge and applications.”

This is why the Medal was established in 2010 at the initiative of the International Commission responsible for developing the Nanoscience and Nanotechnologies theme for the Encyclopedia of Life Support Systems (EOLSS). Since then, 46 Medals have been awarded to prominent scientists, institutions and public figures, such as Isamu Akasaki, winner of the 2014 Nobel Prize in Physics, Zhores Alferov, winner of the Nobel Prize in Physics in 2000, and Chunli Bai, President of the Chinese Academy of Sciences.

The 2018 UNESCO Medals for contributions to the development of nanoscience and nanotechnologies were awarded to:

Sergeev Alexander Mikhaylovich, President of the Russian Academy of Sciences, Deputy Chairman of Russian Presidential Council for Science and Education.

Mikhaylovich’s expertise in plasma physics, nonlinear dynamics of optical systems and highly sensitive optical measurements are internationally recognized. He has made important contributions to the fields of optical tomography.

Tatartchenko Vitali Antonovitch, Consultant at the Aix-Marseille University in France, Vice-Chairman of COSPAR (International Committee of Space Research).

Antonovitch provided the theoretical basis of PeTa effects (Perelman-Tatartchenko effect)—the physical phenomenon of characteristic radiation accompanying first order phase transitions - and demonstrated its existence experimentally. On the basis of the PeTa effect, he developed a new conception of cavity-less lasers and models for cavitation luminescence, sono-luminescence and laser induced bubble luminescence.

Fursenko Andrei Aleksandrovich, President of the Supervisory Board of the Russian Scientific Foundation, Assistant of the President of the Russian Federation, Chairman of the Academic Council of the Foundation “Centre for Strategic Research North-West”.

Aleksandrovich directed the development of the national programme ‘Development of nanotechnologies in Russia’ as Minister of Education and Science of the Russian Federation. He is the author of over 100 scientific publications, notably on technological innovation.

Ismail Elmaghar Mohammed, Founding Director of the Khalifa Semiconductor Research Center in the United Arab Emirates.

Mohammed many achievements include the development of a self-powered wearable device that can predict the onset of a heart attack ahead of time.

Kauppinen Esko Ilmari, Manager of the NanoMaterials Group at the Department of Applied Physics of the Aalto University School of Science.

Ilmari research focuses in gas phase synthesis of nanomaterials, including carbon nanotubes and polymer-drug composite nanoparticles and their characterization with advanced electron microscopy methods. These fields create new opportunities for drug delivery, inhaled at the micro and nano scales, which are very promising to treat diabetes and many other diseases.

Nassiopoulou Androula Galiouna, Director of Research and Head of the “Nanostructures for Nanoelectronics, Photonics and Sensors” research group at the National Centre for Scientific
Research Demokritos in Athens, President of the General Assembly of the European Institute of Nanoelectronics.

Galiouna pioneered the fabrication of vertical silicon nanowires on the Si wafer and developed innovative applications of Si nanowires, nanocrystals and porous Si, which include low-loss transmission lines and antennas on the Si wafer working up to 210 GHz, thus enabling fast communication on the Si chip, nanocrystal memories, high capacitance density microcapacitors for energy storage, high performance miniaturized Si thermal sensors applied in a respiration system and a flow meter for gas engine etc.

Zehetbauer Michael Josef, Head of the Faculty Group “Physics of Nanostructured Materials” at the University of Vienna.

Josef has been working on increasing the efficiency of functional materials such as nanostructured thermoelectrics, hydrogen storage materials, and biodegradable implant materials.

Jagadish Chennupati, Head of the Semiconductor Optoelectronics and Nanotechnology Group of the Australian National University; Convenor of the Australian Nanotechnology Network.

Chennupati has made important contributions in the field of semiconductor nanotechnology, and established a pioneering research programme in Australia in semiconductor nanotechnology and optoelectronics.

Mansurov Zulkhair, Director-General of the Institute of Combustion Problems, Doctor of Science, Professor.

Zulkhair has made important contributions in the production of nano-carbon materials and carbon nanotubes and graphene. His research focuses on hydrocarbon combustion kinetics and mechanisms, the structure of cold and sooting flames, and investigation the functions of nano-carbon materials.

Chekhonin Vladimir Pavlovich, Vice President of the Russian Academy of Sciences. Founder and Head of the Department of Medical Nanobiotechnologies of the Russian National Research Medical University.

Pavlovich fields of research include development of nanotechnological visualization systems and the targeted delivery of therapeutic agents and genetic material to target cells, and investigation of nanotechnological approaches to genodiagnosis and bioprotection in socially significant diseases. This includes the targeted delivery of diagnostic compounds to cancer cells, which can bring us closer to better understanding and treating oncological diseases.

About the Encyclopedia of Life Support Systems (EOLSS)

EOLSS is the world’s largest web-based source of professional knowledge on trans-disciplinary science base for sustainable development, as a result of the joint efforts of over 8000 specialized authors in over 100 countries. The encyclopedia is a virtual dynamic library that is aimed at a wide audience, from pre-university students to educators and professional practitioners, as well and policy analysts and decision-makers. By providing a complete and accessible body of knowledge, EOLSS aims to lead to the fulfillment of human needs by simultaneously considering socio-economic and technological progress that may lead to conservation of Earth’s natural systems.

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It’s Now Easier to Nominate a Potential Fellow

Changes to the process include reducing the number of references and streamlining the nomination form
By Stefano Galli

Last year the IEEE Board of Directors and the Fellow Committee approved an amendment to the committee's operations manual that is expected to allow the committee to operate more efficiently.

One important modification is related to the nomination process. The number of required references for a nominee has been reduced to between three and five, from the original five to eight. This policy change hopefully will increase the number of nominees from industry, whose nominators often have struggled to find enough Fellows to serve as references, especially when the nominee was not involved in scholarly activities.

The committee also made several changes to the Fellow nomination form, which is now effective with the current nomination cycle, for the class of 2020. The deadline for nominations for that class is 1 March 2019.

The changes include:
• A more structured, streamlined form that elicits crisper, more focused narratives of the candidate’s accomplishments.
• Removal of potential ambiguities concerning the nominee’s identity by encouraging the inclusion of a common “disambiguation identifier” such as open researcher and contributor ID, researcher ID, or Scopus author ID. An identifier is a unique and persistent number that is assigned to a group of documents written by the same author and help attribute papers to the right author. This is particularly useful when a nominee has a common name and most of the presented evidence is based on scholarly papers.
• Clearer identification of the nominee’s one or two most distinctive technical contributions.
• A more structured way to list technical accomplishments and the nominee’s IEEE and non-IEEE activities.
• A new section to list awards from IEEE as well as those from other organizations.
• Reducing the number of words to 15 from 20 for the award’s citation.

Three New Guides

The nomination form is the most critical document for making the case for elevation to IEEE Fellow. Many nominations are unsuccessful because the information is poorly written or does not follow the requirements. In the committee’s continuing efforts to educate those involved in the Fellow nomination and evaluation process, it has issued three recommendation guides.

The “How to Write an Effective Nomination” guide provides examples and best practices from the perspective of those who are evaluating the nominations. It includes advice on how to choose the right nomination category. These are the categories: application engineer/practitioner, educator, research engineer/scientist, and technical leader.

The guide also describes who makes an effective reference, and suggests when and how to solicit endorsements. It walks the nominator through the form, section by section, helping the person convey the impact of the candidate’s contributions for evaluators who might not be familiar with the specific area of work.

The document also clarifies the difference between references and endorsers. Both support the case for elevation, but they serve different purposes. The references are to provide an independent evaluation of, and support for, the nominee. Therefore, they should be experts in the nominee’s technical field and be familiar with the person’s contributions and the impact they have on the profession, society, or both. All references must be Fellows in good standing, with the exception of those from IEEE Region 9, who may be senior members or life senior members.

An endorser, who does not need to be an IEEE Fellow or otherwise affiliated with IEEE, strengthens the nomination but only by providing specific evidence highlighting the nominee’s contributions and their impact. Endorsements can be helpful for those candidates who perform proprietary or classified work, for which public evidence is often not available. The most effective endorsements come from a company officer, program director, or committee chair of a technical community or standards body.

The “Effective References and Endorsements” guide aims to provide a better understanding of roles and responsibilities. It includes best practices for making effective letters of support, as well a list of things to avoid.

The “Society/Technical Council Evaluators and IEEE Judges” guide includes the best practices for assessing a nominee’s accomplishments. Nominators are encouraged to read this guide to get a better understanding of what evaluators and judges are looking for in the application and how they weigh the supporting information.

All three guides can be found at www.ieee.org/fellows, under the Fellow Guides header.

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Meet the Newly Elected Members of the Board of Governors 2019–2021

MEREDITH HUTCHINSON (GSM’10-M’10-SM’16) is currently a Staff Scientist in the Optical Sciences Division at the US Naval Research Laboratory (NRL). Meredith has been an active member in the IEEE Photonics Society (IPS) previously as the Associate Vice President (AVP) for Young Professionals (2015–2017) and currently as the AVP of Women in Photonics (WIP). She has served on the IPC technical program committee (2015–2018), and Integrated Photonics Research technical program committee (2016–2018), as well as serving as a guest editor for the special issue on Optical Detectors in JSTQE (2018). She is currently the president of NRL Women in Science and Engineering (WISE).

STEPHEN E. RALPH (StM’86-M’87-SM ’04) is Professor of Electrical and Computer Engineering at the Georgia Institute of Technology where he leads the Terabit Optical Networking group and is Director of the Georgia Electronic Design Center. He currently serves on the IEEE Photonics Society Technical Affairs Council (2014–2020) and the OFC Technical Program Committee (2018–2020). He has previously served as past conference chair of the Plastic Optical Fiber Conference (2012) and as Associate Editor of IEEE Transactions on Electron Devices, optoelectronic devices (2011–2014). He participated in the IEEE 802.3aq LRM standard (2004–2007) and was a member of the organizing committee of the IEEE Summer Topicals: Terabit Optical Ethernet (2011) and chaired the International Conference on Photonics and Switching (2003).


JIANPING YAO (M’99-SM’01-F’12) is a Distinguished University Professor and University Research Chair in the School of Electrical Engineering and Computer Science, University of Ottawa, Ottawa, Ontario, Canada. He is Editor-in-Chief of IEEE Photonics Technology Letters, a former Topical Editor of Optics Letters, an Advisory Editorial Board Member of Optics Communications, and a Steering Committee Member of IEEE/OSA Journal of Lightwave Technology. Dr. Yao is currently the Technical Committee Chair of IEEE MTT-3 (Microwave Photonics) and the Chair of the IEEE Photonics Ottawa Chapter. Dr. Yao served as a TPC or General Chair for over 20 IEEE conferences including the TPC Chair of the 2010 IEEE International Topical Meeting on Microwave Photonics (MWP2010), General Co-Chair of MWP2011, TPC Co-Chair of MWP2014, General Co-Chair of MWP2015 and MWP2017, and General Chair of MWP2019. Dr. Yao also served as a committee member for a number of international conferences, including IPC, OFC, CLEO and MWP.
Kim Roberts, Ciena Corporation, Awarded 2019 John Tyndall Award

The IEEE Photonics Society and The Optical Society are pleased to announce that Kim Roberts, Ciena Corporation, is the recipient of the 2019 John Tyndall Award, an honor endowed by Corning, Inc. Roberts is being recognized “for pioneering contributions to the development of practical coherent communication systems.” The award, one of the top honors in the fiber optics community, will be presented to Roberts during the plenary session of the 2019 Optical Fiber Conference (OFC) Conference taking place in San Diego, California, USA, 3–7 March 2019.

Kim Roberts is a passionate evangelist of new optical and high-capacity packet technologies and holds the distinction of being Ciena Corporation’s (previously Nortel’s) leading inventor. Kim holds more than 150 patents with many more pending. Kim has been a major force in the field of digital signal processing (DSP) for optical transmission systems, and played a key role in virtually every optical innovation developed by Nortel. These range from the Superdecoder (the use of electronic signal processing of optical signals), the OC-48 regenerator, and the original OC-192 (10-Gbit/s) system, to terrestrial optical amplifiers and the revolutionary WaveLogic-1 precompensating transmitter. Building on these breakthroughs, Kim helped develop the DSP-assisted coherent transceivers that are at the heart of coherent 40, 100, and 400 Gb/s optical systems that are deployed around the world. Today Kim is Vice President of WaveLogic Science at Ciena, leading an R&D team focused on pushing the optical boundaries even further in terms of speed, distance and cost.

“The John Tyndall award recognizes outstanding contributions in any area of optical-fiber technology that have stood the test of time. Kim Roberts’ contributions to the development of practical coherent communication systems are exemplary of this prestigious award,” said Doug Razzano, Executive Director of the IEEE Photonics Society.

“In recognition of the pioneering role he has played in the industry, Kim was named an IEEE Fellow and a Nortel Fellow. He received the Outstanding Engineer Medal in 2008 from IEEE Canada.

Kim holds a Bachelor’s degree in Electrical Engineering with an emphasis on mathematics, and a Master’s degree in Electrical Engineering on the topic of processing of brain signals, both from the University of British Columbia.

The John Tyndall Award is named for the 19th century scientist who was the first to demonstrate the phenomenon of internal reflection. First presented in 1987, the Tyndall Award recognizes an individual who has made pioneering, highly significant, or continuing technical or leadership contributions to fiber optic technology. Corning, Inc. endows the award, a prize check and a glass sculpture that represents the concept of total internal reflection. The award is administered by The Photonics Society and co-sponsored by the Optical Society.

The 2019 IEEE Photonics Society Young Investigator Award Recipient Junjie Yao

The IEEE Photonics Society Young Investigator Award was established to honor an individual who has made outstanding technical contributions to photonics (broadly defined) prior to their 35th birthday.

The 2019 Young Investigator Award will be presented to Dr. Junjie Yao, “for pioneering novel photoacoustic imaging that allows probing living tissue functions at unprecedented accuracy, sensitivity, and speed.” The presentation will take place at the IEEE Photonics Conference, September 29–October 4, 2019, San Antonio, Texas.

Dr. Junjie Yao is currently Assistant Professor at the Department of Biomedical Engineering at Duke University, and a faculty member of Duke Center for In Vivo Microscopy, Duke Cancer Institute, Duke Institute of Brain Sciences, and Fitzpatrick Institute for Photonics. Dr. Yao received his B.E. (2006) and M.E. (2008) degrees in Biomedical Engineering from Tsinghua University, Beijing, and his Ph.D. degree in Biomedical Engineering at Washington University (2013), St. Louis. Dr. Yao’s research interest is in
IEEE Fellow is a distinction reserved for select IEEE members whose extraordinary accomplishments in any of the IEEE fields of interest are deemed fitting of this prestigious grade elevation. The IEEE Grade of Fellow is conferred by the Board of Directors.

Please join us in congratulating the 19 Photonics Society Members who are included in the Class of 2019.

J. Stewart Aitchison,
University of Toronto,
“for contributions to nonlinear optical devices and point-of-care testing systems.”

Gabriella Bosco,
Politecnico Di Torino,
“for contributions to modeling and design of coherent optical communication systems.”

Hui Cao,
Yale University,
“for contributions to spatial coherence engineering of lasers.”

Patrick Chapman,
Solar Bridge Technologies,
“for application of power electronics devices and systems for solar energy conversion.”

Alexander Gaeta,
Columbia University,
“for contributions to quantum and nonlinear photonics.”

Reuven Gordon,
University of Victoria,
“for contributions to nanoscale optical manipulation for protein and nanoparticle analysis.”

Hiroshi Ito,
Kitasato University,
“for contributions to high-speed photodiodes for millimeter and terahertz wave generation.”

Mona Jarrahi,
University of California, Los Angeles,
“for contributions to terahertz technology and microwave photonics.”

Daniel Kuchta,
IBM, TJ Watson Research Center Inc.
“for contributions to high-speed Vertical Cavity Surface-Emitting Lasers for Optical Interconnects.”

Siddharth Ramachandran,
Boston University,
“for contributions to higher-order modes in optical fibers.”

Roland Ryf,
Nokia Bell Labs,
“for contributions to optical switching and multiplexing technology.”

Samar Saha,
Prosptic Devices,
“for contributions to compact modeling of silicon field-effect transistors.”

Harkhoe Tan,
The Australian National University,
“for contributions to compound semiconductor optoelectronic materials and devices.”

Ioannis Tomkos,
Athens Information Technology,
“for contributions to dynamic optical networks.”

Hon K. Tsang,
The Chinese University of Hong Kong,
“for contributions to nonlinear silicon photonics and advanced waveguide grating couplers.”

Deepak Uttamchandani,
University of Strathclyde,
“for contributions to photonics-based sensing.”

Jelena Vuckovic,
University of California, Los Angeles,
“for contributions to experimental nano and quantum photonics.”

Chee Wei Wong,
University of Waterloo,
“for contributions to silicon nanophotonics.”

Steve Yao,
General Photonics Corporation,
“for leadership in opto-electronic oscillator and optical polarization devices.”
CALL FOR NOMINATIONS

IEEE Photonics Society 2019 Distinguished Service Award

Nomination deadline: 30 April 2019

The Distinguished Service Award was established to recognize an exceptional individual contribution of service that has had significant benefit to the membership of the IEEE Photonics Society as a whole. This level of service will often include serving the Society in several capacities or in positions of significant responsibility. Candidates should be members of the Photonics Society. The award is presented at the IEEE Photonics Conference formerly known as the IEEE Photonics Society Annual Meeting.

Visit the on-line awards platform to nominate a colleague today.

https://ieee.secure-platform.com/a/page/society_awards/ieephotonicssocietyawards
IEEE Photonics Society - Call for Nominations

IEEE Photonics Society 2019 Awards
Nomination deadline: 5 APRIL 2019

Visit the on-line awards platform and nominate a colleague today!

Submit your nomination here!

The Aron Kressel Award is given to recognize 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 intent is to recognize key contributors to the field for developments of critical components, which lead to the development of systems enabling major new services or capabilities. These achievements should have been accomplished in a prior time frame sufficient to permit evaluation of their lasting impact. The work cited could have appeared in the form of publications, patents products, or simply general recognition by the professional community that the individual cited is the agreed upon originator of the advance upon which the award decision is based. The award may be given to an individual or group, up to three in number. The award is administered by the Aron Kressel Awards Committee and presented at the IEEE Photonics Conference.

The Engineering Achievement Award is given to recognize an exceptional engineering contribution that has had a significant impact on the development of lasers or electro-optics technology or the commercial application of technology within the past ten years. It may be given to an individual or a group for a single contribution of significant work in the field. The intention is to recognize some significant engineering contribution which has resulted in development of a new component, a new processing technique, or a new engineering concept which has had a significant impact in either bringing a new technology to the market, significantly improving the manufacturability of a component or device, or creating a new technology which will greatly accelerate or stimulate R&D. No candidate shall have previously received a major IEEE award for the same work. Candidates need not be members of the IEEE or the Photonics Society. The award will be presented at the IEEE Photonics Conference.

The Quantum Electronics Award is given for exceptional and outstanding technical contributions that have had a major impact in the fields of quantum electronics and lasers and electro-optics. This award is given for truly excellent and time-tested work in any of the fields of interest of the Photonics Society. It may be given to an individual or a group for a single outstanding contribution or for a long history of significant technical work in the field. No candidate shall have previously received a major IEEE award for the same work. Candidates need not be members of the IEEE or the Photonics Society. The award will be presented at the IEEE Photonics Conference.

The William Streifer Scientific Achievement Award is given to recognize an exceptional single scientific contribution, which has had a significant impact in the field of lasers and electro-optics in the past ten years. The award is given for a relatively recent, single contribution, which has had a major impact on the Photonics Society research community. It may be given to an individual or a group for a single contribution of significant work in the field. No candidate shall have previously received a major IEEE award for the same work. Candidates need not be members of the IEEE or the Photonics Society. The award will be presented at the IEEE Photonics Conference.
The 2019 IEEE Photonics Society Young Investigator Award Recipient Junjie Yao
(continued from page 13)

photoacoustic tomography (PAT) technologies in life sciences, especially in functional brain imaging and early cancer detection. He (co-)invented photoacoustic Doppler-bandwidth flowmetry, photoacoustic oxygen metabolic microscopy, super-resolution photoacoustic microscopy, fast-functional photoacoustic microscopy, and reversibly-switchable photoacoustic tomography. Dr. Yao’s lab pioneers on developing break-through PAT technologies with novel and advanced imaging performance to interrogate biological tissue clearer, deeper, and with more functions. On top of the technological advancements, Dr. Yao’s lab is devoted to serve the broad life science and medical communities with matching PAT systems for various research and clinical needs, especially for studying tumor angiogenesis, cancer hypoxia, and brain disorders. More research at http://photoacoustics.pratt.duke.edu/.

Got News?
We want to hear from you!

Want to recognize a colleague, attended a conference or had a great event sponsored by the Photonics Society?

Contact us at IPSNEWSLETTER@IEEE.ORG
IEEE Photonics Society News
Women in Photonics Member of the Month

Despoina Petousi, Post-Doc Student at IHP-Microelectronics

Petousi’s research has focused on silicon-photonic modulators, i.e. the development of optical modulators. She optimizes device performance and designs devices that are then fabricated using photonic BiCMOS technology.

Raised by mathematician parents, who introduced her to natural sciences very early, her excitement for science grew throughout her childhood and on. She has since been an active volunteer in the community serving as a role model for other young women engineers.

In fact, Petousi was recently awarded with the Bertha Benz Prize 2018 from Daimler-Benz Foundation. The prize is aimed specifically at young female doctorate engineers. Following Bertha Benz who was a visionary and dedicated pioneer of the automobile, doctoral candidates are honored by the technical as well as social impact of their work. Her “Analysis of Integrated Silicon Depletion-Type Mach-Zehnder Modulators for Advanced Modulation Formats”, through the Electrical Engineering and Information Department of the Technical University Berlin, was specially sited.

Petsousi also represented the IEEE Photonics Society at the International Topical Meeting on Microwave Photonics (MWP 2018) as a Young Professionals Rep. As she recently finished her PhD, she is in the phase of examining new research topics and collaborations with industrial partners.

Petsousi represented the IEEE Photonics Society at MWP 2018 (left) and has focused much of her research on silicon-photonic modulators within IHP-Microelectronics (right).
Membership

IEEE Photonics Society Supports National Society of Black Physicists’ Conference with Scientific Passion and Progress

The IEEE Photonics Society sponsored the National Society of Black Physicists (NSBP) Conference for the third year, which was themed “Scientific Passion and Progress—Meeting The Challenge.” The conference took place in November 2018 at the Renaissance Columbus Downtown Hotel in Columbus, Ohio, USA. This annual conference brings together a broad range of experts in multiple fields of physics, i.e. astrophysics, biophysics, condensed matter and materials, high energy physics, optics and photonics, and more. The NSBP conference is the largest academic meeting of minority physicists in the United States and was co-organized in partnership with Associated Universities, Inc. and U.S. National Science Foundation (NSF).

The purpose of NSBP aims to promote the professional well-being of African American and Black physicists within the international scientific community and within the society at large. The organization strives to develop and support efforts to increase opportunities for its marginalized members, which IEEE Photonics supports as a sister organization and diversity advocate. Together the organizations seek to actively partner and provide each other expert consultation. NSBP specifically serves as an expert partner for our Society on how to better reach and support underrepresented educational and research institutions, specifically historically black colleges and universities. The ultimate goal, together, is to nurture diversity and inclusion efforts that will, in turn, increase the number of underrepresented minorities in the field.

NSBP President, Dr. Willie Rockward, explains that, “Without constant efforts and reminders, accountability for inclusion would be minimized and numbers will never improve. Inclusion should be highlighted and advocated not only in writing but in practice. Science leaders must constantly emphasize and seek out individuals with the potential to positively impact research and development regardless of race, gender, sexual orientation, creed, religion, or ethnicity.”

The program chairs representing our Society’s specialties within the conference’s scientific sessions and workshops, did just that. The topics and leaders were: Photonics and Optical Physics (Thomas Searles); Advanced Light Sources (Sekazi Mtingwa and E. Fontes); and Atomic, Molecular and Optical Physics (Clayton Simien). The conference also included a poster session for students with over 25 posters in photonics and optics areas.

Dr. Stanley Ikpe, of NASA and the IEEE Photonics AVP of Young Professionals, Dr. Fatima Gunning, of Tyndall and the IEEE Photonics AVP of Multicultural Outreach, and Niámh Kavanagh, PhD Candidate and the Young Professional Rep on the IEEE Photonics Diversity Oversight Committee, represented the Society at the conference. Each assisted with outreach activities, served diversity focus groups and participated in educational workshops aimed at improving inclusion in the community.

The general session talks were given by Dr. William Wilson, of the Center for Nanoscale Systems at Harvard University, and Dr. Aziza Baccouche, Founder and President of AZIZA Productions.

Wilson discussed the work of his center, in which he also serves as Executive Director, and as Adjunct Research Professor in Materials Science and Engineering at the University of Illinois, Frederick Seitz Materials Research Laboratory. Wilson is a preeminent innovator in holographic technologies. He was part of the founding team at InPhase Technologies and played a role serving as a technology driver for materials, components,

Dr. Hakeem Oluseyi, of Florida Institute of Technology, shared his PhD journey during at professional development luncheon at the NSBP Conference.

Ikpe, Gunning and Kavanagh (right to left) represented the IEEE Photonics Society at the conference, serving diversity focus groups and participating in educational workshops aimed at improving inclusion in the community.
and systems. He discussed how he has devoted his research life to the study and development of advanced materials and devices for photonic applications. He began his professional career at Bell Laboratories studying the ultrafast photophysics of semiconductor quantum dots, where he produced the seminal work studying photodynamics and transport behavior in silicon backbone polymeric systems. An early researcher in the study of the photoconductivity (PC) and doping dynamics of C60 and C70 thin films, the PC work resulted in one of the first device patents in this area.

Wilson has also extensively explored an array of engineered self-assembled multilayer materials. In addition to the range of materials work described, he has developed semiconductor laser devices for low cost, high speed optical communication systems, external cavity GaN lasers for optical storage and co-developed and patented strategies for multi-wavelength sources for DWDM applications.

Baccouche, who goes by Dr. Z, gave an emotional as well as highly technical talk on how she overcame seven brain operations over the course of her life that were deemed necessary to tackle a slowly growing tumor in her brain that has affected her sight. She shed light on how a person like herself navigates the field with a disability, stating boldly that, “It doesn’t take sight to have vision. It doesn’t take mobility to have direction. It doesn’t take the ability to hear to be in tune.”

Dr. Z went on to explain how people notice her blindness before her race and gender. She got a “C” in her first college course, and her advisor told her that she needed to have sight to do physics. Dr. Z got rid of that advisor and kept going. She is the first African-American woman with roots connected to the Pequot tribe and Arab lineage from North Africa who is legally blind to have earned a Ph.D. She is currently affiliated with AZIZA Productions Inc., a small science media production company she established in the year 2000, and specializes in theoretical nuclear physics.

During the NSBP conference, Dr. Z shared with students actual images of her brain surgeries and explained how the tumor she has is changing. She repeatedly expressed how grateful she is to live in a time where treatments and such advancements are available, and stressed the value of advancing technology for the benefit of humanity. Especially in medical physics, which is the technology that is saving her life.

The conference’s luncheon speakers, that the IEEE Photonics Society sponsored, were Dr. Hakeem Oluseyi, of Florida Institute
Chapter Best Practice: Inter-Section Cooperation Between North Jersey, Coastal and Princeton Sections

Three chapters come together to organize state-wide 5G talks and meet-ups

To conserve resources, attract a larger audience and increase interactions as well as set an example of inter-section cooperation, the professional IEEE Photonics Society Chapters of all three sections of New Jersey (North Jersey, Coastal and Princeton sections) organized two talks on photonics subjects of current interest in a combined session at Futurewei Technologies. These chapters are chaired by Drs. Naresh Chand, Anjali Agrawal and Jiang Wei, respectively. Dr. Adriaan van Wijngaarden, Chair of METSAC—The Metropolitan Technologies. These chapters are chaired by Drs. Naresh Chand, Anjali Agrawal and Jiang Wei, respectively. Dr. Adriaan van Wijngaarden, Chair of METSAC—The Metropolitan

of technology, and Dr. Nadya Mason, of the University of Illinois at Urbana-Champaign.

Oluseyi is an astrophysicist, inventor, educator, author, humanitarian, and TV personality. He is a Distinguished Research Professor of Physics and Space Sciences at the Florida Institute of Technology currently on assignment to NASA Headquarters where he serves as the Space Science Education Lead for the Science Mission Directorate. He gave an inspiring talk about his journey through poverty to his Ph.D. in Physics from Stanford University.

He's made research contributions across diverse fields including astrophysics, cosmology, astronomical instrumentation, semiconductors, time-domain informatics, ion propulsion, and science education. Oluseyi has also gone on to host popular science television shows including Outrageous Acts of Science, How the Universe Works, Space’s Deepest Secrets, Strange Evidence, You Have Been Warned, Strip the Cosmos, and ThePlanets and Beyond.

Mason gave talk about the wonders and pitfalls of a physics profession, reminding students that if they find something they love to do >80% of the time they are ahead of the curve. She earned her PhD in physics from Stanford University and engaged in postdoctoral research as a Junior Fellow at Harvard University. A condensed matter experimentalist, Mason focuses on electron behavior in low-dimensional materials such as nanowires, graphene, and nano-structured superconductors. Her research is relevant to the fundamental physics of small systems and applications involving nano-scale electronic elements. In addition to maintaining a rigorous research program and teaching, Mason works to increase diversity in the physical sciences.

Scientific talks on photonics that took place at the conference, included (not limited to): 2d Topological Photonic Crystal Band Structures (Dewan Woods, Purdue University); Wavefront Shaping: A New Tool in Optics (Moussa N’gom, Rensselaer Polytechnic Institute); Electrically Pumped Mie Sphere Single Photon Source (Oluseye Akomolede, Purdue University); The Growth Of Organic Lanthanide Crystals For Nano-Optics Studies (Alexis Bullock, Norfolk State University); Realizing A Better Magneto-Optical Trap By Building A Laser Locking Circuit (Dimitri Klauss, Georgia Institute of Technology); Magnetic Levitation Of Superfluid Helium: Towards Quantum Optomechanics With Liquid Drops (Charles Brown, Yale University); Optical Control Of Photoemission At The Attosecond Timescale (Guillaume Laurent, Auburn University); The Impact Of Vapor Supersaturation On The Morphology, Mixing State And Optical Properties Of Atmospheric Soot (Ogochukwu Enekwizu, NJIT).

The technical workshops the conference focused on were mainly professional development led, such as Physics Education Research and Women & Gender Minorities. For example, a workshop titled, “Mutual Mentoring with eAlliances”, discussed being a woman in physics and how it is often an isolating experience as well as how peer mentoring has been shown to help combat this isolation. eAlliance, an NSF ADVANCE PLAN-D program hosted by AAPT, is seeking to establish mutual mentoring networks of women faculty within the physics and astronomy community.

The eAlliance program reduces the isolation of participating faculty members and provides support to help members achieve their personal goals and enhance their career development. Participants register at the eAlliance website (www.ealliance.aapt.org) and complete a personal profile which is used to match them to other registered women faculty with similar mentoring goals. So far, over 100 women have registered in the eAlliance database.

Another progressive diversity workshop focused on the gender minority community. Chair Dr. Chanda Prescod-Weinstein, of University of New Hampshire, featured a talk by co-chair Grey Batie, of UC Berkeley, on Black trans/non-binary experiences, followed by a panel including Black women/gender minority students and faculty in physics.

To learn more about the NSBP conference’s full program and post conference synopsis, details can be found at: www.nsbp.org/conference

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NYU, under the NSF’s recently announced Platforms for Advanced Wireless (PAWR) program. The COSMOS testbed has a particular focus on “beyond 5G” ultra-high BW and low latency communication tightly integrated with edge computing, and is thus intended to provide a suitable platform for real-world evaluation of future edge-cloud enhanced mobile networks and services. He defined the motivating applications, such as augmented reality, cloud-assisted vehicular and smart intersection, in terms of typical functionality and bandwidth/latency requirements.

Raychaudhuri spoke about COSMOS open, programmable testbed architecture based on software-defined radios (SDR), cloud radio access networks (CRAN), software defined x-haul networks (SDN) and mobile edge cloud (MEC). In addition, key technologies in COSMOS including SDR base stations, mmWave radio, optical wavelength division switching, NG mobile core network and distributed edge cloud were discussed during the talk. He also shared plans for COSMOS deployment in uptown Manhattan along with a future roadmap.

The second talk was on “5G: A Playground for Artificial Intelligence” and how it promises to transform our lives in a radically, big way. Gilbert discussed how the revolution will transform cars to be self-driving, communication networks to be software-defined and autonomous, virtual reality and augmented reality to be mobile and completely untethered, and Internet of Things (IoT) sensors to be intelligent and connected. He went on to explain how behind this 5G revolution, Artificial Intelligence (AI) plays a significant role in the planning, forecasting, building, development and deployment of 5G. It also enables a new set of experiences including intelligent stores and factories, autonomous flying drones, robots and holographic meetings.

Gilbert’s presentation provided a technical and a market landscape overview of AI in creating the 5G world, highlighting recent developments in Edge Computing and Software-Defined Networking and how they will accelerate widespread adoption of 5G-based applications for both consumers and enterprises. Finally, he discussed the roles of open source and open platforms as key ingredients of this 5G transformation.

Roughly 77 participants registered for both educational talks. Based on the compliments received, attendees who came from all over the state benefited and the talk ended with cultural, Indian buffet.

If a chapter chair would like to learn more about these topics or how to incorporate such an inter-section cooperation model locally, please reach out to Naresh Chand, IEEE Photonics AVP of Chapter Relations at Naresh.Chand@huawei.com.

Written excerpts from Naresh Chand and event descriptions from speakers, Raychaudhuri and Gilbert.
“Culture Night” is a national event held annually in Ireland on the 3rd Friday in September. On Culture Night, arts and cultural organizations across Ireland extend their open hours and grant access to the public. Events, demonstrations and workshops are arranged in the participating venues to encourage attendance. Many of the events are free to encourage diverse participation and the chance to visit businesses and buildings which may not normally be open to all.

In Cork, more than 100 venues were open to the public including educational/research institutions, churches, libraries and even breweries. On the night, Tyndall National Institute also opened its doors to the public and provided activities, demonstration stands and workshops related to photonics, bio-photonics and device fabrication. A total of 165 visitors engaged with Tyndall.

One of the activities available to the visitors at Tyndall was the “Light & Optics Family STEM Zone”. This workshop was sponsored by IEEE Photonics Society with funds from an IEEE Photonics Fund outreach grant awarded to Natalia Canas Estrada, a PhD student of the Irish Photonic Integration Centre.
Estrada led the workshop, which contained five stations: Optics and Magic tricks (optical illusions, reflection of light in different media); Make-Your-Own Kaleidoscope; UV-light; photography; and virtual reality travel around the Universe. The varying activities allowed children, parents and accompanying adults to participate and learn together.

Student members of the Tyndall/UCC Optical Society (OSA) and SPIE student chapters also volunteered to participate in the workshop, making it a collaborative effort between all societies, the IEEE and IPIC. In each stage, the students explained the use of optics and photonics for different purposes.

The organizers of the event collected feedback from attendees with comments from parents that expressed how their children enjoyed the evening and positively, hands-on the activities. The most popular activity was the virtual reality set, and attendees claimed that they learned about LED lights, screens, and the science’s core principles. The other stations seconded equally in popularity, and learning outcomes included: light properties (reflection, refraction); UV light; how cameras work compared to the human eye; and light painting.

Given the success of the Family Stem Zone, Tyndall is confident that it can be rolled out at similar family style open days. For example, the “Light & Optics” activities were put on during science week at the University College Cork in November, which reached 2000+ people in attendance. The volunteer leadership side of the program has also grown, which now includes training sessions and volunteer recruitment meetings for IPIC and the local student chapters.

“Nick” Cartoon Series by Christopher Doerr

![Cartoon Image]
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
https://ieee-oi.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
https://ieee-rapid.org

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

2019 IEEE Photonics Conference (IPC)
Hilton Palacio Del Rio
San Antonio, TX USA
Sep 29, 2019 - Oct 3, 2019
http://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
http://ieee-avfop.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
https://ieee-rapid.org
The IEEE Photonics Conference this year was held in Reston, VA on September 30 through October 4. It was a well-attended meeting featuring plenary talks, a tasteful and fun awards banquet, enthusiastic chatter surrounding our esteemed colleagues and newly announced laureates of the Nobel Prize in Physics, myriad special events, and, of course, a series of fantastic invited and contributed presentations and posters.

If you attended the conference this year, you may have spotted diligent student and young professional scribes taking notes and snapping photos throughout the week. These young volunteers took on the task of capturing, through their own “lens”, and recounting particular sessions for the larger IEEE Photonics Society to experience.

What follows is a selection of their contributions that we hope you will enjoy. Each listened in and took notes on the innovative points and technical insights discussed within technical sessions. The Society wholeheartedly thanks these volunteers for their contributions, and looks forward to seeing much more from these bright young minds within our Society.

**Thomas Ferreira de Lima**, Princeton University  
*Session: TuD2: Optical Modulators*

As photonic telecommunications endpoints become smaller, more efficient, and closer to computers’ motherboards, much of the research in optical modulators are defined with respect to co-packaging and fabrication compatibility with electronics. The IEEE Photonics Conference session on optical modulators, chaired by Jens Schmid from NRCC, was a rather diverse one but all talks had packaging and fabrication in common.

The first contributed talk, by Felix Eltes, from IBM Zürich, showed how to build a monolithic integrated Si/BaTiO3 modulator on the back-end-of-line of a CMOS chip. This material offers a strong Pockels effect that allows pure-phase refractive index modulation (instead of typical free-carrier effect or \(n(3)\) effect in silicon which induce phase shift and loss). The biggest challenge of this is that it requires fabrication on a single crystal BaTiO3/oxide material, but that can be solved by wafer bonding on the back of the line. It was demonstrated that this process did not damage the front-end-of-line of the chip (essentially where the transistors are). This work could offer a nice way for making high-bandwidth transceivers on silicon.

Marija Trajkovic, from Eindhoven University of Technology, followed with a contributed talk about impedance matching for high-speed indium phosphide modulators. She showed that carefully probing an impedance mismatched integrated modulator (typical situation in many designs) causes a lot of RF power reflection, resulting in efficiency loss and excessive heat in the modulator, which then degrades its optical efficiency even more. She proposed an elegant approach, using two separate circuits in different chips, wire bonded to the modulator. One for the impedance conversion circuit, and another for a 50 \(\Omega\) with a decoupling capacitor. This resulted in a two-fold improvement of reflectance-free bandwidth (22 GHz instead of 10 GHz), while keeping excessive power dissipation out of the indium phosphide die.

Michael Krainak, from NASA Goddard Space Flight Center, shifted gears and provided a larger overview of projects being funded by NASA Integrated Photonics center in a contributed talk. These included the latest efforts in heterointegration, graphene silicon microring modulators, low loss grating couplers and high power indium phosphide amplifiers. NASA is also up for business, offering STTR grants available for small businesses, with about 6 awardees per year. NASA is using photonics to look for applications in sensing and spectrometry, microwave photonics with very low SWaP (size, weight and power), and some niche telecom solutions (satellite uplinks for example).

Tolga Gelkin, from Fraunhofer IZM Institute, finished the session with an invited talk on 3D system-in-a-package. According to him, the focus of the institute is to develop technology around the technology readiness level 6 or beyond, an important step before technologies can reach the market. The main motivation for a 3D system-in-a-package is to provide a solution for a “more than Moore” scaling of computing. He reminded us that “system in a package” (SiP) does not mean “system on a chip” (SoC), and sometimes trying to solve a problem with SoC is overkill compared to a much more robust and appropriate SiP. He showcased massive SiP packaged solutions banking on the expertise of many research institutions in Europe, combining ASICs, FPGAs, PICs and lasers in the same package, particularly for data centers.

It seems integrated photonics technology is on the same exciting path that electronics was at the beginning of the integrated circuits era. Moore’s law is dead, and photonics might just be what is needed to keep the frenetic pace of our information revolution. What an exciting future indeed!

**Daniel Torres Gonzalez**, Universidad de Guanajuato  
*Session: TuD3: Chalcogenide and Micro-structured Fibers*

For this session, a research group from McGill University led by Martin Rochette, Nurmemen Abdukelim, and Kaixuan Zhang talked about chalcogenide fibers and applications they have developed with this special optical fiber. Martin Rochette began his
for higher PAM formats (16 and 32). The main drawback lies in that its computational complexity is more than that of the transversal equalizer.

Finally, Elias Giacoumidis, from Dublin City University, introduced machine learning based nonlinearity equalization techniques for coherent optical communication systems. In this talk, he mentioned that machine learning clustering (MLC) tackled more effectively intra- & inter-channel nonlinearities compared to artificial neural network or inverse Volterra series transfer function for QPSK. In addition, fuzzy logic based clustering had the highest performance among all MLC algorithms at optimum launch powers.

**Moubani Bandyopadhyay**, University of Calcutta

This new and innovative component is useful in the development of mid-infrared all-fiber lasers.

Now that we understand chalcogenide fibers and can develop all-fiber lasers in the mid-infrared region (MIR), it would be interesting if there was a fiber filter in MIR. Kaixuan Zhang in his talk “Chalcogenide Fabry-Perot Fiber Tunable Filter” gave us the details in the fabrication process and results of his Fabry-Perot filters with a wide transmission spectrum, showing experiments where the material of the gap was changed, obtaining a spectrum similar frequency comb generation from 1.4 μm to 2.2 μm by adding micro lenses in the tip of the chalcogenide fibers. Finally, he presented a ring cavity all-fiber configuration including an Erbium-doped fiber amplifier, thulium doped fiber and the Fabry-Perot filter which is widely tunable.

**Qiulin Zhang**, Chinese University of Hong Kong

In this session, Lidia Galdino, from University College London, gave an invited talk about the limitations and practical issues of digital back propagation (DBP) when there exists noise from amplifier spontaneous emission and the transceiver. A generalized expression to estimate SNR for DBP was presented by involving the transceiver constrained-SNR. Then, it was shown, how the performance of DBP can be predicted more accurately. In addition, the received SNR also depends on the ratio between the noise of transmitter and receiver. Galdino also mentioned that the reach-increase evaluated for a fixed SNR is a better figure of merit for DBP, as the linear transceiver noise affects both distances equally.

A contributed talk followed about mitigating the inter-symbol interference and nonlinearity by multilayer perceptron (MLP) based equalizer was given. Results show that MLP equalizer offer the best error performance for a band-limited system with high nonlinear distortion and is the best option for higher PAM formats (16 and 32). For example, the computational complexity is more than that of the transversal equalizer.
dots near critical thickness. In this session, it was also explained that the development of optical communication including large capacity, low cost, compact size, stable performance, system on chip based on PIC technology is gaining ground involving indium rich content for long wavelength emission.

Lastly, Sheikh Z Ahmed, of University of Virginia, presented a paper entitled “APD Performance Enhancement: Minigap Engineering in Digital Alloys”. Co-authors were Yaohua Tan, of University of Virginia and Synopsys, and Jiyuan Zheng, Joe C. Campbell and Avik W. Ghosh, of the University of Virginia. The speaker explained in length that in order to detect weak signals we need high performance of avalanche photodiode (APDs) and the process of noise reduction. It was expressed that InGaAs digital alloy APD are better than InAs random alloy APD. Orbital interference is the cause of minigap and InAlAs have low hole concentrations at high energy. Correlation between mini-gaps and noise suppression was also well discussed by the speaker.

To sum up, it can be said that the deliberations of the speakers and response from attendees churned up intense interest among the researchers for promising future work in this arena.

For more details on the IPC 2018 sessions and the full conference proceedings, IEEE members can access and visit IEEE Xplore here: http://bit.ly/2SBN6In

A series of Lab Automation Hackathons, sponsored by the IEEE Photonics Society and led by Nokia Bell Labs, were formed in 2018 to ease networking between students and professionals as well as introduce an important skill—“lab automation.” The hackathons provided an informal environment where seasoned photonics veterans and students can meet and network about a topic of interest—conducting research in a lab. Such subject areas can include (but are not limited to): lab automation photonic simulation and design tools, and photonic integrated circuit design. These subjects are perfect ice-breakers for engineers and scientists. Organizers run the hackathons at the premier conferences globally, where there is a large gathering of students.

The best format for the hackathons comprise of a short introduction followed by demos where people are free to mingle and network. The introduction includes a welcome message from the organizers followed by a one-minute introduction of each demo to introduce the attendees to the instructors running the demo and the topics. Each demo is run by a student or a professional researcher. Every 20 minutes the attendees are

Conference Best Practices: Lab Automation Hackathons and Mentor Matches in 2018

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encouraged to move to the next demo. Finally, holding these events in the evenings when people are free with some light snacks and some drinks tend to relax the normal serious mood of a technical conference.

Recently, the IEEE Photonics Society ran a lab automation hackathon at the IEEE Photonics Conference (IPC) in Reston, VA, USA and at the Asia Communications and Photonics Conference (ACP) in China. The ACP hackathon was held in the evening on the first day of the conference and included six demos with approximately 30 students and 20 professionals in attendance. Most demos used Python, an easy to use, powerful, free programming language accessible to all. Ruben S. Luis, an expert in optical communications from the National Institute of Information and Communications Technology in Japan, presented a very basic tutorial on how to perform digital signal processing to transmit a pol-muxed QPSK signal over fiber.

Jochen Schröder from Chalmers University in Sweden followed up with the QAMpy software package for very complex DSP, which he produced with his student, Mikael Mazur. Yuqing Jiao and Ronald Broeke, from TU/e and Bright Photonics in Holland gave a tutorial on their NAZCA photonic integrated circuit design software to build complex photonic circuits. Hanzi Huang, a student from Shanghai University, China, presented a Deep Neural Network model implemented...
on an FPGA using Python. Yetian Huang, a student from Shanghai University, China, brought a tunable laser and an optical spectrum analyzer from their lab and did an equipment automation demo. Finally, Nicolas Fontaine, Roland Ryf and Haoshuo Chen, from Nokia Bell Labs in the USA, helped people get started with the basics—installing python, etc. Overall, the hackathon was a great success and we hope to run it at ACP 2019 in Chengdu, China.

The lab automation hackathon at IPC had 70 attendees. Xaveer Leijtens, a professor at Tu/Eindhoven, displayed NAZCA software for photonic integrated circuit design. Karthik Choutagunta, a student from Stanford University, showed producing plots for papers and presentations using a python library, called Matplotlib. Roland Ryf from Nokia Bell Labs presented how to control instruments over the internet using the ZMQ messaging library. Thomas Ferreira de Lima, a student at Princeton university, showed the instrument control library, Lightlab. Eugene Sokolov, from VPI Photonics, showed how to use VPI photonics to simulate photonic integrated circuits.

In regards to the IEEE Photonics Society’s Mentor Match program, two successful installments were rolled out at ACP and IPC, alike. Conferences are great places to meet the experts, but networking at conferences can be difficult for young student new to photonics. This program was designed to help students expand their professional networks while at the conference, gain personalized career insights, and receive guidance from senior professionals in photonics. Attendees signed up to be either a mentor or mentee for the conference while registering.

Ultimately, the Mentor Match program pairs a student with a photonics professional, throughout the duration of a conference, by technical interest. However, often, the relationship survives much longer than the conference.

At ACP, specifically, students were primarily from China and do not have the opportunity or means to attend an international conference to meet global experts regularly. Additionally, the language barrier can be quite intimidating. To make the students more comfortable meeting professionals, the Mentor Match program had a two-hour kick-off event the first day to connect the mentors with the mentees. It went about one hour longer than programmed due to all the networking and discussion. Throughout the remainder of the conference, the mentees and mentors were encouraged to continue their meet up plans, attend sessions together and walk the show floor to help facilitate other connections.

At ACP the Society was able to pair over 30 students with mentors and at IPC over 60 students.

If conference organizers or universities would like to learn how to support similar hackathons or mentor programs, please reach out to Nicholas Fontaine at nicolas.fontaine@nokia-bell-labs.com.

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IEEE Summer Topicals 2019 Topics Announced

The IEEE Summer Topical Meeting Series serves as an international forum to facilitate information exchange between various technical communities using or affected by rapidly growing areas of technology or “Hot Topics” related to the general field of Photonics. This intimate environment provides the opportunity to learn about emerging fields and to interact with the research and technology leaders. Historically, the conference hosts 4–7 individual topics and can attract 250 people with 30–50 participants attending each topic. The smaller meeting size provides the flexibility to pilot new and unique ideas such as the mentor match.

IEEE Photonics is proud to announce the 5 topics for 2019 summer topicals to be held 8–10 July in Ft. Lauderdale:

- Next Generation High Speed Access Networks for New Emerging Services
- Quantum Integrated Photonics
- Physics and Applications of Semiconductor Laser Dynamics
- Mid-Infrared Optoelectronics in Silicon and Emerging Materials
- Programmable Photonics

Hope to see you there!
IEEE Photonics Society Co-Sponsored Events 2019

PHOTOPTICS
25-27 February
2019 International Conference on Photonics, Optics and Laser Technology
Prague, Czech Republic
http://www.photoptics.org

CSW
19-23 May
2019 Compound Semiconductor Week
Nara, Japan
http://www.csw-jpn.org

OECC/PSC
7 - 11 July
2019 24th OptoElectronics and Communications Conference and 2019 International Conference on Photonics in Switching and Computing
Fukuoka, Japan
http://www.oeccpsc2019.org

FOAN
2-4 September
2019 International Workshop on Fiber Optics in Access Networks
Bosnia and Herzegovina
http://foan.info

ECOC
22-26 September
2019 European Conference on Optical Communications
Dublin, Ireland
http://www.ecoc2019.org

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

IEEE

Announcement of an IEEE/OSA
Journal of Lightwave Technology Special Issue on:
Ultra-Wideband WDM Systems

This special issue addresses three important questions, namely: "how", "what", and "what quality for what purpose": The "how" identifies the technologies and systems upon which UWB-WDM networks will be built. In particular, we seek solutions to realize components, such as optical amplifiers, filters, and transceivers that present sufficient performance over the entire spectrum; the "what" considers the way of exploiting the upcoming plethora of WDM channels. What kind of network / node architectures and routing schemes would emerge? Does this lead to a lower CAPEX platform and how? Will it simplify network operations, leading to lower OPEX, and what innovations are needed to achieve this?; The "what quality for what purpose" aims to provide guidelines on how we will make the most of all bands, which, due to their different local fiber parameters, will provide dissimilar quality-of-transmission. The use-cases for these sub-bands need to be investigated as well.

The special issue will address the following topics:

• Ultra-wideband optical amplification
• Integrated ultra-wideband transceivers for elastic optical networks.
• Optical multiplexing technologies for a massive number of channels and optical switching and node architectures for all-optical forwarding of channels.
• Analytical transmission models for physical layer aware optical networking.
• Optical and electrical mitigation and ad-hoc transmission schemes for UWB-WDM.
• UWB-WDM system design guidelines and benchmarking against alternative solutions, including techno-economic studies. Operator point of view on the exploitation and road-map of the full-spectrum and deployment policies.

On behalf of the Guest Editors and the Editor-in-Chief, we encourage you to submit your work for inclusion in this Special Issue. Accepted papers will appear in the Jan/Feb 2020 hardcopy issue with accepted papers posted online within one week of author final file upload. Mandatory page charges of $260.00 per page are enforced for Original Contributions in excess of 7 pages and in excess of 10 pages for Invited Papers. Tutorial presenters will be invited to write articles that are up to 16 pages in length. The same mandatory fees apply to each Tutorial paper in excess of 16 pages.

Submissions by website only: http://mc.manuscriptcentral.com/jlt-ieee
Manuscript Type: "WDM 2019"
Submission questions: Doug Hargis, Journal of Lightwave Technology d.hargis@ieee.org

Guest Editors Editors: Antonio Napoli (Infinera), Johannes K. Fischer (Fraunhofer-Gesellschaft zur Förderung – HHI), Mark Filer (Microsoft), Shu Namiki (AIST), Vittorio Curri (Politecnico di Torino)

Submission Deadline: 31 March 2019
Publication: Jan/Feb 2020
Preliminary Call for Papers

Announcing an Issue of the IEEE JOURNAL OF SELECTED TOPICS IN QUANTUM ELECTRONICS on Photonics for Deep Learning and Neural Computing

Submission Deadline: April 1, 2019
Hard Copy Publication: January/February 2020

The IEEE Journal of Selected Topics in Quantum Electronics (JSTQE) invites manuscript submissions in the area of Photonics for Deep Learning and Neural Computing. Artificial Intelligence (AI) is transforming our lives by revolutionizing the healthcare industry with complex medical data analysis, actualizing self-driving cars, and beating humans at strategy games such as Go. It takes thousands of CPUs and GPUs, and many weeks to train the neural networks in AI hardware. Over the last six years, this compute power has doubled every 3.5 months. Traditional CPUs, GPUs, and neuromorphic electronics will not be powerful enough to train the neural networks of the near future. There is an immediate need to develop the next generation of AI hardware. Fundamentally, AI computing concepts heavily depend on interconnects, a functionality where photonic processors significantly outperform electronic systems. By combining the high bandwidth and efficiency of photonic devices with the adaptive, parallelism and complexity similar to the brain, photonic neural networks have the potential to be faster than conventional neural networks while consuming less energy. The purpose of this issue is to present the state-of-the-art in this field through a collection of invited and contributed papers ranging from photonic devices, systems, architectures and algorithms, and applications to photonic deep learning and neuromorphic computing. It is our hope that this special issue will serve as a universal resource for future development. Topics of this call include (but are not limited to):

- Neurromorphic hardware
- Neurromorphic algorithms
- Analog optical computing
- Spiking neural networks
- Reservoir computing
- Recurrent and convolutional neural networks
- Reinforcement learning and backpropagation
- Photonic synaptic devices
- Optical neural networks architecture
- Deep learning hardware accelerators
- Attojoule photonic nonlinear devices
- Photons memory, in memory computing, edge processing
- Cryogenic photonic neural networks
- Inverse design concepts
- Optical Ising machines
- Complex systems

The Primary Guest Editor for this issue is Prof. Paul Prucnal, Princeton University, U.S.A. The Guest Editors are: Prof. Bhavin Shastri, Queen’s University, Canada; Dr. Daniel Brunner, Femto-ST Institute, France; Prof. Ingo Fischer, IFISC (UIB-CSIC), Spain.

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/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.

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Preliminary Call for Papers

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

Submission Deadline: June 1, 2019
Hard Copy Publication: March/April 2020

The IEEE Journal of Selected Topics in Quantum Electronics (JSTQE) invites manuscript submissions in the area of Silicon Photonics. Silicon Photonics is the overall name for photonic integrated circuit technologies that combine the functionality of high-density circuits of high-contrast waveguides with the economic potential for volume manufacturing in a microelectronics fab. Over the past two decades, Silicon Photonics has grown out of the niche of academic research into an industrially viable technology, largely driven by applications in data communication. We have seen the material palette of silicon photonics extend well beyond silicon to incorporate low-loss waveguides, efficient modulators and detectors, as well as optical gain. This special issue focuses on the recent progress of silicon photonics. Topics include:

- Active and passive devices (e.g., waveguide structures, switches, WDMs, resonators, modulators, photodetectors, amplifiers, light sources, and sensors; sub-wavelength structures); New developments in area of photonic crystals, plasmonics;
- Application Specific Integrated optical circuits for datacom, RF-photonic, WDM networks and coherent communications with high baud rate devices and high-order modulation format;
- Programmable Silicon Photonic devices and circuits for optical information processing, quantum optics and microwave photonics.
- Strategy and implementation status of optoelectronic integration (e.g., III-V laser, organic-Si devices, Isolators, optical-interposer, 2.5D/3D IC), and thermal management;
- Efforts in the technology development towards productization, e.g., low cost packaging, design enablement, test and yield enhancement;
- Quantum photonics devices and integrated circuits and their applications in communication and future computing;
- Novel concepts in device and integrated photonic circuits and applications, e.g., aerospace, automotive, bio-imaging, bio-photonics, non-linear, mid-IR, spectrometers, opto-mechanical and opto-acoustic sensors, and
- Silicon photonic design, theory, modeling and simulations.

The Primary Guest Editor for this issue is Prof. Wim Bogaerts, Ghent University – IMEC, Belgium. The Guest Editors of the issue are: Dr. Eric Bernier, Huawei, Canada; Dr. Sun Jie, INTEL, USA; Prof. Delphine Marris-Morini, University of Paris-Sud, France; Prof. Joyce Poon, University of Toronto, Canada; Dr. Thomas Van Vaerenberg, Hewlett-Packard Laboratories, USA.

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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.

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Announcing an Issue of the IEEE JOURNAL OF SELECTED TOPICS IN QUANTUM ELECTRONICS on Photonics for Quantum Information Technologies

Submission Deadline: August 1, 2019
Hard Copy Publication: May/June 2020

The IEEE Journal of Selected Topics in Quantum Electronics (JSTQE) invites manuscript submissions in the area of Photonics for Quantum Information Applications:

- Quantum communication
- Quantum cryptography
- Quantum random-number generation
- Single-photon sources and detectors
- Quantum memories
- Quantum networks
- Quantum sensing and metrology
- Quantum opto-mechanics
- Quantum software
- Quantum computation
- Quantum annealers and optimizers
- Quantum simulators
- Certification of quantum devices
- Quantum engineering
- Quantum control
- Quantum machine learning
- Quantum information theory
- Foundations of quantum physics
- Quantum software

The Primary Guest Editor for this issue is Antonio Ancin, Institute for Photonics Sciences, Barcelona, Spain. The Guest Editors are: TBA

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Call for Papers

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

Emerging Applications of Multimode, Multicore and Specialty Fibers

Submission Deadline: October 1, 2019
Hard Copy Publication: July/August 2020

The IEEE Journal of Selected Topics in Quantum Electronics (JSTQE) invites manuscript submissions in the area of Emerging Applications of Multimode, Multicore and Specialty Fibers. For the past few decades, research on optical communications has focused on developing new optical fibers and systems to solve the capacity saturation of conventional singlemode fibers. The addition of the spatial dimension to the portfolio of optical multiplexing technologies, widely known as Space-Division Multiplexing (SDM), boosted the development of novel optical fibers including among others multicore, multimode and few-mode fibers. The growing interest on these novel fibers has very recently opened up new avenues for research in emerging fields of application including radio access networks, imaging, optical fiber sensing or astrophotonics. This special issue will address the current progress and latest breakthroughs in emergent applications of space-division multiplexing and specialty fibers, covering among others the following areas of interest:

- Multicore, multimode and specialty fibers for high-capacity digital communications
- Space-division multiplexing in fiber-wireless and 5G communications
- Imaging though multimode fibers
- Space-division multiplexed submarine links
- Multicore, multimode and specialty fibers for optical sensing
- Space-division multiplexing in astrophotonics
- Multimode- and multicore-based quantum optics
- Space-division multiplexing for radiofrequency photonics
- Nonlinear multimode optics
- Application of multicore, multimode and specialty fibers in data center links
- Industrial applications of multicore, multimode and specialty fibers

The Primary Guest Editor for this issue is Ivana Gasulla, Universitat Politècnica de València, Spain. The Guest Editors of the issue are Rodrigo Amezcua Correa, University of Central Florida, USA; Nicolas Fontaine, Nokia Bell Labs, USA; Sergio Leon-Saval, University of Sydney, Australia; Dan Marom, The Hebrew University of Jerusalem, Israel and Ben Puttnam, NICT, Japan.

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For inquiries, please contact:
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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.

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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
- valletronics
- 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.

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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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• publishing journals, sponsoring conferences, and supporting local chapter and student activities;
• formally recognizing the professional contributions of members;
• representing the laser, optoelectronics, and photonics community and serving as its advocate within the IEEE, the broader scientific and technical community, and society at large.

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The Society’s Field of Interest is lasers, optical and photonic devices, optical fibers, and associated lightwave technology and their systems and applications. The society is concerned with transforming the science of materials, optical phenomena, and quantum electronic devices into the design, development, and manufacture of photonic technologies. The Society promotes and cooperates in the educational and technical activities which contribute to the useful expansion of the field of quantum optoelectronics and applications.

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