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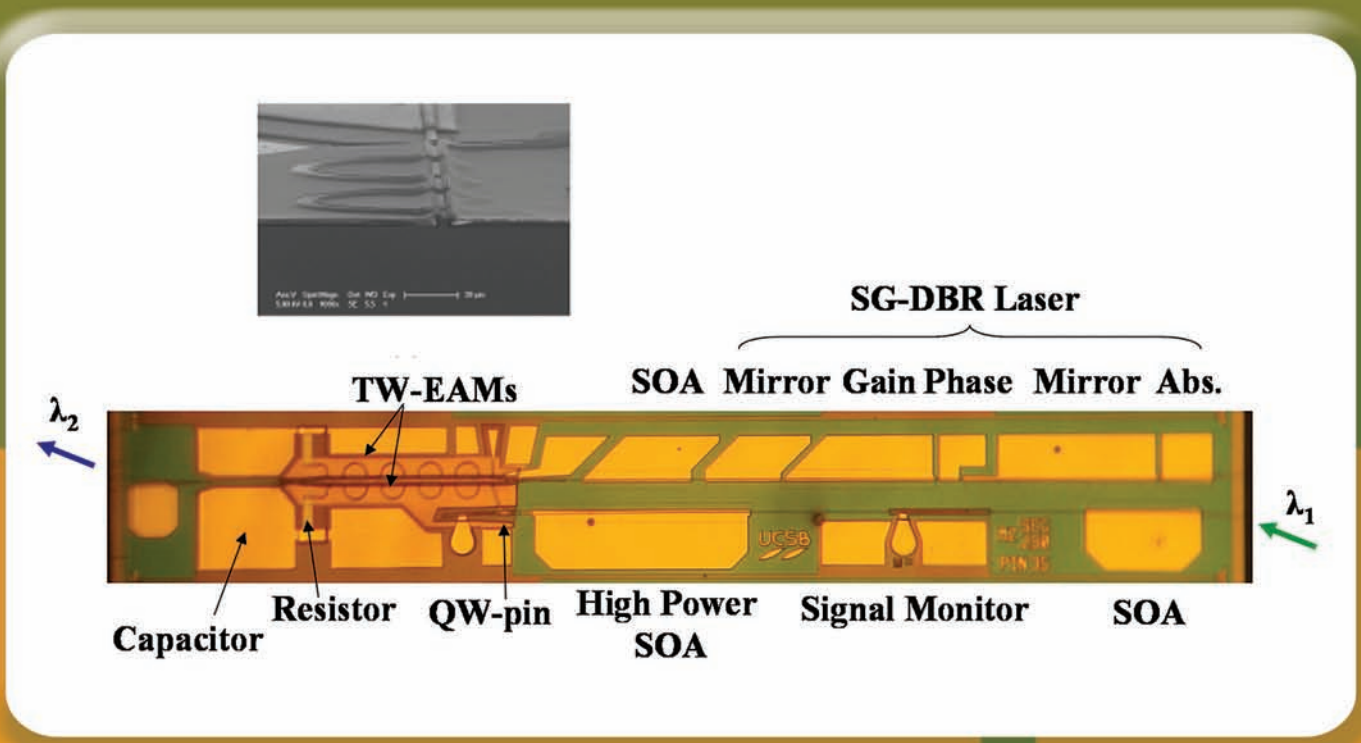
IEEE photonics SOCIETY NEWS

Semiconductor Laser Advances: The Middle Years



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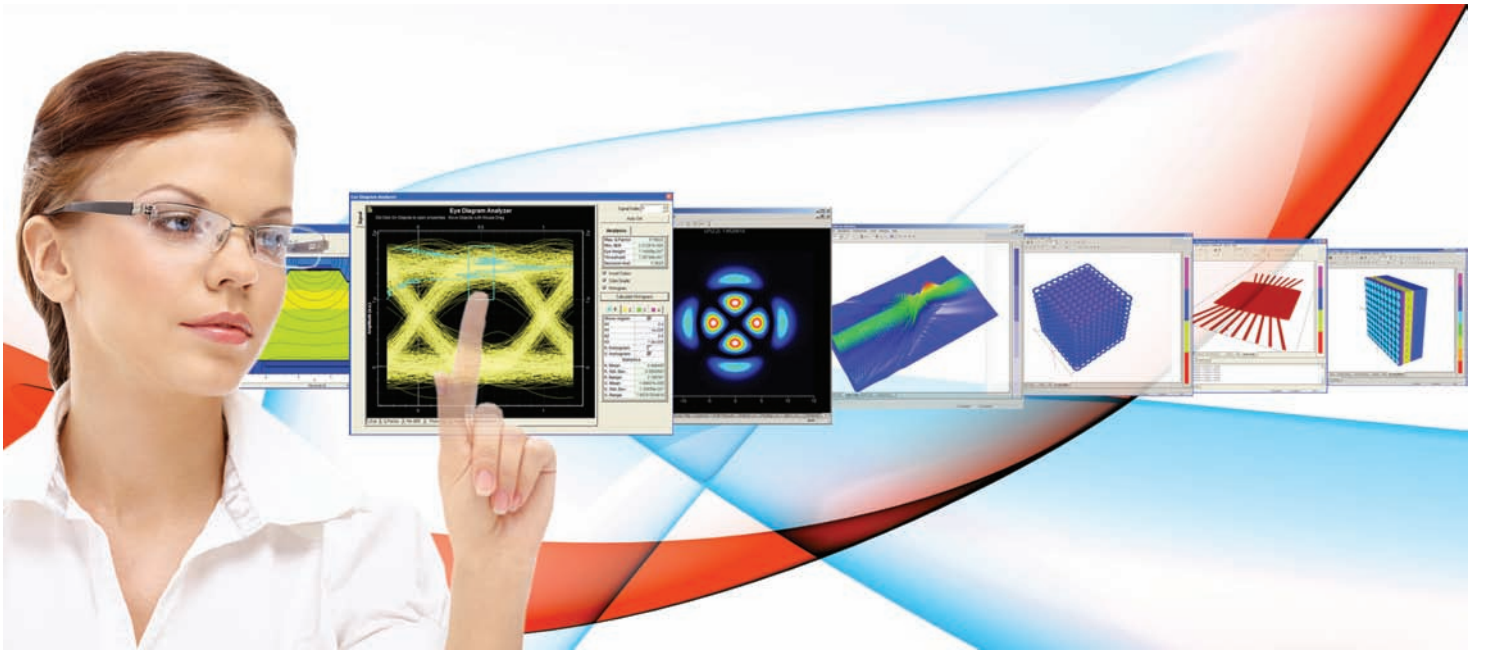

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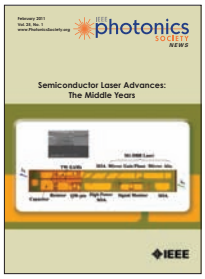

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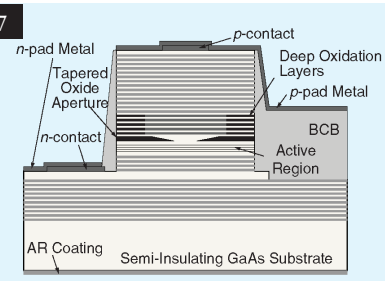

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Editor's Column

KRISHNAN PARAMESWARAN

I write this column as the snow falls steadily outside my window. Winter is here, and a New Year has begun. Despite the cold conditions in my neck of the woods, the year ahead promises to be full of hot developments in Photonics!

As a final reflection on the 50th anniversary of the invention of the laser last year, Prof. Larry Coldren has contributed an insightful article describing the development of the sampled grating distributed feedback laser, a major advance in semiconductor laser technology that is at the core of many photonic systems. The Careers Section has photos of award recipients from the Annual Meeting last November. Please join me in congratulating the winners and thanking our volunteers for their service. I encourage all members to stay active in their local chapters and contact any member of the Newsletter Editorial team to submit an article about recent events.

As the economy recovers worldwide, Photonics technology promises to be an important part of improving the quality of lives of people everywhere. Thanks to all of you for helping develop and promote Photonics!

Best wishes for a productive and safe 2011 for all!

Cheers,
Krishnan Parameswaran

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President's Column

JAMES J. COLEMAN

It is just after the New Year and that always brings hopes associated with the beginning of a new year along with a respectful fear of the next few months of winter weather. It is a great time to "clear your desk"—physically, electronically, and metaphorically—to get a fresh start and energize yourself for unfinished tasks, new and old. For the Photonics Society, it is time to take the wonderful ideas that originated last year and were refined in our fall meeting and set about the task of implementing them during this year. More about some of these in a bit…

Reflect on the past…

At this point in my life, I don't buy green bananas.
~Tingye Li

Several occurrences in the late fall caused me to reflect on the past and, in particular, the technical history of our Society. The first was the ceremony for the dedication of an IEEE Milestones plaque in Malibu to commemorate the 50th anniversary of Ted Maiman's ruby laser. Another was the opportunity I had to prepare and present a brief history of the laser for a general audience at the COMMAD conference in Australia. Finally, I had several opportunities to chat with Tingye Li at the annual meeting in Denver. Tingye is, of course, one of our Society's best known and most respected senior scientists. He is widely known for quoting Confucius—although I suspect he occasionally invents the quotes himself.

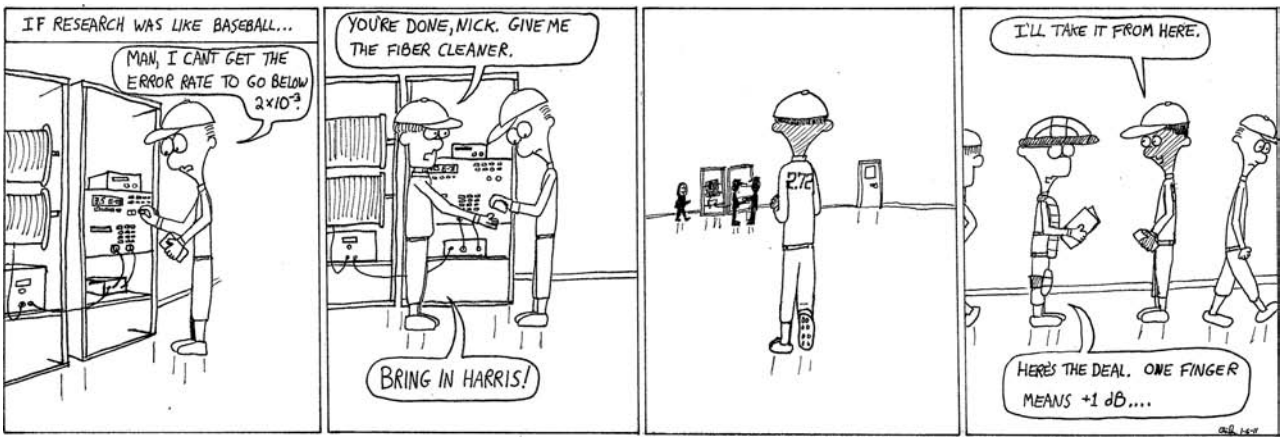
History for technical people is a little different than for others. Our results and our understanding become the stuff of papers and talks, then review papers, then tutorials, then book chapters, and then textbooks. But the people and events surrounding discoveries and inventions are usually given little or no attention. Some of these are great stories. Perhaps they are not interesting to Hollywood but they might be very interesting, and educational, for those of us who are doing related work today. For example, did you know that the Russian scientist Alexander Prokhorov who shared the Nobel Prize for the laser was actually born in Australia? Have you seen the YouTube interview with Bob Hall who made the first working diode laser?

The simple point I want to make is that some of our technical ancestors were interesting and remarkable people. If you haven't read some of the history of the laser, find some time to do so. And if you see someone who looks senior—like Tingye—at one of our conferences, go introduce yourself and learn something about the history of photonics, or even bananas for that matter.

This and that…

There were lots of interesting things discussed and decided at the Annual Meeting in Denver. But the one item I want to highlight above the others is the end of the Photonics Society Annual Meeting. No, the conference isn't going away. Quite the contrary. A few years ago we rolled out a new name for our Society and it is time now to change the name of our fall conference. While it is the annual meeting for our Society, it is much more than that. It is the premier photonics conference in the fall and attracts scientists from all over the world, whether they are members of the Society or not. So consider this your first invitation to present a paper next October in Virginia at the IEEE Photonics 2011 conference.

With Warm Wishes,
Jim Coleman
University of Illinois
j.coleman@ieee.org



Semiconductor Laser Advances: The Middle Years

Applications that stimulated advances 20 years ago are now the latest rage!

By Larry A. Coldren, UCSB

Introduction

As we celebrate the 50th anniversary of the Laser and roughly the 40th anniversary of the semiconductor laser, I am reminded of some important developments that occurred about 20 years ago that really revolutionized the field and have had a lasting effect on many of the semiconductor lasers that impact our lives today. The developments are in two widely separated segments of semiconductor laser technology—widely-tunable lasers and vertical-cavity surface-emitting lasers (VCSELs). Indeed, both are very important today; the first in dense wavelength-division-multiplexed (WDM) fiber communication and fiber sensor technology, and the second in data communications, computer mice, and other emerging consumer applications. Both are also loosely connected because both rely upon sophisticated and novel Distributed Bragg Reflector (DBR) mirrors.

In both cases the desirability of such devices and some basic concepts had been put forth by the late 1980s, but the viability of such devices was unclear. *Some breakthroughs were needed.* In the case of the widely-tunable laser, work on coherent communication during the 1980s had defined a need for a tunable local oscillator (LO) in the coherent heterodyne receivers that could tune across the fiber C-band of some 40 nm, much like the LO of a car radio receiver that tunes across the entire FM band. A single universal transmitter laser that could be set to any wavelength was also desired. Bulky, expensive external-cavity lasers existed that could do this, but there were no monolithically integrated semiconductor lasers that might have the kind of cost and reliability desired. In the case of VCSELs, again the arguments had been made that such devices would be very desirable, if they could be practically manufactured [1]. However, after a significant multi-year effort by Prof. Iga and his elite group at the Tokyo Institute of Technology (TIT), the results were still somewhat marginal, and the structure also appeared to be rather complex. CW operation finally came in 1988 [2], but the practicality of the device was still in question. I was lucky enough to find myself in a position to make contributions to both of these opportunities beginning in the late 1980s.

Widely-Tunable Lasers

My efforts on monolithic tunable diode lasers actually began at Bell Labs in the late 1970s with efforts on monolithic coupled-cavity lasers in the then new InGaAsP/InP materials system [3]. After going to UCSB in 1984, my work continued on tunable 2-section coupled-cavity lasers, but it was soon realized that these had some significant limitations. Three-section tunable DBRs had also appeared in the 1980s [4, 5], but these also had their limitations. The coupled-cavity lasers had trouble with spurious mode suppression and reproducibility, and the 3-section DBR was practically limited to < 10 nm of tuning in the 1550 nm range, much less than the ~ 40 nm that was desired for the coherent as well as the emerging WDM applications.

The first breakthrough idea involved a combination of some concepts from both the coupled-cavity and 3-section DBR lasers. It was to be a *4-section multi-element mirror laser*. It enabled full wavelength coverage over > 40 nm in multiple wavelength bands within a single monolithic chip. Like the coupled-cavity laser, it used the vernier effect; in this case using differently spaced reflection maxima from the two mirrors rather than the two differently spaced Fabry-Perot mode spacings of the coupled cavities. But similar to a standard DBR laser, it also used an intra-cavity tuning electrode to line up a cavity mode with the single net reflection maximum resulting from the product of the two mirror spectra. (See Fig. 1) A patent was filed in 1988 and issued in 1990 [6], and this later became the key element in the Intellectual Property of a company to be formed nearly a decade later—Agility Communications.

Before Agility was formed in 1988 to commercialize the multi-element mirror widely-tunable laser technology, quite a bit of additional R & D was done on the preferred embodiment, the Sampled-Grating-DBR or SGDBR laser at UCSB [7, 8]. During the 1990s, many other monolithic widely-tunable laser designs also evolved. For example, there were variants on the SGDBR that used chirped grating bursts rather than uniform sampled grating bursts [9]; there were relatively complex vertically-coupled laser structures that used the wide tuning feature of a grating-assisted co-directionally coupled filter within their cavities[10]; and there were even VCSELs with electrostatically moveable mirrors mounted on microscopic cantilevers [11]. Although many of these were also the subject of startup companies, most of this technology is no longer in production today. More recently another variant on the SGDBR, the so-called DSDBR has been developed and is now being mass produced in similar quantities to the SGDBR [12]. It uses a similar concept for the back mirror, but a multiply-contacted grating array for the front mirror. Together these two account for the majority of all of the dense WDM lasers being sold today. The SGDBR is currently being manufactured by JDSU which acquired Agility in 2005.

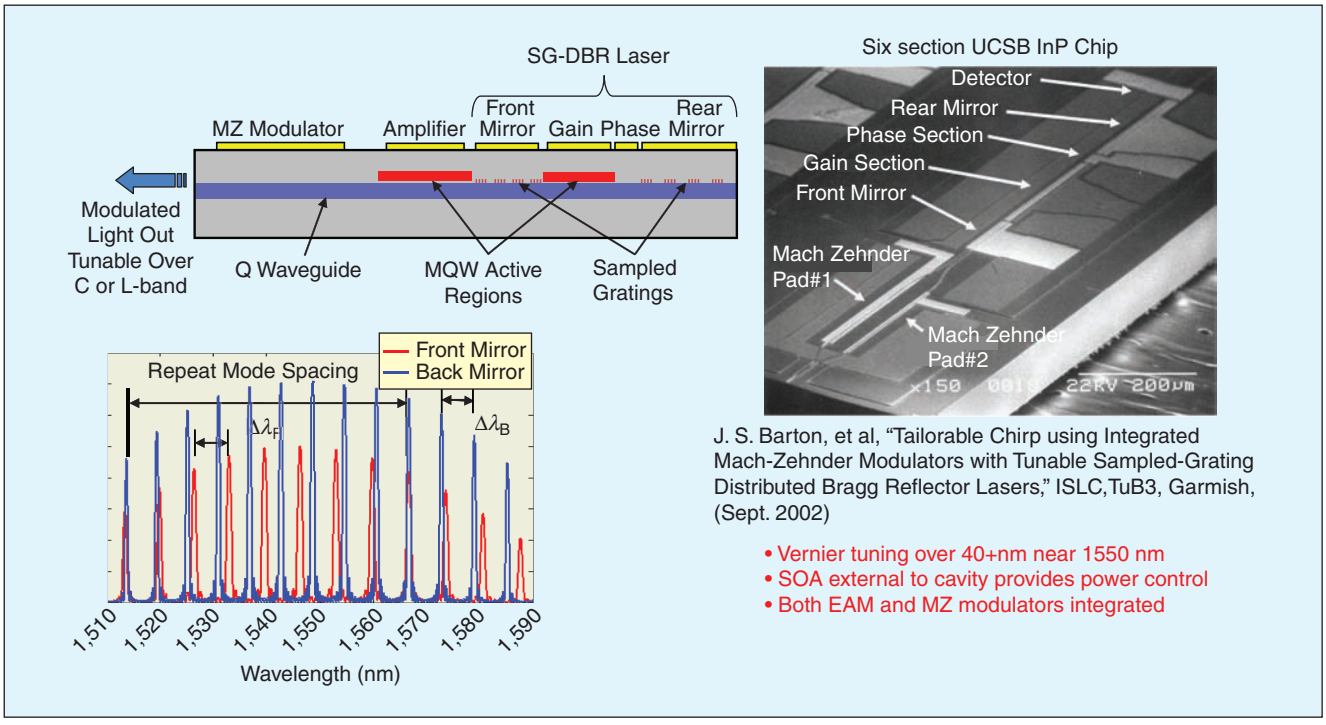


Figure 1. Widely-Tunable SGDBR-SOA-Modulator PIC.

During the 1990s, work on the SGDBRs at UCSB, as well as some of the work on other monolithic tunable lasers elsewhere, began to spawn larger Photonic Integrated Circuits (PICs) as it became obvious that the same fabrication steps required to make the laser could also form other components outside of the cavity at the same time. Thus, these lasers integrated with modulators, amplifiers, and monitoring detectors were soon demonstrated [8, 13]. In fact, the very first Agility products had integrated Semiconductor Optical Amplifiers (SOAs) or Electro-Absorption Modulators (EAMs) as well as back-side monitoring detectors integrated with the SGDBRs. Today JDSU manufactures an integrated Mach-Zehnder Modulator (MZM) with the SGDBR.

The InP-based PIC work at UCSB has continued to evolve in recent years with improvements in the capabilities of the integration platform and the design of the components. For example, a robust impurity-free, quantum-well intermixing technology for the InGaAsP/InP system has been found to be invaluable in providing multiple active and passive waveguide sections from a single initial epitaxial layer growth [14]. Integrated widely-tunable transmitters operating up to data rates of 40 Gb/s have been demonstrated in a variety of designs and technologies. (See Fig. 2) Wavelength converters using both integrated SOA-PIN receivers directly driving the modulator of a widely-tunable transmitter [15, 16]—the so-called separate absorption and modulation (SAM) design—and designs using cross phase modulation in SOAs within the MZM modulator of a widely-tunable transmitter [17]—the so-called combined absorption and modulation (CAM) design—have been demonstrated up to 40 Gb/s. Using eight of these integrated with an Arrayed Waveguide Grating Router (AWGR) on a single chip, we have more recently demonstrated a MOnolithic Tunable Optical Router (MOTOR) PIC, which functions as an 8 × 8 crossbar switch [18]. Current work is focused on coherent transmitters and receivers that incorporate SGDBRs (e.g. Fig. 3)—sort of ironic that some 20 years later we are finally focusing on the primary application that spawned the invention!

VCSELs

Going back to the mid-1980s again, the other half of our research at UCSB was focused on reflective surface-normal modulators for optical interconnects within and between computers. To support the modulator work we had developed a Molecular Beam Epitaxy (MBE) effort focused on the GaAlAs/GaAs materials. The modulator work evolved toward resonant-cavity designs with multi-layer DBR mirror stacks and multiple-quantum-well (MQW) active regions in the cavities. In order to improve their efficiency, modeling indicated that the quantum-wells should be placed only at the peaks of the electric field standing wave of the resonant cavity. This was true whether one considered the index shift or absorption from the quantum wells. We realized very quickly that this enhancement would also be true for VCSELs, and proposed devices designed with quantum-well gain regions placed only at the standing-wave peaks in order to get up to 2x the modal gain as compared to the same amount of gain material distributed uniformly along the standing wave. [It's really just the maximum value of $\cos^2 x$ compared to its average.] (See Fig. 4) This concept was first published at CLEO in 1988 [19], but surprisingly the VCSEL veterans didn't get very excited about this key advance. Of course, a factor of *two* in modal gain for the same current and active volume is *huge*. This completely changes

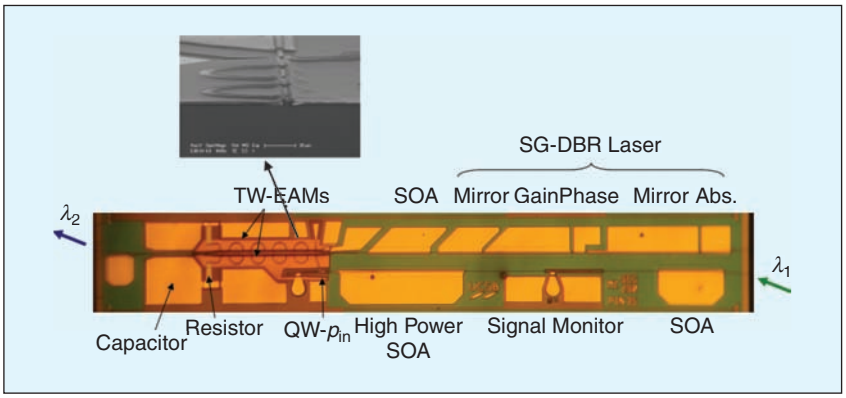


Figure 2. Transceiver/wavelength-converter: 2-stage-SOA-PIN Receiver and SGDBR-TW/EAM Transmitter.

the design possibilities, for example, enabling cavities to have twice the loss and still lase.

There was one believer, but he wasn't a VCSEL guy, he was another modulator guy—Jack Jewell. He also knew something we did not—that multi-layer mirror stacks could be made with >99% reflectivity. Thus, only one set of quantum wells at one standing wave peak would be necessary to make a viable VCSEL, while we thought that ~98% was about as high as could be expected for a vertical mirror stack. So, our modeling showed that we would need at least three or four periods of gain, which made the problem considerably harder. So, we at UCSB tried to make this multiple-periodic-gain laser, while Jack put together a single period device at Bell Labs with the help of multiple collaborators. We both also had to develop bandgap engineered mirrors to reduce the voltage drops caused by the discontinuities between the high and low Al-containing layers.

By the time it was realized that high-reflectivity mirrors could be formed, more than a year had gone by, and Jewell, et al beat us into print by a few months with the first cw electrically-pumped, low-threshold "microlaser" that used a thin active region (1–3 QWs) on a single standing wave peak [20]. (However, in our defense it might be mentioned that our first publication reported considerably better results [21].) Our UCSB group went on from there to generate a few years of leading results in VCSEL efficiency, output power, and temperature stability [22]. Essentially *all* commercial VCSELs from that time through the present have included the design features developed jointly with Jewell—that is, an all-epitaxially grown cavity, a thin active region placed at a single standing wave maximum, high-reflectivity (>99%) mirrors, and graded interfaces between layers within the cavity. In recognition of these contributions we jointly received the 2009 Aron Kressel Award.

Since the early 1990s, our UCSB VCSEL efforts have continued to focus on high efficiency, all-epitaxial designs.

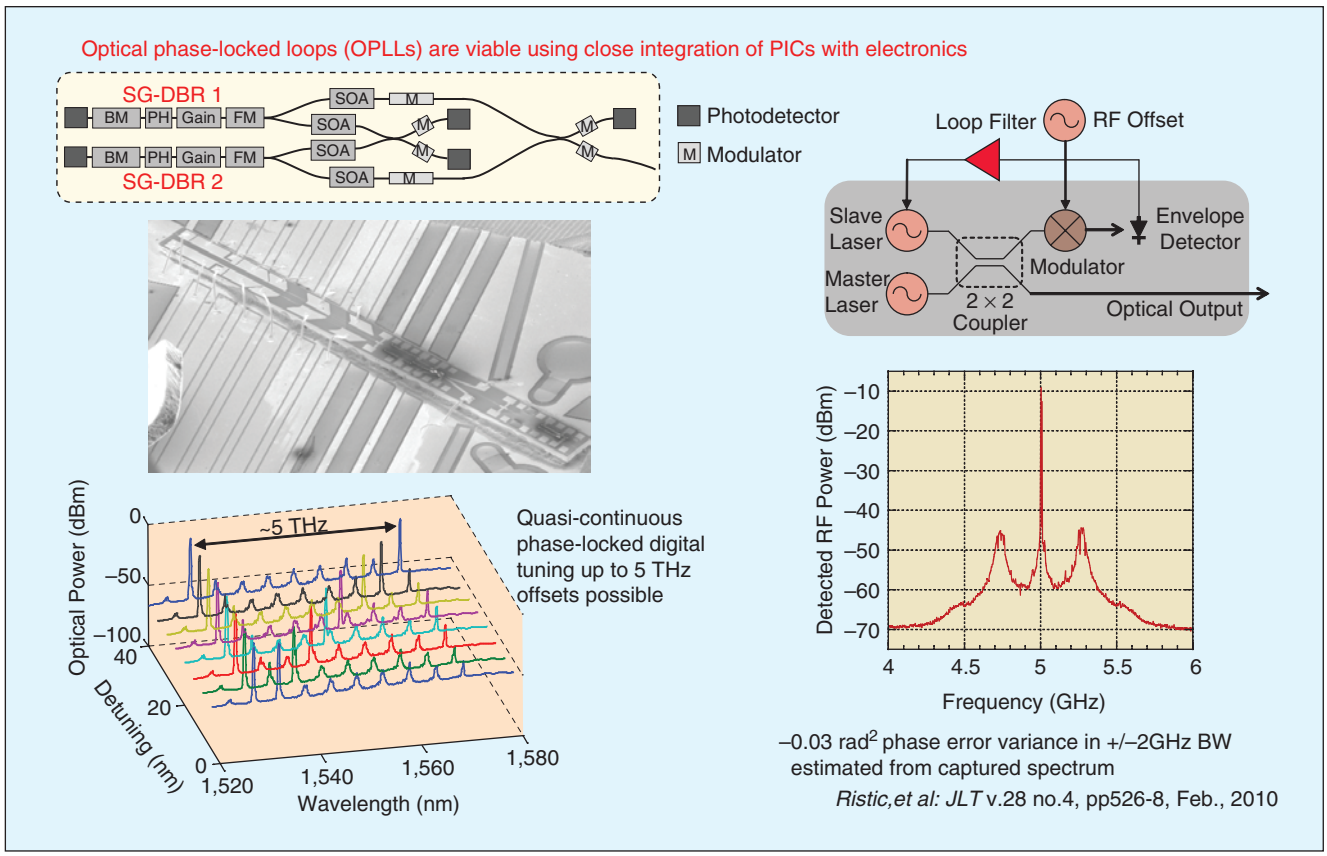
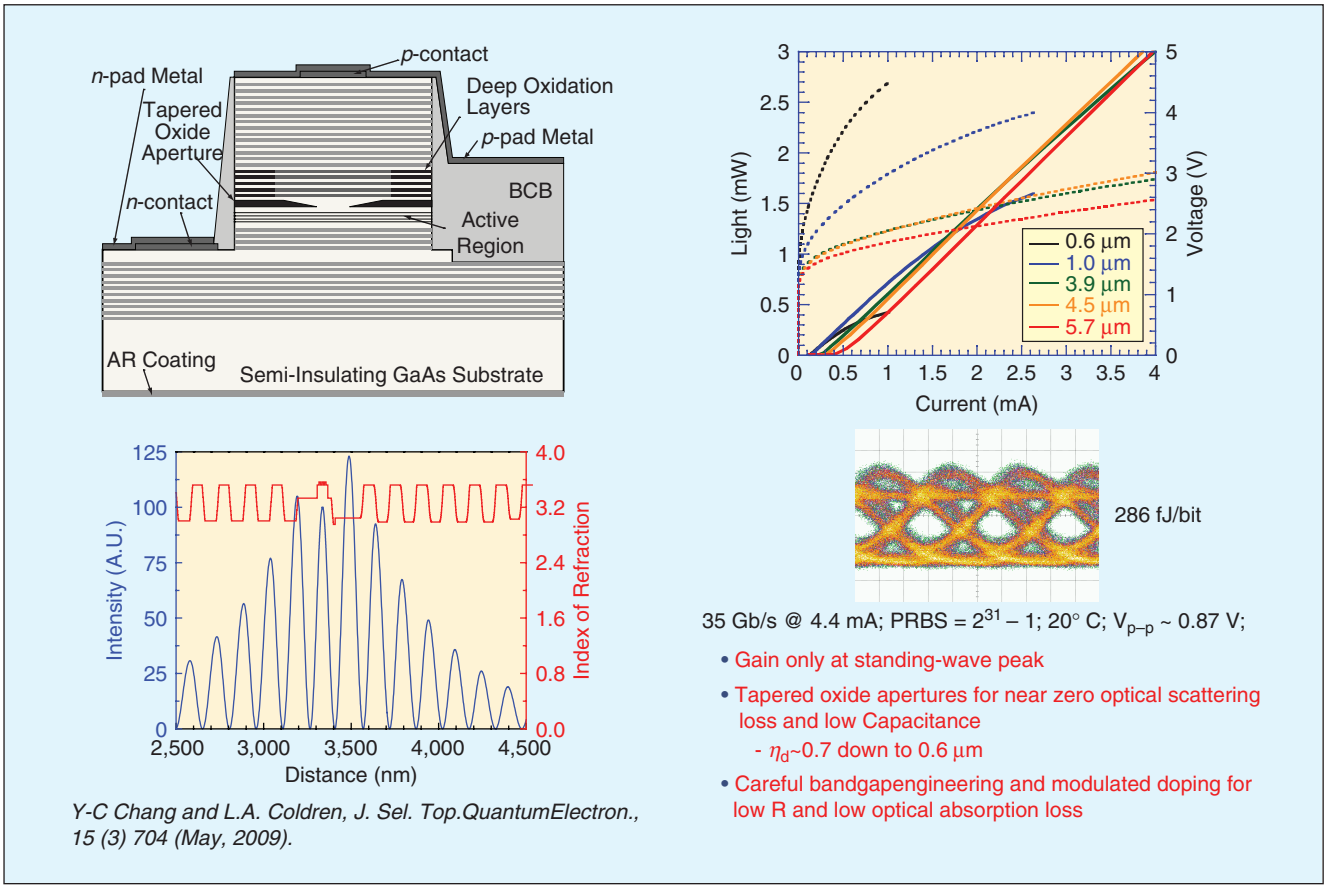


Figure 3. Optical Phase Locked Loops: Offset Locking Two SGDBRs.



Y-C Chang and L.A. Coldren, J. Sel. Top.QuantumElectron., 15 (3) 704 (May, 2009).

Figure 4. VCSEL Advances.

This has required the use of strained quantum-well active regions, which results in a wavelength in the ~980 nm range in the GaAs system. Unfortunately, for a number of practical reasons at the time, a data-link standard ~850 nm was established in the 1990s for VCSELs, so the more efficient devices that we pursued were not widely developed commercially. Even the companies that Jack Jewell and I co-founded, which initially worked on our original designs at 980 nm, eventually switched away from this wavelength for market reasons. (At UCSB we did demonstrate strained 850 nm AlInGaAs quantum-well VCSELs, with good properties, but our GaAs-based efforts continued to focus at 980 nm because of the numerous benefits associated with the longer wavelength [23].)

Another key contribution made by our UCSB group in the 1990s, which has enabled the record power efficiencies and bit rates/mW that have been demonstrated, was the virtual elimination of optical scattering loss by the incorporation of an intra-cavity lens-like aperture. This invention also provides a Gaussian cavity mode for low diffraction loss output beams as well as enabling the cavity volume to be reduced (for higher bandwidth) without requiring added threshold current density [24].

More recently there has been renewed interest in high-efficiency devices, so our long term pursuit of the longer-wavelength, strained-active-region VCSELs on GaAs is beginning to be more appreciated. VCSELs are now being used in high-density arrays for optical interconnects in data centers and between and within high-performance computers. Again, we see the motivation that drove some key advances 20 years ago becoming a key driver today. In fact, compressively-strained active regions provide more than improved efficiency, which occurs because of their lower transparency current and higher differential gain. Importantly, these active regions also appear to have higher reliability [25], they operate better at higher temperatures [26], they provide a higher intrinsic modulation bandwidth, and the longer wavelengths they emit can penetrate the GaAs substrate enabling flip-chip mounting and easier coupling optics. (See Fig. 5) Today, several companies are pursuing VCSELs with highly strained quantum-well active regions having wavelengths even longer than 980 nm—1060 nm appears to be the new choice [23]. Again, the primary driver is computer interconnects with high efficiency and high reliability.

Larry A. Coldren is the Fred Kavli Professor of Optoelectronics and Sensors and Acting Richard A. Auhll Dean of Engineering at the University of California, Santa Barbara, CA. He received the Ph.D. degree in Electrical Engineering from Stanford University in 1972. After 13 years in the research area at Bell Laboratories, he joined UC-Santa Barbara in 1984 where he now holds appointments in Materials and Electrical & Computer Engineering. In 1990 he co-founded Optical Concepts, later acquired as Gore Photonics, to develop novel VCSEL

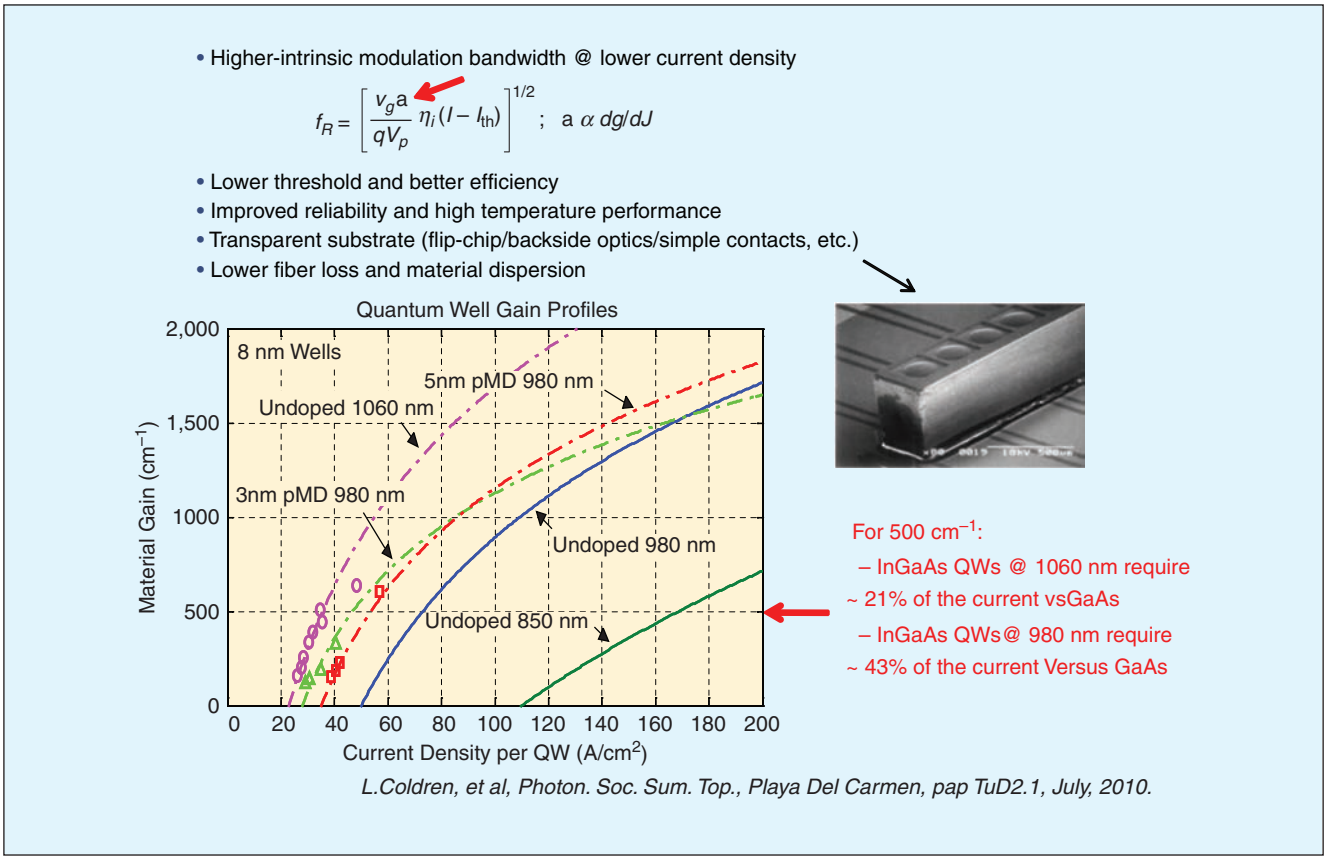


Figure 5. The case for 980-1100 nm (strain/GaAs).

Figure 6. Student Testing Photonic IC.

technology; and in 1998 he co-founded Agility Communications, later acquired by JDSU, to develop widely-tunable integrated transmitters.

At Bell Labs, Coldren initially worked on waveguided surface-acoustic-wave signal processing devices and coupled-resonator filters. He later developed tunable coupled-cavity lasers using novel reactive-ion etching (RIE) technology that he created for the then new InP-based materials. At UCSB he continued work on multiple-section tunable lasers, in 1988 inventing the widely-tunable multi-element mirror concept, which is now used in some JDSU products. Near this same time period he also made seminal contributions to efficient vertical-cavity surface-emitting laser (VCSEL) designs that continue to be implemented in practical devices to this day. More recently, Prof. Coldren's group has developed high-performance InP-based photonic integrated circuits (PICs) as well as high-speed VCSELs, and they continue to advance the underlying materials growth and fabrication technologies.

Professor Coldren has authored or co-authored over a thousand journal and conference papers, 7 book chapters, 1 textbook, and has been issued 63 patents. He has presented dozens of invited and plenary talks at major conferences, he is a Fellow of the IEEE, OSA, and IEE, a recipient of the 2004 John Tyndall and 2009 Aron Kressel Awards, and a member of the National Academy of Engineering.

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Career Section

IEEE 2011 David Sarnoff Award Recipient: Constance J. Chang-Hasnain

The IEEE David Sarnoff Award was established in 1959 through agreement between the RCA Corporation and the American Institute of Electrical Engineers, and continued by the Board of Directors of the IEEE. In 1989, sponsorship of the award was assumed by the Sarnoff Corporation. It may be presented each year to an individual or team up to three in number for exceptional contributions to electronics. For additional information on IEEE Technical Field Awards and Medals, to view complete lists of past recipients or to nominate a colleague or associate for IEEE Technical Field Awards and Medals, please visit http://www.ieee.org/awards.

Constance J. Chang-Hasnain

The IEEE David Sarnoff Award will be presented to Constance J. Chang-Hasnain, "for pioneering contributions to vertical cavity surface emitting laser (VCSEL) arrays and tunable VCSELs." The award will be presented during the 2011 Optical Fiber Communication Conference and Exposition and the National Fiber Optic Engineers Conference, OFC/NFOEC 2011 that will be held March 6-10, 2011- Los Angeles Convention Center, Los Angeles, CA, USA.

C.J. Chang-Hasnain's groundbreaking contributions to the physics and design of vertical cavity surface emitting lasers (VCSELs) have been instrumental in establishing VCSELs as the dominant technology for multimode fiber applications. Used in applications ranging from Ethernet data networks to computer mice to laser printers, VCSELs can be turned on and off very fast and manufactured at very low cost in wafer-scale. Dr. Chang-Hasnain explained the modal structure of VCSELs and demonstrated the first planar structure, which was commercialized. She was first to demonstrate multi-wavelength VCSEL array for multi-mode-fiber interconnects and 140-wavelength array with precise wavelength variation. She developed the first tunable VCSEL structure with a wide tuning range and later invented a high-contrast grating, which led to a tunable laser with a 160x speed improvement. An IEEE Fellow, Dr. Chang-Hasnain is currently the John R. Whinnery Chair Professor of Electrical Engineering and Computer Science at the University of California, Berkeley.

Newly Elected Members to the Board of Governors

Peter Andrekson

Peter Andrekson is a Professor of Photonics at Chalmers University of Technology, Gothenburg, Sweden. He has served on various technical program committees (including OFC, ECOC, and CLEO as well as on topical IEEE and OSA meetings) for several years. He was an associate editor for IEEE Photonics Technology Letters during 2003–2007. In 2010 he was on the IEEE Engineering Achievement Award Committee and was secretary of the board of the IEEE Student Branch at Chalmers University during 1986–1988. He has served twice as an expert for the evaluation of the Nobel Prize in Physics.

Peter Andrekson received his M.Sc. and Ph.D. degrees from Chalmers University of Technology, Sweden, in 1984 and 1988, respectively. After about three years with AT&T Bell Laboratories, Murray Hill (USA) during 1989–1992, he returned to Chalmers where he is now a full professor at the Department of Microtechnology and Nanoscience. He was Director of Research at Cenix Inc. (USA), during 2000–2003 and with the newly established Center for Optical Technologies at Lehigh University (USA) during 2003–2004. His research interests include nearly all aspects of high speed and high capacity fiber communications such as optical amplifiers, nonlinear pulse propagation, all-optical functionalities, and advanced modulation formats. He is co-founder of the optical test & measurement company Picosolve Inc., now part of EXFO where he is Director of EXFO Sweden AB. Andrekson is a Fellow of the Optical Society of America and a Fellow of the IEEE. Since 2009 he is a member of the board of Chalmers University of Technology and since 2010 the Director of a newly established Center of Excellence on optical communications at Chalmers. He is the author of over three hundred scientific publications and conference papers in the area of optical communications, including three book chapters and over sixty invited papers at leading international conferences and journals. He holds several patents. In 1993 he was awarded a prize from the Swedish government research committee for outstanding work performed by young scientists, and in 2000 he was awarded the Telenor Nordic research award for his contribution to optical technologies. He regularly serves as international evaluator for project proposals and professional appointments and as external international evaluator for Ph.D. dissertations.

Paul Juodawlkis

Paul Juodawlkis (S'86-M'86-SM'06) is Assistant Group Leader of the Electro-Optical Materials and Devices Group at the Massachusetts Institute of Technology's Lincoln Laboratory. He has served as Chair of the LEOS Technical Committee on Microwave Photonics (2003–2006) and Chair of the Subcommittee on Microwave Photonics for the LEOS Annual Meeting (2002–2003). He initiated and Co-Chaired the 2003 LEOS Summer Topical Meeting on Photonic Time/Frequency Measurement and Control. He was Associate Guest Editor for the 2006 IEEE Transactions on Microwave Theory and Techniques/Journal of Lightwave Technology Joint Special Issue on Microwave Photonics. He presently serves as a Member of the Technical Steering Committee of the Photonics Society Boston Chapter (2004-present). Most recently, he served as Program Co-Chair of the 2010 Conference on Lasers and Electro-Optics (CLEO) and he is currently a Photonics Society representative to the CLEO Steering Committee.

Paul Juodawlkis received the B.S. degree from Michigan Technological University, the M.S. degree from Purdue University, and the Ph.D. degree from the Georgia Institute of Technology, all in electrical engineering. From 1988 to 1993, he was a Technical Staff Member at the Lincoln Laboratory, Massachusetts Institute of Technology (MIT), where he was a Hardware Systems Engineer on an airborne radar testbed program. He then joined the Ultrafast Optical Communications Laboratory (UFOCL) at Georgia Tech where he performed graduate research on the optoelectronic properties and device applications of low-temperature-grown semiconductor quantum-well materials. In 1999, he rejoined Lincoln Laboratory, as a member of the Electro-Optic Materials and Devices Group. He is currently Assistant Leader of the Group where he leads research on semiconductor optoelectronic devices and microwave integrated photonics. His research efforts focus on development of optical sampling techniques for photonic analog-to-digital converters, quantum-well electrorefractive modulators, high-power waveguide photodiodes, and Watt-class semiconductor optical amplifiers (SOAs) and their application in mode-locked lasers and narrow-linewidth external-cavity lasers.

John McInerney

John McInerney is the Professor and Head of Physics at University College Cork (UCC) and leads the laser dynamics group at the Tyndall Institute at UCC. UCC is an independent constituent of the National University of Ireland and a long standing centre of excellence in microelectronics, optoelectronics and inter-disciplinary science. John has grown up with IEEE LEOS, having been involved since he was a graduate student. His first professional conference was the fledgling IEEE International Semiconductor Laser Conference in Brighton, UK in 1980 (at that time laser diodes did not last very long!). Since then, he has been involved in LEOS/Photonics activities at several levels from local meetings to full scale international conferences. He has served as a semiconductor laser program committee member or chair for CLEO, CLEO Europe, LEOS Annual Meeting as well as similar activities for OSA (NDOS and various topical meetings) and SPIE (Photonics West, Photonics Europe, Photonics Ireland). He has also taught short courses at CLEO, served on IEEE Photonics award panels and, as the wonderful IEEE support staff know, is a very slow reviewer. He serves on the editorial boards of Research Letters in Optics and International Journal of Optics and has also been a journal guest editor.

John McInerney has spent all of his professional life at the interface between photonics and industry, where physics meets product development. He received his BSc from UCC and PhD from Trinity College, Dublin, both in Physics. From 1981–2 he was a research engineer at Standard Telecommunication Laboratories (STL), Harlow, UK, then a renowned research centre for photonics. From 1984–86 he held the STL Research Fellowship in Optoelectronics at the Cavendish Laboratory, Cambridge University doing research on nanolithography for DFB lasers and quantum dots/dashes. From 1986–93 he was an assistant and then associate professor of electrical engineering and physics at the Center for High Technology Materials, University of New Mexico. He has held his current position since 1993, except for a career break in 2001–3 when he was Director of Research and later Director of New Products at Novalux Inc, Sunnyvale, CA. He has also been a part time board member of various small optical and plasma startup companies in Cork, and has consulted widely in the photonics industry. His research is in laser dynamics, mainly switching and modulation, mode selection and stabilization, pulse generation and mode locking, injection and coupling, high brightness and high power in large aperture lasers, He has ~300 publications in professional journals and refereed conference proceedings, and is a Fellow of the Institute of Physics (UK).

Dalma Novak

Dalma Novak (S'90, M'91, SM'02, F'07) is a Vice President at Pharad, LLC in Glen Burnie, MD. She founded the Victorian Chapter of IEEE LEOS in 1999 and then served as Chapter Chair until 2001. From 2003–2007 she was an Associate Editor of the *IEEE/OSA Journal of Lightwave Technology* and since 2009 has been an Associate Editor of *IEEE Photonics Technology Letters*. From 2006–2009 she was Chair of the IEEE Photonics Society Technical Committee on Microwave Photonics and was Technical Program Chair for the 2010 IEEE Photonics Society Annual Meeting. She has served on the program committees of many IEEE Photonics Society sponsored conferences, including the *Optical Fiber Communications Conference*.

Dalma Novak received the degrees of Bachelor of Engineering (Electrical with First Class Honours) and PhD from the University of Queensland, Australia, in 1987 and 1992, respectively. In 1992 she joined the Department of Electrical and Electronic Engineering (EEE) at The University of Melbourne, Australia where she carried out research in microwave photonics, hybrid fiber radio systems, and high speed optical communication systems. From July to September 2000 she was a Visiting Professor in the Department of Electrical Engineering at UCLA, and was a Visiting Researcher at the Naval Research Laboratory, Washington, DC from October 2000–January 2001. From June 2001–December 2003 she was a Technical Section Lead at Dorsál Networks, Inc. and later at Corvis Corporation, where she led cross-disciplinary R&D teams developing WDM hardware for long-haul transmission systems. From January–June 2004 she was Professor and Chair of Telecommunications in the EEE Department at The University of Melbourne and during 2004–2009 was a Professorial Fellow in the same Department. In 2004 she co-founded Pharad, where she develops technologies for realizing high performance RF-over-fiber systems. Dr. Novak is a Fellow of the IEEE and has published more than 250 papers in journals and international conferences, including six book chapters. She also gives regular Short Courses on Hybrid Fiber Radio Network technologies.

Photonics Society 2011 President-Elect, Hideo Kuwahara

Hideo Kuwahara

Dr. Hideo Kuwahara is a Fellow of Fujitsu Laboratories Ltd. headquartered in Japan. He received his B.S., M.S., and Ph.D. degrees in Electronics Engineering from the University of Tokyo, in 1972, 1974, and 1984 respectively. He joined Fujitsu in 1974, and has since enjoyed a long career in optical communications R&D, including high speed TDM, coherent, optical amplifier and WDM technologies. From 2000 to 2003, Dr. Kuwahara led the Photonics Networking Lab in Fujitsu Network Communications, Inc. in Richardson, Texas. He was a Board Member of Fujitsu Laboratories Ltd. from 2004 through 2006. In his current position, Dr. Kuwahara leads the direction of photonics technologies R&D at Fujitsu Laboratories Ltd.

As a Fellow of the IEEE, Dr. Kuwahara has long been engaged in activities of the Institute. He was a member of the Board of Governors of the IEEE LEOS from 2006 through 2008, a member of the Honorary Membership Committee from 2008 through 2010, and Vice Chair of APCC2008. Presently, he serves as a member of the Prize Papers / Scholarship Awards Committee, a guest editor of Communications Magazine Optical Communications Series, and a guest editor of IEEE J-SAC. His international participation includes his positions as the Chair of the Steering Committee of CLEO Pacific Rim, a member of the Steering Committee in IEEE / Optical Society of America JOCN, and a member of the International Advisory Committee in ECOC (European Conference on Optical Communications), presenting the plenary talk in ECOC2008.

In Japan, Dr. Kuwahara is a Fellow of the IEICE (Institute of Electronics, Information and Communications Engineering of Japan), where he currently serves as Director of Finance. He received the IEICE Achievement Award in 1998. In 2007, Dr. Kuwahara was General Co-Chair of OECC (Opto-Electronics and Communications Conference), and a member of the International Advisory Committee. In 2011, he is the Chair of IEEE Photonics Society Japan Chapter. He also is an active participant in the OITDA (Optoelectronics Industry and Technology Development Association of Japan) and received the Sakurai Memorial Award in 1990. Dr. Kuwahara regularly participates in government related committees and activities in Japan. In China, he holds a guest professor position at the Beijing University of Post and Telecommunications.

IEEE Photonics Society 2011 Fellows

Congratulations!

Please join us in congratulating the 21 Photonics Society members who became IEEE Fellows this year. It's a significant honor that is based on major technical contributions, leadership, and service to the Institute and the profession.

The deadline for 2012 Fellow nominations is March 1. For more information, and to learn how to submit a nomination, check out the Fellows page on the IEEE website at: http://www.ieee.org/web/membership/fellows/index.html

Douglas Baney
Agilent Technologies, Santa Clara, CA, U.S.A.
for contributions in the field of optical measurement and sensing

Paul Berger
The Ohio State University, Columbus, OH, U.S.A.
for contributions to the understanding, development, and fabrication of silicone-based resonant interband tunneling devices and circuits

Pierre Berini
University of Ottawa, School of Information Technology and Eng., Ottawa, Canada
for contributions to surface plasmon photonics

Jin-Xing Cai
Tyco Telecommunications, Eatontown, NJ, U.S.A.
for contributions to long-haul fiber optic transmission

Naresh Chand
BAE Systems, Wayne, NJ, U.S.A.
for contributions to semiconductor lasers and optical communication systems

Jen-Inn Chyi
National Central University, Jhong-Li, Taiwan
for contributions to III-V compound semiconductor optoelectronic devices

John Dudley
University of Franche-Comte/CNRS, Besancon, Franche-Comte, France
for contributions to ultrafast optics and supercontinuum generation in photonic crystal fiber

Shanhui Fan
Stanford University, Stanford, CA, U.S.A.
for contributions to nanophotonics

Mark Itzler
Princeton Lightwave Inc., Princeton, NJ, U.S.A.
for leadership in avalanche photodiode technologies

Frederick Kish
Infinera Corporation, Sunnyvale, CA, U.S.A.
for development and commercialization of high-efficiency transparent-substrate AlGaInP light-emitting diode and monolithic large-scale InP photonic integrated circuits

Kelin Kuhn
Intel Corporation, Hillsboro, OR, U.S.A.
for contributions to high performance complementary metal-oxide mechanical system device technology for microprocessors

Luke Mawst
University of Wisconsin-Madison, Madison, WI, U.S.A.
for contributions to semiconductor lasers

Daniel Mittleman
William Marsh Rice University, Houston, TX, U.S.A.
for contributions to terahertz radiation imaging, sensing, and spectroscopy

Paul Morton
Morton Photonics Incorporated, West Friendship, MD, U.S.A.
for contributions to optical transmitters

Peter Moulton
Q-Peak Inc., Bedford, MA, U.S.A.
for contributions to development of laser and nonlinear optics technology, including the invention of the Ti:sapphire laser

Evgenii Narimanov
Purdue University, West Lafayette, IN, U.S.A.
for contributions to nanophotonics and microlasers

Robert Puers
Katholieke Universiteit Leuven, Leuven, Belgium
for contributions to implantable microelectromechanical systems

Johann Reithmaier
University of Kassel, Kassel, Germany
for research in active semiconductor nanostructures

Edward Sargent
University of Toronto, Toronto, ON, Canada
for contributions to colloidal quantum dots optoelectronic devices

Rodney Waterhouse
Pharad, LLC., Glen Burnie, MD, U.S.A.
for contributions to microwave photonic systems and printed antennas

Alice White
Alcatel-Lucent, Murray Hill, NJ, U.S.A.
for leadership in development and commercialization of integrated silicon optical components for communication networks

Call for Nominations Reminder!

IEEE PHOTONICS SOCIETY 2011 Award

The deadline for submitting nominations for the following awards is APRIL 30:

William Streifer Scientific Achievement Award
Engineering Achievement Award
Aron Kressel Award and
Distinguished Service Award

Send nomination information with supporting material to:
IEEE Photonics Society Awards Committee;
445 Hoes Lane, Piscataway, NJ 08854.
Fax: +1 732-562-8434
Email: PhotonicsAwards@ieee.org

A list of previous winners, awards information and nomination forms are available on the Photonics Society web site: www.PhotonicsSociety.org under the "Awards" tab.

The **William Streifer Scientific Achievement Award** is given to recognize an exceptional single scientific contribution that has had a significant impact in the field of lasers and electro-optics in the past 10 years. It may be given to an individual or to 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 **Engineering Achievement Award** is given to recognize an exceptional engineering contribution that has had a significant impact on the development of laser or electro-optic technology within the past 10 years. It may be given to an individual or to 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 **Aron Kressel Award** is given to recognize those individuals who have made important contributions to opto-electronics 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 last 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 **Distinguished Service Award** was established to recognize an exceptional individual contribution of service which 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.

Petition for Candidates for Election to the Photonics Society Board of Governors

Petitions for candidates for the next Photonics Society Board of Governors election must be received by the Photonics Society Executive Office no later than April 1, 2011. The Petition must bear the signatures of one percent of the members of Photonics Society as of January 1, 2011, and an indication by the candidate of his/her willingness to serve if elected. Printed name, signature and IEEE member number are required for all individuals signing the petition.

Nominations for IEEE Medals and Recognitions

The IEEE Awards Program provides peer recognition to technical professionals whose exceptional achievements and outstanding contributions have made a lasting impact on technology, society, and the engineering profession.

The IEEE Photonics Society members may be particularly interested in the following IEEE Medals and Recognitions, whose nomination deadlines are 1 July 2011. The awards typically consist of a medal, certificate and honorarium and are presented at the distinguished IEEE Honors Ceremony.

- **IEEE Medal of Honor**, for an exceptional contribution or an extraordinary career in the IEEE fields of interest.
- **IEEE Founders Medal**, for outstanding contributions in the leadership, planning, and administration of affairs of great value to the electrical and electronics engineering profession.
- **IEEE James H. Mulligan, Jr. Education Medal**, for a career of outstanding contributions to education in the fields of interest of IEEE.
- **IEEE Jun-ichi Nishizawa Medal**, for outstanding contributions to material and device science and technology, including practical application.
- **IEEE/RSE (Royal Society of Edinburgh) Wolfson James Clerk Maxwell Award**, for groundbreaking contributions that have had an exceptional impact on the development of electronics and electrical engineering or related fields.
- **IEEE Medal for Innovations in Healthcare Technology**, for outstanding contributions and/or innovations in engineering within the fields of medicine, biology and healthcare technology.
- **IEEE Edison Medal**, for a career of meritorious achievement in electrical science, electrical engineering or the electrical arts.
- **IEEE Jack S. Kilby Signal Processing Medal**, for outstanding achievements in signal processing.
- **IEEE Service Awards**
- **IEEE Corporate Recognition Awards**
- **IEEE Honorary Membership**

Awards presented by the IEEE Board of Directors fall into several categories: The Medal of Honor, Medals, Technical Field Awards, Corporate Recognitions, Service Awards, and Prize Papers. The IEEE also recognizes outstanding individuals through a special membership category: IEEE Honorary Member.

Nominations are initiated by members and the public, and then reviewed by a panel of peers. Their recommendations are submitted to the IEEE Awards Board prior to final approval by the IEEE Board of Directors.

For nomination guidelines and forms, visit http://www.ieee.org/awards. Questions? Contact IEEE Awards Activities, 445 Hoes Lane, Piscataway, NJ 08854 USA; tel.: +1 732 562 3844; fax: +1 732 981 9019; e-mail: awards@ieee.org.

Complete List of IEEE Medals and Recognitions

IEEE Medal of Honor, for an exceptional contribution or an extraordinary career in the IEEE fields of interest.

IEEE Edison Medal, for a career of meritorious achievement in electrical science, electrical engineering or the electrical arts.

IEEE Founders Medal, for outstanding contributions in the leadership, planning, and administration of affairs of great value to the electrical and electronics engineering profession.

IEEE James H. Mulligan, Jr. Education Medal, for a career of outstanding contributions to education in the fields of interest of IEEE.

IEEE Alexander Graham Bell Medal, for exceptional contributions to the advancement of communications sciences and engineering.

IEEE Simon Ramo Medal, for exceptional achievement in systems engineering and systems science.

IEEE Medal for Environmental and Safety Technologies, for outstanding accomplishments in the application of technology in the fields of interest of IEEE that improve the environment and/or public safety.

IEEE Medal for Innovations in Healthcare Technology, for outstanding contributions and/or innovations in engineering within the fields of medicine, biology and healthcare technology.

IEEE Medal in Power Engineering, for outstanding contributions to the technology associated with the generation, transmission, distribution, application and utilization of electric power for the betterment of society.

IEEE Richard W. Hamming Medal, for exceptional contributions to information sciences, systems and technology.

IEEE John von Neumann Medal, for outstanding achievements in computer-related science and technology.

IEEE Jack S. Kilby Signal Processing Medal, for outstanding achievements in signal processing.

IEEE Jun-ichi Nishizawa Medal, for outstanding contributions to material and device science and technology, including practical application.

IEEE Dennis J. Picard Medal for Radar Technologies and Applications, for outstanding accomplishments in advancing the fields of radar technologies and their applications.

IEEE Robert N. Noyce Medal, for exceptional contributions to the microelectronics industry.

IEEE/RSE (Royal Society of Edinburgh) Wolfson James Clerk Maxwell Award, for groundbreaking contributions that have had an exceptional impact on the development of electronics and electrical engineering or related fields.

IEEE Honorary Membership, awarded by the IEEE Board of Directors to individuals who have rendered meritorious service to humanity in the technical fields of interest of the IEEE and who are not members of IEEE.

IEEE Service Awards

- **IEEE Haraden Pratt Award**, for outstanding service to IEEE and presented to IEEE members.
- **IEEE Richard M. Emberson Award**, for distinguished service to the development, viability, advancement and pursuit of the technical objectives of the IEEE, and given to IEEE members.

IEEE Corporate Recognitions

- **IEEE Corporate Innovation Recognition**, for outstanding and exemplary contributions by an industrial entity, governmental or academic organization, or other corporate body, which have resulted in major advancements in electrotechnology.
- **IEEE Ernst Weber Engineering Leadership Recognition**, for exceptional managerial leadership in the fields of interest of the IEEE.

News (cont'd)

IEEE Prize Paper/Scholarship Awards

- **IEEE W.R.G. Baker Award**, for the most outstanding paper reporting original work published in an IEEE archival publications.
- **IEEE Donald G. Fink Award**, for the outstanding survey, review, or tutorial paper in any of the IEEE transactions, journals, magazines or proceedings.
- **IEEE Life Members Graduate Study Fellowship**, awarded to a first year, full-time graduate student for work in the area of electrical engineering, at an engineering school/program of recognized standing worldwide.
- **The Charles LeGeyt Fortescue Graduate Scholarship**, awarded to a beginning graduate student every year for one year of full time graduate work in electrical engineering.

Membership Section

Benefits of IEEE Senior Membership

There are many benefits to becoming an IEEE Senior Member:

- The professional recognition of your peers for technical and professional excellence
- An attractive fine wood and bronze engraved Senior Member plaque to proudly display.
- Up to $25 gift certificate toward one new Society membership.
- A letter of commendation to your employer on the achievement of Senior member grade (upon the request of the newly elected Senior Member.)
- Announcement of elevation in Section/Society and/or local newsletters, newspapers and notices.
- Eligibility to hold executive IEEE volunteer positions.
- Can serve as Reference for Senior Member applicants.
- Invited to be on the panel to review Senior Member applications.

The requirements to qualify for Senior Member elevation are a candidate shall be an engineer, scientist, educator, technical executive or originator in IEEE-designated fields. The candidate shall have been in professional practice for at least ten years and shall have shown significant performance over a period of at least five of those years."

To apply, the Senior Member application form is available in 3 formats: Online, downloadable, and electronic version. For more information or to apply for Senior Membership, please see the IEEE Senior Member Program website: http://www.ieee.org/organizations/rab/md/smprogram.html

New Senior Members

The following individuals were elevated to Senior Membership Grade thru November-December:

Randy A. Bartels
Frank Bucholtz
Shoou Jinn Chang
Chung-Cheng Chang
Kin Kee Chow
Giuseppe Coppola
J. Lynn Davis
Eduardo Marcelo De Posada
Jeffrey T. Glass
Atsufumi Hirohata
Kyu-Pyung Hwang
Jungsang Kim
Bishnu P. Pal
Mohammad S. Sharawi
Michael G. Taylor
Hirohito Yamada
Xiaohui Yang
Yong Kee Yeo
Tomoyuki Yoshie
Guomin Yu
Fan Zhang
Donghui Zhao

2010 IEEE Photonics Society Awards and Recognitions

James Coleman, Photonics Society President, recognized the recipients of the 2010 Photonics Society awards and several of our volunteers for their service to the Society. The awards were presented during the Awards Banquet at the IEEE Photonics Society Annual Meeting in Denver, Colorado, USA.

The William Streifer Scientific Achievement Award was presented to Dieter Bimberg, "for demonstration of quantum dot lasers and pioneering contributions to semiconductor nanophotonics."

IEEE Photonics Society Fellow plaque was presented to Carmen Menoni in recognition of her achievement to IEEE Fellow grade.

Wood-Hi Cheng received the Engineering Achievement Award, "for design, development and commercialization compact solid-state laser modules."

The Distinguished Service Award was presented to Chennupati Jagadish, "for dedicated service to the Photonics Society in diverse areas, including exceptional contributions to membership activities in Asia, and significant contributions to conferences and publications."

James Coleman recognized John Cartledge, John Dudley and Prem Kumar who completed their terms as Photonics Society Distinguished Lecturer.

Janet Jackel, Ton Koonen, Jerry Meyer, and Peter Winzer completed their terms as elected members of the Photonics Society Board of Governors.

Steven P. DenBaars & James S. Speck joint recipients received the Aron Kressel Award, "for pioneering work in the development of high-efficiency nonpolar and semipolar nitride-based materials and devices for solid state lighting."

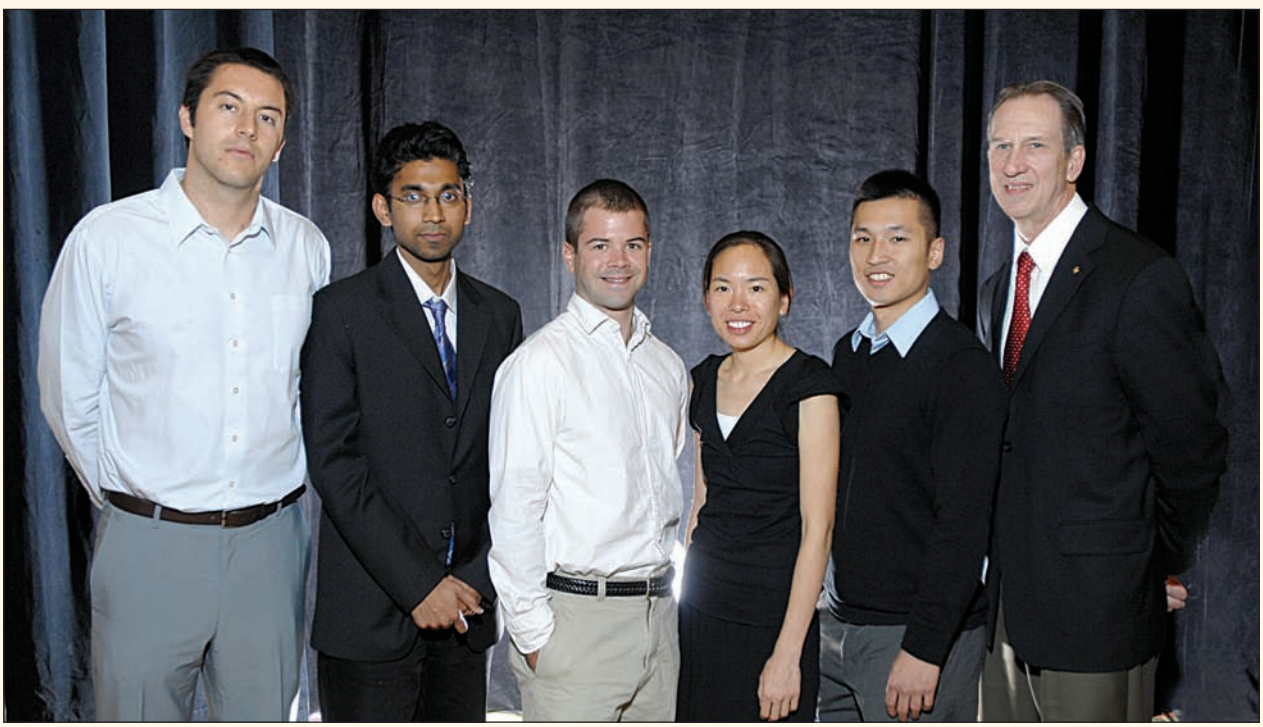
James Coleman recognized Amr Helmy for his service to the Photonics Society as VP of Membership.

The Chapter of the Year award was presented to the Hong Kong Chapter. The Italy Chapter was awarded the Most Improved Chapter, the award for Largest Membership Increase was awarded to the Singapore Chapter, the Most Innovative Chapter was presented to Thailand Chapter, and the Senior Member Initiative Award was presented to the Phoenix Chapter.

Chapter of the Year Award, Hong Kong Chapter.

Most Improved Award, Italy Chapter.

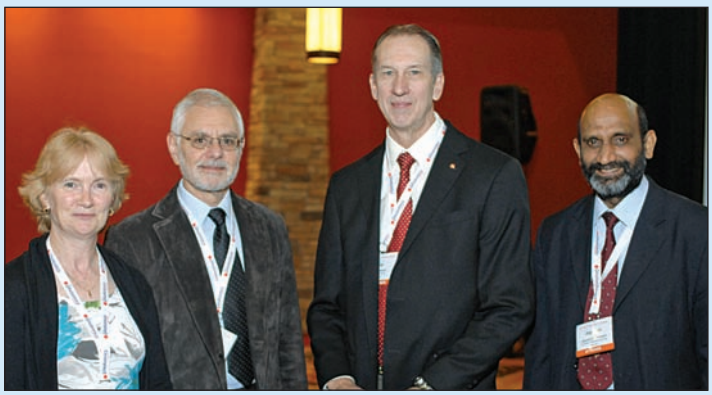
The Graduate Student Fellowship recipients.



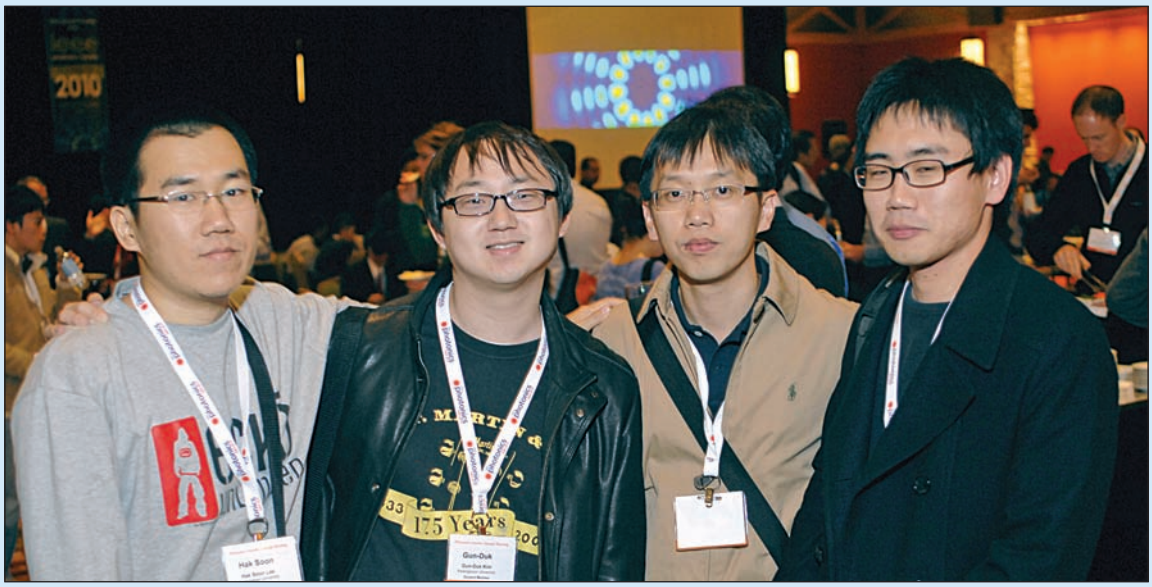
The Best Student Paper Award recipients.

The Photonics Society Staff at the 23rd Photonics Society Annual Meeting in Denver, Colorado, USA.

Photos from the 23rd Photonics Society Annual Meeting in Denver, Colorado, USA



Photos from the 23rd Photonics Society Annual Meeting in Denver, Colorado, USA



2011 Photonics Society Conference Calendar

OFC/NFOEC March 6 – 10, 2011
Optical Fiber Communication Conference and Exposition (OFC)
National Fiber Optic Engineers Conference (NFOEC)
Los Angeles Convention Center
Los Angeles, California
www.ofcnfoec.org/

CLEO May 1 – 6, 2011
The Conference on Lasers and Electro-Optics
Baltimore Convention Center
Baltimore, Maryland
www.cleoconference.org/

IEEE Sarnoff Symposium May 2 – 4, 2011
Sarnoff Symposium
Nassau Inn
Princeton, New Jersey
www.sarnoffsymposium.org

HSD May 8 – 11
22nd Annual Workshop on Interconnections within High Speed Digital Systems
Eldorado Hotel & Spa
Santa Fe, New Mexico
www.PhotonicsConferences.org/HSD2011

ICSOS May 11 – 13, 2011
IEEE International Conference on Space Optical Systems and Applications
Le Merigot Marriott
Santa Monica, California
http://icsos2011.nict.go.jp/

OFS21 May 15 – 19, 2011
21st International Conference on Optical Fiber Sensors
Fairmont Chateau Laurier Hotel
Ottawa, Canada
www.OFS21.org

CTTE May 16 – 18, 2011
10th Conference on Telecommunications Internet and Media Techno-Economics
Berlin, Germany
www.ctte-conference.org

SOPO May 16 – 18, 2011
Symposium on Photonics and Optoelectronics
Wuhan, China
www.sopoconf.org/2011/Home.aspx

Conference Section (cont'd)

IP May 18 – 20, 2011
2011 ICO International Conference on Information Photonics
Ottawa Convention Center
Ottawa, Canada
www.ip2011.org

CLEO EUROPE – EQEC May 22 – 26, 2011
The European Conference on Lasers and Electro Optics
XIIth European Quantum Electronics Conference
ICM Center / New Munich Trade Fair Centre
Munich, Germany
www.cleoeurope.org/

CSW / IPRM May 22 – 26, 2011
Compound Semiconductor Week / 23rd International
Conference on Indium Phosphide and Related Materials
Maritim ProArte Hotel
Berlin, Germany
www.csw2011.org

OPEE May 27 – 29, 2011
2nd International Conference on Optics, Photonics and Energy Engineering
Jade Palace Hotel
Beijing, China
www.opee2011.net

NOMA June 5 – 11, 2011
10th Mediterranean Workshop and Topical Meeting
"Novel Optical Materials and Applications"
Grand Hotel San Michele
Cetraro, Italy
www.fis.unnical.it/NOMA

BioPhotonics June 8 – 10, 2011
International Workshop on BioPhotonics
Santa Elisabetta Congress Center, Parma University
Parma , Italy
http://biophotonics.tlc.unipr.it/

PVSC June 19 – 24, 2011
37th IEEE Photovoltaic Specialists Conference
Washington State Convention Center
Seattle, Washington
http://www.ieee-pvsc.org/PVSC37/

ISOM/ODS June 26 – 30, 2011
The Joint International Symposium on
Optical Memory & Optical Data Storage Topical Meeting
Kauai Hawaii Resort and Beach Club
Lihue, Kauai Hawaii
www.photonicsconferences.org/ISOM-ODS2011/

Conference Section (cont'd)

OECC July 4 – 8, 2011
16th Opto-Electronics and Communications Conference
National Sun Yat-sen University
Kaohsiung, Taiwan
www.oecc2011.org

SUM July 18 – 20, 2011
Photonics Society Summer Topicals
Hilton Montreal Bonaventure
Montreal Quebec, Canada
www.PhotonicsConferences.org/SUM2011

OMN August 8 – 11, 2011
2011 International Conference on Optical MEMS & NanoPhotonics
Sevgi Gonul Auditorium, Koc University
Istanbul, Turkey
www.omn2011.org

GFP September 14 – 16, 2011
8th International Conference on Group IV Photonics
The Royal Society
London, England
www.PhotonicsConferences.org/GFP2011

ECOC September 18 – 22, 2011
2011 37th European Conference and Exhibition on Optical Communication
Palexpo
Geneva, Switzerland
www.ecoc2011.org

ICPNO September 24 – 25, 2011
2011 International Conference on Photonics, Nanotechnology and Optoelectronics
Chongqing, China
www.ier-institute.org/icpno

AVFOP October 4 – 6, 2011
Avionics, Fiber Optics and Photonics Conference
Holiday Inn on the Bay
San Diego, California
www.PhotonicsConferences.org/AVFOP2011

October 9 – 13, 2011
IEEE Photonics 2011
Marriott Crystal Gateway
Arlington, Virginia (Greater Washington D.C. Area)
www.PhotonicsConferences.org/ANNUAL2011

MWP /APMP October 18 – 21, 2011
International Topical Meeting on Microwave Photonics
Asia-Pacific Microwave Photonics Conference
Singapore
www.mwp-2011.org

IEEE Photonics Society
Boston Chapter Presents:

Imaging Workshop

Wednesday, April 6, 13, 20, 28*, May 4, 2011, 7:00–9:30 PM (* Thursday April 28th)
Located at MIT Lincoln Laboratory – 244 Wood Street, Lexington, MA, 02420, USA

The rapid growth of innovative imaging techniques in many areas of science and engineering, such as biomedicine, materials science, astronomy, and homeland security, resulting from the application of maturing technologies in integrated optics, fiber optics, lasers, terahertz and microwave sources, detectors, and nanotechnology, requires practicing professionals to become knowledgeable about a whole new generation of imaging equipment. These imaging devices are not just optical, but range across the frequency spectrum from microwaves to x-rays, and even gamma rays. The techniques include quantum imaging, coherent or non-coherent imaging, coded aperture imaging, synthetic aperture radar, speckle imaging, dual photo-acoustic imaging, optical coherent tomography, polarization imaging, and many more. Some of these imaging techniques are well known in older narrow fields of application, but are now being reinvented and applied in a wide range of new applications. A major new aspect of today's imaging engineering is the new software and software tools available, which are able to do things thought impossible only a few years ago, and do it extremely fast. It is the aim of this workshop to introduce new ground-breaking aspects of the different key areas of imaging technology to the attendees, as well as to foster communication and collaboration among the many different fields of imaging science of the individual practicing engineers and researchers attending. To learn more about these amazing new imaging technologies, attend the Imaging Workshop and discover the latest advancements at the cutting edge of optical and non-optical imaging research from ten of the foremost researchers in these emerging fields.

Wednesday April 6, 2011	**Imaging Overview** **Prof. Bahaa E. Saleh, University of Central Florida, Orlando, FL** **Multi-Photon and Entangled-Photon Imaging and Lithography** **Prof. Malvin C. Teich, Boston University, Boston, MA**
Wednesday April 13, 2011	**Synthetic Aperture Imaging** **Dr. Tyler S. Ralston, Lawrence Livermore National Laboratory, Livermore, CA** **Optical Coherence Tomography** **Dr. Joseph Schmitt, LightLab Imaging, Inc., Westford, MA**
Wednesday April 20, 2011	**Photoacoustic Tomography: Ultrasonically Breaking through the Optical Diffusion Limit** **Prof. Lihong V. Wang, Washington University, St. Louis, MO** **Looking Around Corners: New Imaging using Time and Angle Resolved Techniques** **Prof. Ramesh Raskar, Massachusetts Institute of Technology, Cambridge, MA**
Thursday April 28, 2011	**Coded Aperture Imaging: Many Holes Make Light Work** **Dr. Richard Lanza, Massachusetts Institute of Technology, Cambridge, MA** **Principles of Optical Disc Data Storage** **Prof. Masud Mansuripur, University of Arizona, Tucson, AZ**
Wednesday May 4, 2011	**Neutrino Telescopes: Catching Images of Ghost Particles** **Prof. Tyce DeYoung, Pennsylvania State University, University Park, PA** **Computational Microscopy for Imaging the Lung** **Prof. Charles A. DiMarzio, Northeastern University, Boston, MA**

Advance registration and fee required (Open to all IEEE members as well as non-members)
$75/$85 (IEEE Member/Non-Member) early registration fee for ten 1-hour talks over 5 nights; cost includes coffee and cookies each night. Early registration deadline March 30th, 2011.

Registration form, talk abstracts, speaker's bios at http://www.bostonphotonics.org/workshops/imaging11/

For more information contact: Robert Stephenson (Robert.Stephenson@ieee.org), IEEE Photonics Society Boston Chapter Chair

El Dorado Hotel, Santa Fe, New Mexico, USA

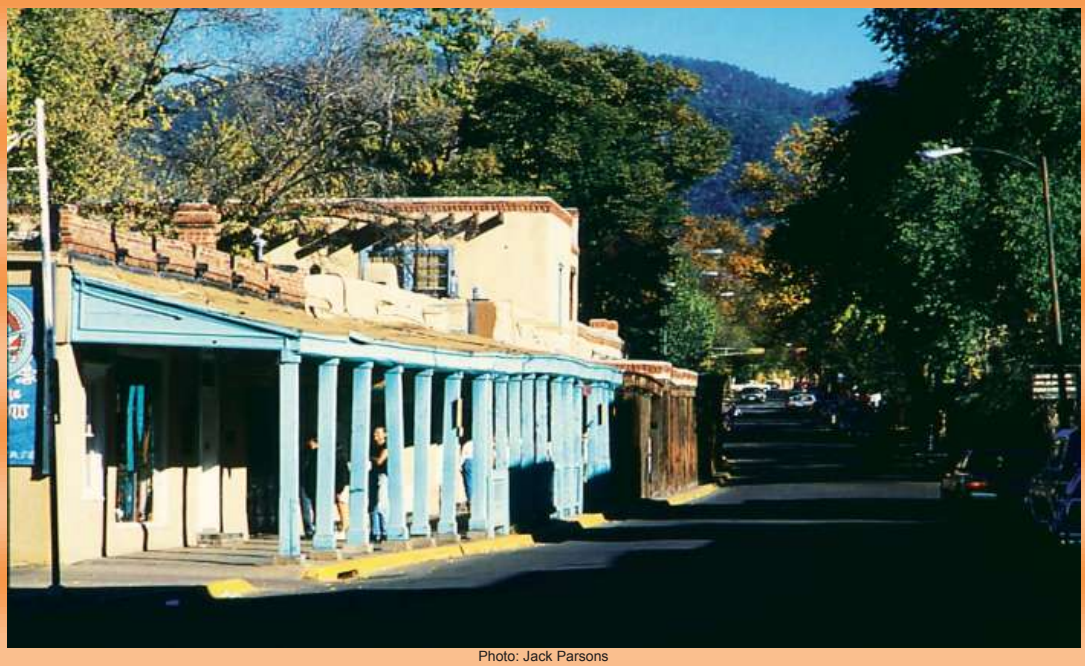


Photo: Jack Parsons

22nd Annual Workshop on Interconnections within High Speed Digital Systems

8-11 May 2011

Sponsored by the IEEE Photonics Society

For more information please visit:
www.photonicsconferences.org/HSD2011/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INTERNATIONAL SYMPOSIUM ON
OPTICAL MEMORY & OPTICAL DATA STORAGE TOPICAL MEETING
26-30 June
Kauai Marriott
Resort & Beach Club
Lihue, Kauai Hawaii USA
Paper Submission Deadline
11 February 2011
Pre-Registration Deadline
26 May 2011
2011
www.PhotonicsConferences.org
www.isom.jp
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OSA
The Optical Society
SPIE
OITDA

First International Conference in Africa on Education &Training in Optics and Photonics

ETOP 2011

8-10 July 2011-Ramada Hotel Gammarth-Tunis-Tunisia

First Announcement and Call for Papers

Abstracts deadline:15 February 2011
Notice of acceptance: 15 March 2011
Manuscript due date: 30 April 2011

Conference/Invited Speakers/Posters/Exhibition

www.esprit-prepa.com/etop/

Local Organizing Committee:

Ben Lakhdar Zohra, Cherif Rym; Dhaouadi Zoubeida; Ghalila Hassen; Lahmar Souad; Majdi Youssef; Mourad Zghal - *(STO members)*

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Vasudevan (Vengu) Lakshminarayanan (University of Waterloo, Canada)

Topics:

- Education in Optics & Photonics for all teaching levels: from primary school to post – doctoral education
- Education in optics and photonics for industry
- Training in optics: introduction to physics or science through hands on experiments in optics from kindergarten to 12th grade/high school and parental participation.
- New pedagogical methods, tools and models for education in optics & photonics
- Education and Training for inter- and multidisciplinary applications.
- Optics and Photonics skills in the global workplace

Contact:

Conference coordinator: Mourad Zghal,
telephone: 0021698521757; *email*: mourad.zghal@supcom.rnu.tn

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18 MARCH 2011
PRE-REGISTRATION DEADLINE:
17 JUNE 2011
SUMMER 2011 TOPICALS
18-20 JULY
Hilton Montreal Bonaventure
Montreal, Quebec
Canada
TOPICS:
MID INFRARED SOLID STATE LIGHT SOURCES, CHALLENGES, AND APPLICATIONS
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Animesh Jha, University of Leeds, United Kingdom
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8th International Conference on
GROUP IV PHOTONICS
GFP
2011
14-16 September
THE ROYAL SOCIETY | LONDON, ENGLAND
PROGRAM CHAIRS:
Graham Reed, University of Surrey, UK
Jean Marc Fedeli, Atomic Energy and Alternatives Energies Commission (CEA), France
PAPER SUBMISSION DEADLINE:
9 May 2011
PRE-REGISTRATION DEADLINE:
12 August 2011
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Call For Papers
Paper Submission Deadline:
6 June 2011
Pre-Registration Deadline:
2 September 2011
9-13 October 2011
IEEE PHOTONICS SOCIETY
ANNUAL MEETING
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Program Chair:
David V. Plant, McGill University, Canada
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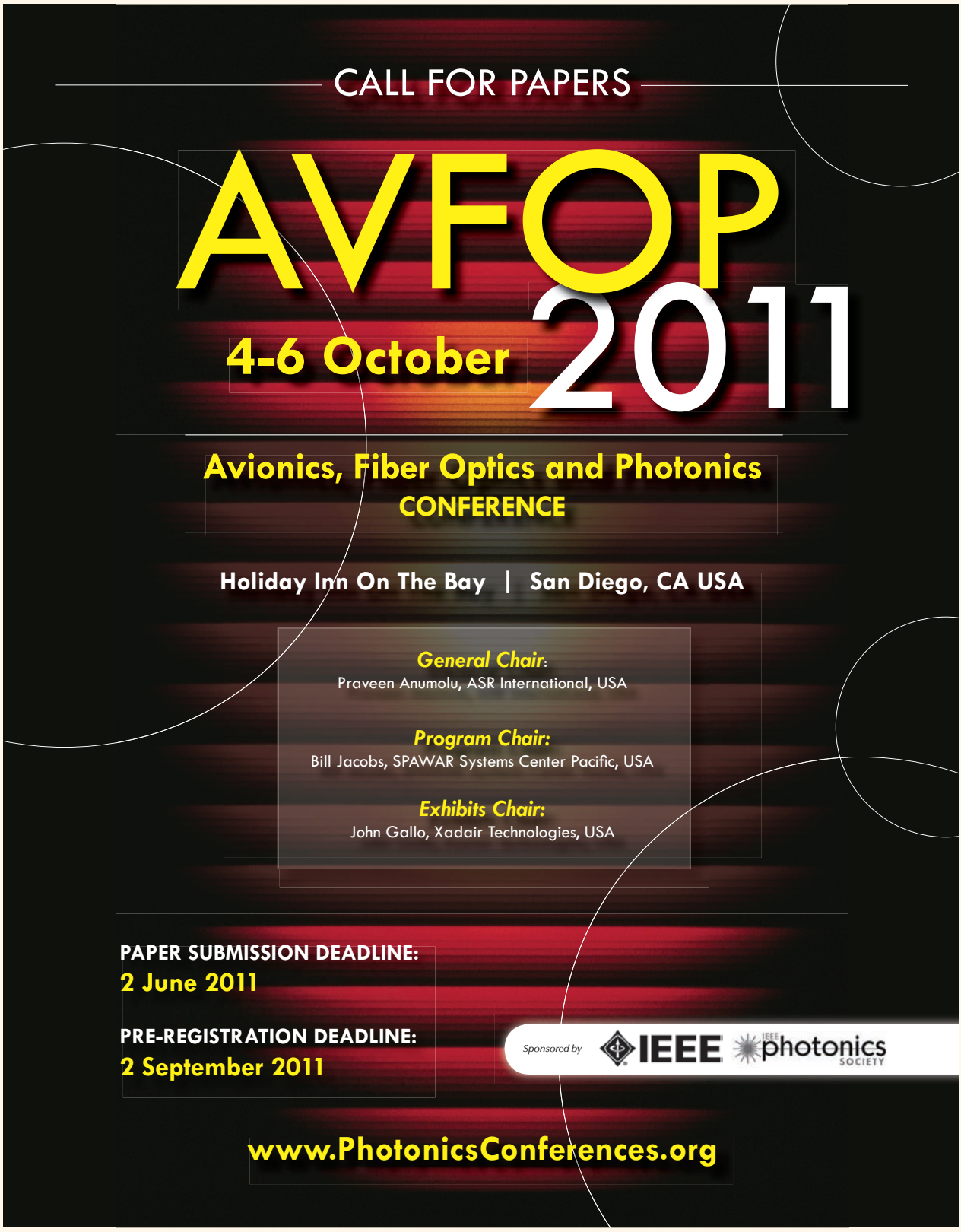
Image of a Gaussian beam spiralling in optical hyperspace courtesy of Zubin Jacob, Department of ECE, University of Alberta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AVFOP
2011
4-6 October
Avionics, Fiber Optics and Photonics
CONFERENCE
Holiday Inn On The Bay | San Diego, CA USA
General Chair:
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Program Chair:
Bill Jacobs, SPAWAR Systems Center Pacific, USA
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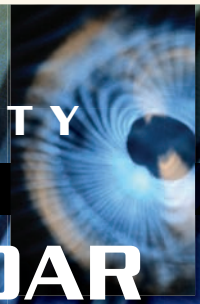
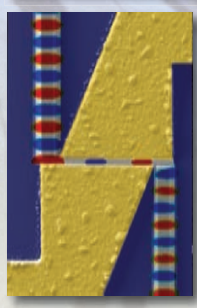
IEEE PHOTONICS SOCIETY 2011 CONFERENCE CALENDAR



HSD (22nd Workshop of Interconnections Within High Speed Digital Systems)
8-11 May 2011
Eldorado Hotel & Spa, Santa Fe, New Mexico USA
Pre-Registration Deadline: 9 April 2011
www.PhotonicsConferences.org/HSD2011

ISOM/ODS (IEEE Photonics International Symposium on Optical Memory & Optical Data Storage) / 26-30 June 2011
Kauai Marriott Resort & Beach Club, Kalapaki Beach, Lihue, HI USA
Paper Submission Deadline: 11 February 2011 • Pre-Registration Deadline: 26 May 2011
www.PhotonicsConferences.org/ISOM-ODS2011

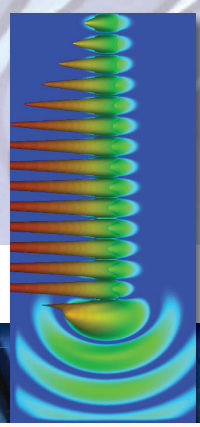


SUM (Summer Topicals) / 18-20 July 2011
Hilton Montreal Bonaventure, Montreal, Quebec
Paper Submission Deadline: 18 March 2011 • Pre-Registration Deadline: 17 June 2011
www.PhotonicsConferences.org/SUM2011

GFP (8th International Conference on Group IV Photonics)
14-16 September 2011
The Royal Society, London, United Kingdom
Paper Submission Deadline: 9 May 2011 • Pre-Registration Deadline: 12 August 2011
www.PhotonicsConferences.org/GFP2011

AVFOP (Avionics, Fiber-Optics and Photonics Technology Conference)
4-6 October 2011
Holiday Inn on the Bay, San Diego, California USA
Paper Submission Deadline: 2 June 2011 • Pre-Registration Deadline: 2 September 2011
www.PhotonicsConferences.org/AVFOP2011

IEEE Photonics 2011 / 9-13 October 2011
Marriott Crystal Gateway, Arlington, Virginia USA
(Greater D.C. Metro Area)
Paper Submission Deadline: 6 June 2011
Pre-Registration Deadline: 2 September 2011
www.PhotonicsConferences.org/IEEEPhotonics2011



IEEE photonics SOCIETY

Forthcoming Events with ICO Participation

For more details: www.ico-optics.org/events.html

3–7 May
International Conference on Applications of Optics and Photonics
Braga, Portugal
Contact: Manuel Filipe Pereira da Cunha Martins Costa,
tel +351 253 604070/604320;
fax +351 253 604061;
mfcosta@fisica.uminho.pt
www.spidof.pt/aop2011

18–20 May
Information Photonics (IP 2011)
Ottawa, Canada
Contact: Pavel Cheben,
tel +1 613 9931624;
fax +1 613 9907656;
pavel.cheben@nrc.ca
www.uop.ca/communications/ip2011

7–17 June
Panamerican Advanced Studies Institute on Frontiers in Imaging Science
Bogotá, Colombia
Contact: Catalina Ramírez Gómez,
tel +57 1 316 5000 ext 14592;
cdramirezgo@unal.edu.co
http://pasi.fau.edu

8–10 July
Education and Training in Optics and Photonics (ETOP)
Carthage, Tunisia
Chair: Zohra Ben Lakhdar
Contact: Mourad Zghal,
tel +216 7185 6240;
fax +216 7185 6829;
mourad.zghal@supcom.rnu.tn
www.esprit-prepa.com/etop

11–13 July
1st EOS Topical Meeting on Photonics for Sustainable Development – Focus on the Mediterranean (PSDM 2011)
Tunis, Tunisia
Contact: Julia Dalichow,
tel +49 511 2788 155;
fax +49 511 2788 117;
dalichow@myeos.org
www.myeos.org/events/psdm2011

15–19 August
International Commission for Optics Congress (ICO-22)
Puebla, Mexico
Contact: Fernando Mendoza Santoyo,
tel +52 477 44142;
fax +52 477 441 4208;
fmendoza@cio.mx
www.cio.mx/ICO2011/1.htm

IEEE Sensors Council

CALL FOR PAPERS
IEEE Sensors Journal

Special issue on

Machine Olfaction

Across a wide range of applications there is an urgent need to rapidly detect, identify and quantify volatile compounds and complex odorant mixtures. Examples include military and law enforcement (e.g. chemical warfare agents), disaster response (e.g. toxic industrial chemicals), environmental monitoring (e.g. pollutants), and food safety (e.g. taints, bacterial spoilage). An approach towards solving these challenging sensing problems has evolved over the past thirty years that seeks inspiration from the sense of smell. The machine olfaction approach is based on the premise that fine discrimination of chemical samples can be achieved by combining an array of cross-selective solid-state gas sensors with suitable pattern recognition algorithms. The field of machine olfaction is inherently cross-disciplinary, and poses interesting problems in basic science and engineering, from materials science to artificial intelligence and neurobiology. Challenges abound and include sensing materials that are more sensitive, selective, and stable; sampling systems that can efficiently deliver analytes to the sensors; and algorithms that can extract information from noisy non-stationary sensor signals. In the pursuit of machine olfaction, much can also be informed by studying the inner workings of biological olfactory systems – both mammalian and insect.

The year 2012 is the tenth anniversary of the original special issue on machine olfaction at the IEEE Sensors Journal. During this time, the field has grown in a number of promising directions, including spectroscopic and olfactory receptor-based sensing, computational models of olfactory processing, and mobile and distributed sensing. The special issue provides a timely update on advances during the past decade (as well as a vantage point from which to evaluate the last 30 years) in the field and, more importantly, the challenges that still lie ahead. Original research contributions, tutorials and review papers are sought in areas including (but not limited to):

Sensors: olfactory receptor-based, DNA-based, nanomaterials-based, optical and spectroscopic, very-high-dimensional arrays, artificial-tongue arrays

Signal processing: chemometrics, drift compensation, calibration transfer, adaptive learning, active sensing, olfactory scene analysis

Olfactory modeling: engineering models of olfactory processing, hardware implementations

Applications: environmental monitoring, disease diagnosis, food and beverage, homeland security

Systems: Hybrid and higher-order sensing, micro-analytical systems, distributed and mobile sensing, plume tracking with mobile robots

Sampling: preconcentration, analyte separation, hyphenated techniques

Solicited and invited papers shall undergo the standard IEEE Sensors Journal peer review process. All manuscripts must be submitted on-line, via the *IEEE Manuscript Central*™, see http://sensors-ieee.manuscriptcentral.com**;** please indicate your "Manuscript Type" as "Special Issue on Machine Olfaction." Authors for this Special Issue are encouraged to **suggest names of potential reviewers** for their manuscripts in the space provided for these recommendations in *Manuscript Central.* For manuscript preparation and submission, please follow the guidelines in the *Information for Authors* at the IEEE Sensors Journal web page, http://www.ieee.org/sensors.

Deadlines:

Manuscript Submission: July 1, 2011
Notification of Acceptance: October 1, 2011
Final Manuscript due: December 1, 2011
Tentative publication date: March, 2012

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Preliminary Call for Papers

Announcing an Issue of the IEEE *JOURNAL OF SELECTED TOPICS IN QUANTUM ELECTRONICS* on Biophotonics 1

Submission Deadline: May 15, 2011

The Biophotonics field is an emerging biomedical technology that has opened up new horizons for extensive transfer of applicable state-of-the-art techniques coming from the area of quantum electronics, lasers and electro-optics to the life sciences and medicine. Recently, minimally invasive, cost-effective and rapid biophotonics techniques have been developed as potential alternatives to conventional medical methods for diagnostics, monitoring and treatment of a variety of diseases. ***IEEE Journal of Selected Topics in Quantum Electronics*** invites manuscript submissions in the area of biophotonics. The purpose of this issue of JSTQE is to highlight the recent progress and trends in developing of novel biophotonics technologies. Broad technical areas include (but are not limited to):

Advanced biophotonics diagnostic methods and systems
- Ultrahigh-resolution biophotonics imaging including cellular/intracellular, molecular, 3D endoscopic, photoacoustic, photothermal, diffuse, improved OCT, confocal and multi-photon *in-vivo* bioimaging
- Spectroscopy-based diagnostics including fluorescence, Raman, elastic scattering, evanescence-wave, near-/mid-IR spectroscopy
- Novel biophotonics sensing techniques
- Multi-modal biophotonics diagnostics

Progress in minimally-invasive biophotonics therapeutic techniques
- Photodynamic cancer therapy
- Ultrashort pulse laser tissue treatment
- Precise laser tissue manipulation/ablation in ophthalmology, dentistry, dermatology, cardiology and neurosurgery
- Novel low-level laser therapeutic techniques and light-tissue-interaction mechanisms at cellular/intracellular level
- Light-assisted neuron stimulation/growth and cellular/tissue repair

Novel approaches in nanobiophotonics
- Breaking the diffraction barrier in biophotonics nanoimaging
- Cellular/intracellular nanobiosensors
- Nanoparticle-enhanced biophotonics diagnostics and therapeutics
- Novel nanobiomaterials engineered for nanobiphotonics applications
- Biocompatibility and phototoxicity of novel nanobiomaterials

Development of novel laser, fiber-optic and electro-optic biophotonics tools and devices

The Guest Editors for this issue are **Ilko Ilev**, U.S. Food and Drug Administration, USA; **Tuan Vo-Dinh**, Duke University, USA; **Stephen Boppart**, University of Illinois, USA; **Beop-Min Kim**, Korea University, Korea; additional Guest Editor/s: TBA

The deadline for submission of manuscripts is **May 15, 2011**; publication is scheduled for **January/February of 2012**. ***Accepted papers will be posted online in our IEEE Xplore website ideally within 6 weeks after the author has uploaded their Final Files, if there are no page proof corrections.**

Online Submission is Mandatory at: http://mc.manuscriptcentral.com/jstqe-pho Please select the Journal of Selected Topics Of Quantum Electronics Journal from the drop down menu. Contributed papers should be up to eight pages in length, and invited up to 12 pages. Beyond that, a charge of $220 per page apply. All submissions will be reviewed in accordance with the normal procedures of the Journal.

For inquiries for this Special Issue, please contact:
***JSTQE* Editorial Office - Chin Tan Lutz**
IEEE – Photonics Society, 445 Hoes Lane, Piscataway, NJ 08854, U.S.A.
Phone: 732-465-5813, Email: c.tanlutz@ieee.org

The following supporting documents are required during manuscript submission:

1).doc manuscript (double columned, 12 pages for an Invited Paper, 8 pages for a Contributed paper). Bios of ALL authors are mandatory, photos are optional. You may find the Tools for Authors link useful: http://www.ieee.org/web/publications/authors/transjnl/index.html

2) Completed the IEEE Copyright Form. Copy and paste the link below:
http://www.ieee.org/web/publications/rights/copyrightmain.html

3) Completed Color Agreement/decline form. Please email c.tan-yan@ieee.org to request for this form.

4) .doc list of ALL Authors FULL Contact information as stated below:
Last name (Family name): /First name: Suffix (Dr/Prof./Ms./Mr):/Affiliation:/ Dept: / Address:/ Telephone:/ Fax:/ Email:/ Alternative Email:

ADVERTISER'S INDEX

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Photonics Society Mission Statement

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

- providing opportunities for information exchange, continuing education, and professional growth;
- 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.

Photonics Society Field of Interest

The Field of Interest of the Society shall be lasers, optical devices, optical fibers, and associated lightwave technology and their applications in systems and subsystems in which quantum electronic devices are key elements. The Society is concerned with the research, development, design, manufacture, and applications of materials, devices and systems, and with the various scientific and technological activities which contribute to the useful expansion of the field of quantum electronics and applications.

The Society shall aid in promoting close cooperation with other IEEE groups and societies in the form of joint publications, sponsorship of meetings, and other forms of information exchange. Appropriate cooperative efforts will also be undertaken with non-IEEE societies.

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IEEE Journal of Photovoltaics

Electronic Version FREE to EDS Members

Journal of Photovoltaics

The IEEE Journal of Photovoltaics is a peer-reviewed, archival publication reporting original and significant research to advance the field of photovoltaics (PV).

Please submit your manuscripts for the J-PV at http://eds.ieee.org/jpv.html. The inaugural edition of the Journal of Photovoltaics will be released in the summer of 2011.

The PV field is diverse in its science base ranging from semiconductor and PV device physics to optics and the materials sciences. The journal publishes articles that connect this science base to PV science and technology. The intent is to publish original research results that are of primary interest to the photovoltaic specialist.

For more information and to inquire about becoming a J-PV editor or reviewer, please contact the EDS Executive Office at eds@ieee.org.

For future updates, please visit:
http://eds.ieee.org/jpv.html

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Polarization Related Development Tools for 40 G/100 G Systems

PDL Source/Emulator:

- PDL tolerance test
- PDL tracking speed test
- PDL response time test

PMD Source/Emulator:

- PMD tolerance test
- PMD tracking speed test
- PMD response time test

Polarization Synthesizer:

- SOP tracking speed test
- SOP recovery time test
- SOP orthogonality test

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