Stanford University Photonics Retreat (SUPR)

April 13-15, 2012

Asilomar Conference Grounds

Pacific Grove, California

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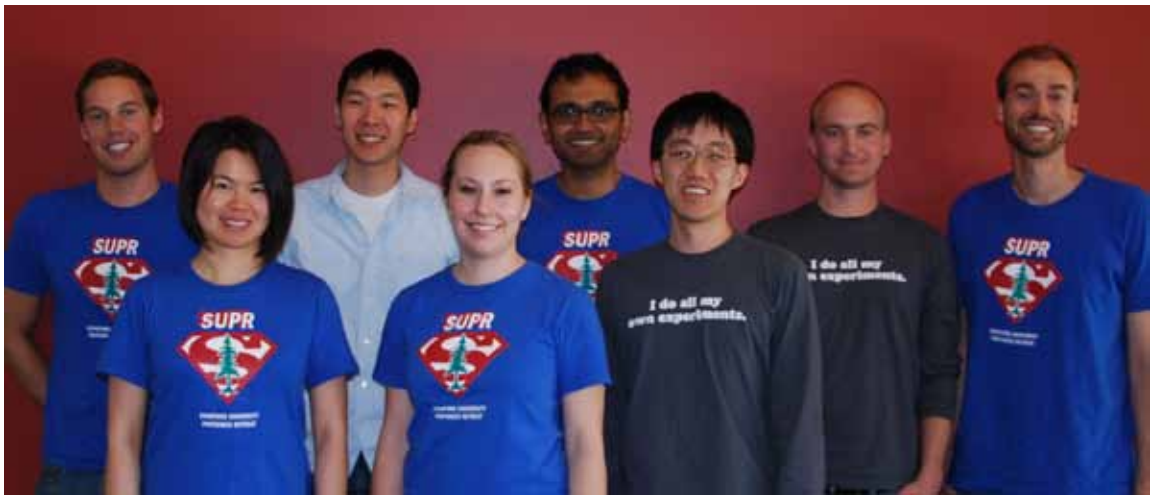
Welcome!

The Stanford Optical Society (a Student Chapter of OSA & SPIE) and the Stanford Photonics Research Center (SPRC) are delighted to welcome you all to SUPR 2012, our fourth annual conference and retreat! We are excited to build on three previous retreats with SUPR 2012 here at the wonderful Asilomar Conference grounds.

SUPR began with the premise that an off-campus conference to bring together Stanford's diverse and dispersed photonics community was long overdue. We have organized this retreat as a way to strengthen Stanford's photonics community, promote cross-disciplinary interaction, and engage with the wider research community beyond campus. The retreat agenda includes three days and two nights filled with seminars, panels, poster sessions, workshops and social activities. We believe that hosting this retreat off campus is essential to avoid daily distractions and to create an engaging yet relaxing atmosphere, conducive to fostering collaboration and innovation.

A special welcome also goes to our many invited speakers and corporate partners. We greatly appreciate you sharing your valuable time and expertise with our community, and for your support of this retreat.

We hope everyone enjoys this weekend and finds it a fun and intellectually stimulating experience!



SUPR 2012 Organizing Committee
Aaswath Raman, Robert Chen, Ross Audet, Sam Bockenhauer, Kristen Boucher, Lana Lau, Matthew Lew, Charlie Rudy & Alok Vasudev

Financial Support

The SUPR Planning Committee would like to thank the generous support of our many partners, and their committment to the success of SUPR 2012.

We are delighted to welcome back four corporate partners again to SUPR:

SUPR Partner	infinera
Gold Level	THORLABS Newport
Silver Level	intel

We are also deeply grateful for the continued financial support of the following individuals and organizations:

Dr. Burt and Deedee McMurtry

STANFORD UNIVERSITY
VICE PROVOST FOR GRADUATE EDUCATION
SPICE Program

SPRC
STANFORD PHOTONICS RESEARCH CENTER

OSA
Optical Society of America

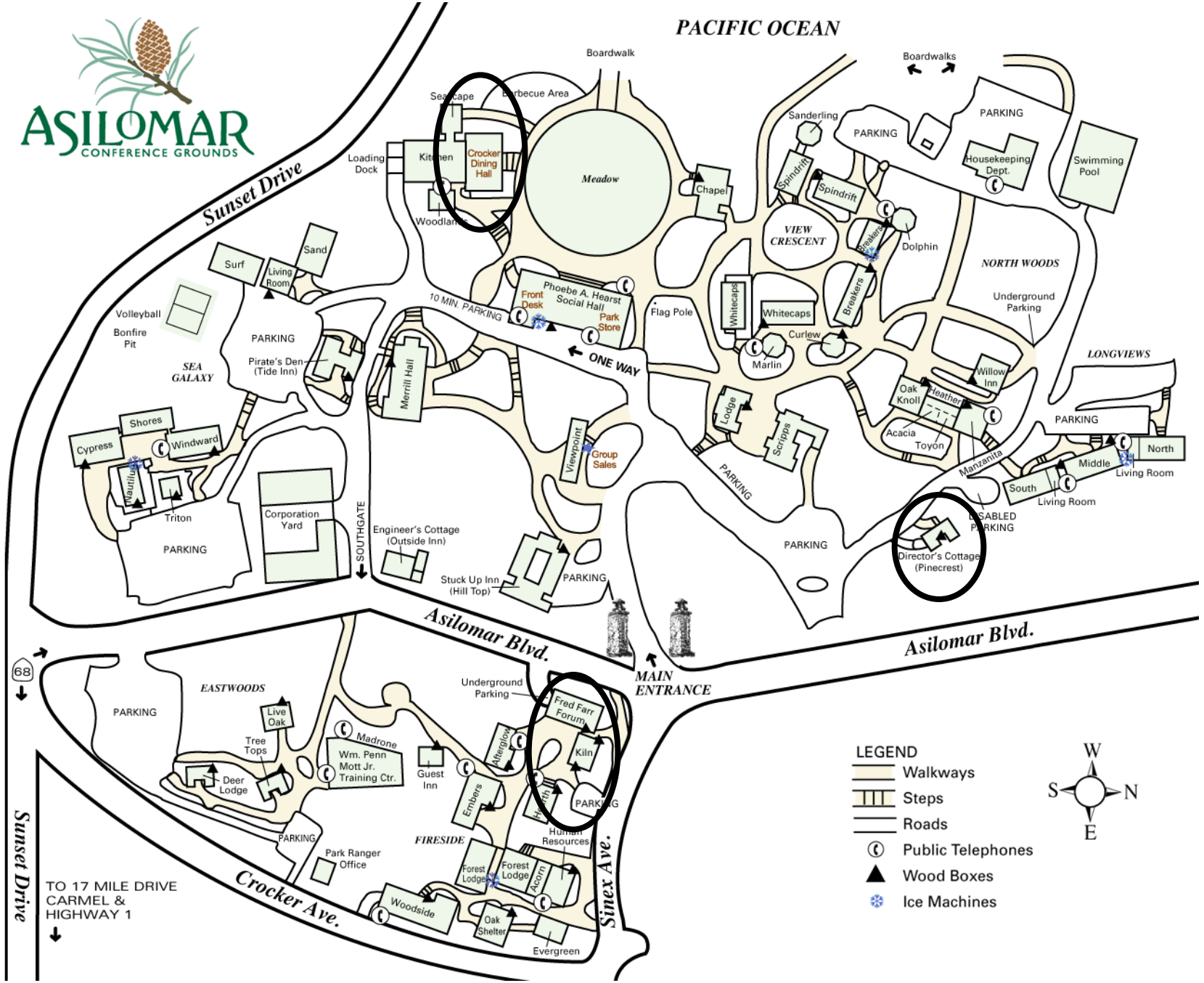
SPIE

THE THIEL FOUNDATION

STANFORD ENGINEERING

Special thanks go to the Directors of the Stanford Photonics Research Center (SPRC) for their continued support and enthusiasm for SUPR:

Dr. Thomas M. Baer, Executive Director
Sara Charbonneau-Lefort, Assistant Director
Prof. Robert L. Byer, Co-Director
Prof. Martin M. Fejer, Co-Director
Prof. David A. B. Miller, Co-Director
Dr. Gary C. Bjorklund, Consulting Director


ASILOMAR
CONFERENCE GROUNDS
PACIFIC OCEAN
Sunset Drive
Boardwalk
Boardwalks
Seascape
Barbecue Area
Loading Dock
Kitchen
Crocker Dining Hall
Meadow
Chapel
Woodlark
Sanderling
PARKING
Housekeeping Dept.
Swimming Pool
Spindrift
Spindrift
VIEW CRESCENT
Breakers
Dolphin
NORTH WOODS
Underground Parking
Surf
Sand
Living Room
Volleyball
Bonfire Pit
SEA GALAXY
PARKING
Pirate's Den (Tide Inn)
10 MIN. PARKING
Front Desk
Phoebe A. Hearst Social Hall
Park Store
Flag Pole
ONE WAY
Whitecaps
Whitecaps
Breakers
Curlew
Marlin
LONGVIEWS
Willow Inn
Oak Knoll
Heathers
Lodge
Scripps
Acacia
Toyon
Manzanita
PARKING
North
Middle
Living Room
South
Living Room
DISABLED PARKING
Director's Cottage (Pinecrest)
Merrill Hall
Viewpoint
Group Sales
Shores
Cypress
Windward
Nautilus
Triton
Corporation Yard
PARKING
SOUTHGATE
Engineer's Cottage (Outside Inn)
Stuck Up Inn (Hill Top)
PARKING
Asilomar Blvd.
Asilomar Blvd.
MAIN ENTRANCE
68
EASTWOODS
PARKING
Live Oak
Tree Tops
Madrone
Wm. Penn Mott Jr. Training Ctr.
Deer Lodge
Guest Inn
Underground Parking
Fred Farr Forum
Afterglow
Kiln
Embers
Hearth
PARKING
Human Resources
FIRESIDE
Forest Lodge
Forest Lodge
Acorn
PARKING
Park Ranger Office
Woodside
Oak Shelter
Evergreen
Sinex Ave.
Crocker Ave.
Sunset Drive
TO 17 MILE DRIVE
CARMEL &
HIGHWAY 1
LEGEND
Walkways
Steps
Roads
Public Telephones
Wood Boxes
Ice Machines
W
S
N
E

SUPR Schedule

Friday April 13, 2012

1:30-2:00pm		Leave Stanford campus
4:00-5:00pm	*Fred Farr*	Arrive at conference center & check-in
4:00-5:00pm	*Fred Farr*	Registration
5:00-6:00pm	*Fred Farr Patio*	Welcome reception
6:00-7:00pm	*Seascape or Woodlands*	Dinner
7:00-7:10pm	*Seascape or Woodlands*	Welcoming remarks
7:10-7:20pm		Corporate partner introductions
7:20-8:10pm		Keynote: Douglas Hall (DOE/ Corning)
8:30-10:00pm	*Kiln*	Poster session I
10:00-11:00pm	*Fred Farr*	Icebreaker

Saturday April 14, 2012

7:30-9:00am	*Crocker Dining Hall*	Breakfast
9:00-9:40am	*Fred Farr*	Invited Lecture: Philip Bucksbaum
9:40-10:20am		Invited Lecture: Sindy Tang
10:20-10:30am		Coffee break
10:30-12:00pm	*Kiln*	Poster Session II
12:00-1:00pm	*Crocker Dining Hall*	Lunch
1:00-5:00pm		Social activities and break
5:00-6:00pm	*Fred Farr Patio*	Reception
6:00-7:00pm	*Seascape or Woodlands*	Dinner
7:15-8:00pm	*Fred Farr*	Keynote: Ray Beausoleil
8:00-9:30pm	*Fred Farr*	Alumni Career Panel: Moderated by Robert Byer; Seth Bank (UT Austin), Amber Bullington (LLNL), Geoff Fanning (nLight), Thomas Lee (Enphase)
9:30-10:30pm	*Fred Farr*	Post-Panel Mixer

Sunday April 10, 2011

7:30-9:00am	*Crocker Dining Hall*	Breakfast
9:00-9:45am	*Fred Farr*	Workshop: Linda Chao (Stanford OTL)
9:45-10:00am		Coffee Break
10:00-10:40am		Invited Lecture: David Miller
10:40-11:20am		Invited Lecture: Daniel Palanker
11:20-11:40am		Poster Awards & Closing Remarks
12:00-1:00pm	*Crocker Dining Hall*	Lunch and Adjourn

Organizing Committee

SUPR is a student-run and focused event that is generously supported by SPRC and our many sponsors. The SUPR Student Organizing Committee includes Ph.D. students from a variety of areas in optics, and across multiple disciplines. We are all members of the Stanford Optical Society and hold various leadership roles, including SUPR Chair (Aaswath), Chapter President (Ross), Vice-President (Lana), IONS Chair (Robert), Treasurer (Charlie), Secretary (Sam), Outreach Chair (Kristen) and Speakers Committee Member (Alok). We have met regularly since late summer in 2011 to plan, fundraise, and invite speakers to make SUPR 2012 a reality.

We hope that this photonics retreat will continue to happen on an annual basis thanks to our sponsors and a team of dedicated student volunteers. If you are interested in being involved in the Stanford Optical Society or the SUPR 2013 Planning Committee, please contact us!

More information about student leadership opportunities is available at: http://photons.stanford.edu

Stanford Optical Society

OSA SPIE

The Stanford Optical Society is a joint Optical Society (OSA)/SPIE student chapter that has become one of the largest student chapters in the world. It is also one of the most active graduate student groups on campus. With a multi-disciplinary focus, we have organized a variety of activities to bring students together for technical education, science education outreach, and networking / social events.

We began as a small society, hosting technical seminars as well as luncheon discussions. Our seminar series has grown rapidly to include highly touted speakers such as Dr. David Welch (Co–Founder and Chief Marketing and Strategy Officer of Infinera), Dr. Timothy Day (Founder and CEO of Daylight solutions), Dr. Richard Swanson (CTO of SunPower), Dr. Jim Turner (former NIST Acting Director) and Prof. Bruce Tromberg (Director of the Beckman Laser Institute).

In addition to our seminars, our recent activities include high-impact science education outreach events and collaborative events with neighboring chapters and optics groups. These events include participation in the Stanford SPLASH program, Girls Go Tech, Expanding Your Horizons, the Maker Faire, the Frontiers in Optics Educator's Day teacher training event, and an international photography competition for middle school and high school students.

Moreover, since 2006 we have held, to great response, collaborative events with UC Berkeley's Student OSA/SPIE chapter. These popular events featured a keynote speaker, laboratory tours (e.g. the National Ignition Facility, SLAC National Accelerator Laboratory, Lawrence Berkeley Lab's Advanced Light Source and the Lawrence Berkeley Lab's Molecular Foundry), poster sessions, and mixers with faculty.

More information about us and our upcoming events is available at: http://photons.stanford.edu

SPRC

The Stanford Photonics Research Center (SPRC) builds strategic partnerships between the Stanford University photonics community and corporations and organizations active in photonics or employing lasers and optical technologies in their research and product development activities. Member companies gain facilitated access to Stanford faculty, students and researchers by participating in SPRC events, supporting and collaborating on specific research projects, mentoring students and visiting research labs.

Member benefits also include priority alerting for Stanford photonics invention disclosures. SPRC promotes member company recruitment of Stanford students, and facilitates research interactions with Stanford Ph.D. students, faculty, and other researchers. In turn, Stanford students establish research connections with scientific experts and business leaders in the photonics industry that continue beyond their Stanford experience.

SPRC faculty and student members belong to one or more working groups which are aligned with their research interests. These working groups cover a wide range of research areas and technologies, including:

Solar Cell Technologies	High Power Laser Sources	Photonic sensors
Information Technology	Ophtalmology	Medical Diagnostics
Telecommunications	Consumer Photonics & Electronics	Aerospace
Neuroscience	Quantum Information Science	Automotive
Microscopy & Molecular Imaging	Nanophotonics	Entrepreneurship

SPRC corporate members interact directly with faculty working groups conducting research in areas most directly related to company interests.

For more information, please visit: http://photonics.stanford.edu

BUSINESS BRIEF

infinera
what THE NETWORK will be

INFINERA: INNOVATION IN THE OPTICAL LAYER

Infinera changed the world of optical telecommunications when we pioneered "Digital Optical Networking", a new approach enabled by photonic integration. The Infinera portfolio combines DWDM scalability, digital bandwidth management and protection and GMPLS-based networking intelligence. Since 2004 the Infinera DTN™ has carried live traffic in long-haul, regional and metro core networks around the world. The recently announced DTN-X provides the next step function in transport network economics with scale, efficiency and simplicity.

Integration is the key The key concept for Infinera is integration. This starts with our photonic integrated circuit, or PIC, where dozens of complex optical components are integrated onto a single tiny chip. With 500 Gb/s of capacity concentrated in that PIC, it now becomes practical to integrate an electronic switching chip to allow this capacity to be managed using a technique we call Bandwidth Virtualization. The next stage of integration is to provide a Generalized Multi-Protocol Label Switching (GMPLS) dynamic control plane that allows many of the Bandwidth Virtualization functions to be managed automatically, while offering full control and visibility to the network operator. Finally, we include an Optical Express capability so that bulk, bypass traffic can be sent through a DTN, enabling our customers to choose the most effective configuration to optimize CapEx and OpEx in their networks.

Rapid Network Deployment Infinera customers tell us that entirely new optical network capacity can be rolled out approximately four times more quickly with an Infinera solution than with a conventional optical network. Engineering, Furnishing and Installation (EF&I) of a high capacity, pan-European network was completed in only 13 weeks, compared to the nine months for which the customers had budgeted. A UK national optical network was deployed in only eight weeks. With a Digital Optical Network, the protracted and complex planning required by analog equipment can be avoided, and installing an individual Infinera - platform from scratch takes less than an hour.

Rapid Service Activation

Once the network backbone is in place, services can be turned up in seconds because the backbone wavelengths in a Digital Optical Network are already lit and waiting to be assigned to a service demand. Service activation is now totally deterministic, and that means we can use an automated protocol—GMPLS—to perform the entire provisioning process in a "point and click" fashion. It is possible to override this process and configure services by hand, but GMPLS will still provide you with a dynamic inventory management and topology discovery capability. The network becomes the database of record, always up to date. Unforecasted service demands are a serious issue for the transmission industry because the lead times for ordering conventional optical transponders can be so long, and the huge variety of transponders means that keeping a stock is impractical. However, the Digital Optical Network does not use transponders. Infinera's modules, the Tributary Adapter Module(TAM) for DTN and the Tributary Interface Module(TIM) for DTN-X) cover Gigabit Ethernet to 40G and 100GE. We have built a program we call "Just in TAM", in which we commit to deliver TAMs within 10 days of receiving an order, even including our 40G TAM.

Low Latency Transport

DCF fiber and some Electronic Dispersion Compensation implementations add significant transmission latency to the optical signal. For applications such

Our Business

- Optical transport systems based on unique photonic integrated circuits
- Deployed worldwide in long-haul and metro dense wave division multiplexing (DWDM) network
- #1 market share in combined terrestrial long-haul WDM transport and ROADM equipment in North America, #4 worldwide
- Customers include carriers, cable network operators, internet content providers, government agencies, and research and education networks

Benefits at a Glance

- Simple and fast roll out of new optical network capacity
- Rapid revenue from new services
- Simplified network engineering and operations
- Full control and visibility for network operator
- A flexible optical transport layer that integrates effectively with modern IP and Ethernet services
- Low-Latency Transport services for all services that demand the lowest possible end to end delays

Our Company

- NASDAQ: INFN
- Strong balance sheet: $250M cash, no debt
- Headquartered in Sunnyvale, California
- Offices worldwide with R&D centers in California, Maryland, and Pennsylvania
- 1100+ employees focused on optical transport innovation

as automated financial trading that require the lowest possible end-to-end delays, Infinera offers a unique dispersion correction capability. The Infinera Low-Latency Transport solution is now being deployed in specialist service applications around the world.

Rapid Fault Finding

Sooner or later a fault will crop up on any network. At that point the network operator needs the right information as quickly as possible in order to isolate and fix the problem in a timely fashion. In an all-optical network, digital information is only available at the ingress and egress points. Once the traffic disappears into the core, only analog measurements are available. But in a Digital Optical Network, full digital Performance Monitoring and OAM functions are available at every node. Tracking a fault can be as easy as a few clicks on the NMS screen. Digital service protection is available, of course, but the Digital Optical Network also allows shared restoration to be offered using GMPLS and OSPF. This support for both 50ms protection and bandwidth-efficient GMPLS restoration allows operators to deliver higher levels of customer satisfaction at dramatically lower costs.

Infinera Products

Infinera delivers its benefits with a complete set of hardware, software, and services products for network operators, including:

Infinera DTN-X: The industry's only multi-terabit packet-optical transport (P-OTN) network platform based on the groundbreaking 500 Gb/s photonic integrated circuits. The DTN-X provides transport (DWDM) and switching (OTN, MPLS) functions combined in a one platform supporting services from 1G to 100G

Infinera DTN: The industry's first, optical networking system based on photonic integrated circuits. The Infinera DTN provides DWDM capacity, ODU1 switching, and service interfaces from 40G to 155M.

Infinera ATN: The metro edge platform is a state-of-the-art CWDM/DWDM aggregation and transport solution designed with up to 40 wavelengths of 10 Gb/s scalability. The ATN platform supports multiple levels of integration with the Infinera DTN platform, and can also be used as a standalone WDM system.

Infinera Line System (ILS): ILS is a modular line system supporting reach between nodes up to 3800 km on DTN and DTN-X. ILS includes Raman and EDFA amplification options and provides industry-leading 25GHz channel spacing.

Infinera IQ Network Operating System: The IQ NOS includes GMPLS intelligence for rapid, point and click provisioning. IQ also includes the automation and protection features which make the DTN and ILS perfect platforms for flexible, fast delivery of reliable and differentiated bandwidth.

Infinera Management Suite: The Infinera Management Suite provides applications and interfaces to manage your Infinera Digital Optical Network. It consists of six major components that can be purchased individually, or as a set.

- Infinera Graphical Node Manager (GNM)
- Infinera Digital Network Administrator (DNA)
- Infinera Network Planning System (NPS)
- Infinera SNMP Fault Integration Server
- Infinera CORBA Integration SDK (CIS)
- Infinera TL-1 Interface (TL-1)

Infinera Submarine Solution: By implementing Infinera's latest photonic integrated circuit technology and a new compact solution for full-band dispersion compensation, the Infinera Submarine Solution enables submarine network operators to increase capacity on their networks while taking advantage of all the operational benefits of Infinera's digital architecture.

Infinera Services Offerings: We offer a broad set of service capabilities to help you design, deploy, and manage your network. Our QuickSwitch™ capability helps you get the benefits of a Digital Optical Network with minimal time and effort. Our professional services team can custom design programs for your particular needs. See www.infinera.com for details.

Summary

At Infinera, we are redefining the very nature and structure of the optical network. It began with our introduction of the PIC, which opened up new vistas of flexibility, capacity and intelligence, allowing network operators to deliver vast amounts of bandwidth with greater ease and economy than ever before.

Our products offer simpler network engineering and operations, faster time to service, lower latency, and a more flexible optical transport layer that integrates more effectively with modern IP and Ethernet services. As a result, our customers have benefitted from cost-effective transport solutions that streamline their business processes and deliver more rapid revenue from new services.

Today our innovation continues. Buoyed by our success and fueled by our vision, we are confidently reshaping what the network is, what it can do, and ultimately, what it will be.

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Invited Speakers

Keynote Speakers

Dr. Douglas Hall

Portfolio Manager, PV Manufacturing Initiative,
Sunshot Initiative, *U.S. Department of Energy*

Director, Product Technology, *Corning* (2005-2010)

Doug received a bachelor's degree in physics from Occidental College, Los Angeles in 1975 and a doctorate from the University of California, Davis in 1982 while a student employee at Lawrence Livermore National Laboratory. His thesis work investigated spectral and polarization hole-burning effects of rare-earths in glass and the phenomena's impact on laser performance.

He joined Corning in 1983 as a senior research scientist. In 1986 he initiated and led Corning's research project on erbium-doped fiber amplifiers for use in long-haul telecom systems. He identified and developed InGaAs strained-layer lasers at 980 nm as a practical pump source for erbium amplifiers. Work that led to the reliable packaging of these lasers was the contribution for which he was named an OSA fellow. In 1991, he became the manager of the newly formed Optical Amplifier Development Department, where he was responsible for design and transfer to manufacture of single and multi-wavelength optical amplifiers. In 1996, Hall returned to Corning Research as manager of the Amplifier and Fiber Systems Research Department. This group explored advanced fiber concepts and developed high- data-rate optical transmission test beds for experimental validation of these concepts. This work led to the invention of Corning's large effective area fibers (LEAF), used in high- performance long-haul telecom systems. He also contributed to a key invention related to dispersion compensating fiber, used in most amplified long-haul WDM systems.

In November 1998, he became the business technology director and DVP, Photonic Technologies. In 2003, Corning Incorporated sold its Photonic Technologies Division to Avanex Corporation. Hall was appointed executive vice president of Avanex, responsible for its amplifier and dispersion compensation business unit. He rejoined Corning Incorporated in September 2005. He identified an opportunity for Corning to participate in the growing photovoltaic energy market and became Director, Product Technology of the newly formed Photovoltaics Glass program in 2007. He retired from Corning March 2010.

In June 2011, Doug joined the Department of Energy in June, 2011 as Portfolio Manager of the SunShot Initiative's Photovoltaic Manufacturing Initiative. He is responsible for the oversight of three programs that are creating multi-user PV pilot lines and consortia to increase the velocity of innovation in manufacturing of US industry.

Doug is the author of over 20 articles in refereed technical journals and three book chapters. He holds 17 U.S. patents. He has served as associate editor of the Journal of Light Wave Technology and as a member of the Public Policy Committee of OSA. He is currently chairperson of ASTM subcommittee E44.20, Glass for Solar Applications. He is a Fellow of the Optical Society of America, on the OSA Board of Directors, and a member of Phi Beta Kappa.

Dr. Ray Beausoleil

HP Fellow
Leader, Large-Scale Integrated Photonics Group, *HP Labs*

Ray Beausoleil is an HP Fellow in the Intelligent Infrastructure Lab (IIL) at HP Laboratories and a Consulting Professor of Applied Physics at Stanford University. At HP, he leads the Large-Scale Integrated Photonics research group, and is responsible for research on the applications of optics at the micro/nanoscale to high-performance classical and quantum information processing.

In 1996, Ray became a member of the technical staff at HP Laboratories, after serving as an officer or director of R&D at three small companies in the laser and computer industries. Among his other accomplishments at HP, he invented the optical paper-navigation algorithms incorporated into the HP/ Agilent optical mouse, and now HP's large-format printers.

Ray received the Bachelor of Science with Honors in Physics from the California Institute of Technology in 1980; the Master of Science degree in Physics from Stanford University in 1984; and his Ph.D. in Physics from Stanford in 1986 as a member of Ted Hansch's research group. As part of his dissertation research, he measured the frequency of the 1S-2S two-photon transition in atomic hydrogen with a precision of 6 parts in 10 billion.

Faculty Speakers

Prof. Philip H. Bucksbaum

Professor of Photon Sciences, Physics, and Applied Physics
Marguerite Blake Wilbur Professorship in Natural Science
Director, Stanford PULSE Institute for Ultrafast Energy Science
Stanford University

OSA Vice-President (2012)

Phil Bucksbaum received his A.B. degree in physics from Harvard University in 1975, and his Ph.D. in physics from the University of California, Berkeley in 1980. Following a postdoctoral year at Lawrence Berkeley Laboratory, he joined the staff of Bell Telephone Laboratories in New Jersey, first as a postdoc at Holmdel, and later as a member of the technical staff at Murray Hill. He was appointed professor of physics at the University of Michigan in 1990, where he became the Otto Laporte Collegiate Professor in 1998 and the Peter Franken University Professor in 2005.

In 2006, Bucksbaum moved to the SLAC National Accelerator Laboratory and Stanford University, and in 2009, he became the Marguerite Blake Wilbur Professor in Natural Science. He has joint appointments in the Physics Department, the Applied Physics Department, and the SLAC Photon Sciences Department, and he served as department chair of Photon Science (2007–2010).

He is the director of the Stanford PULSE Institute for Ultrafast Science, and he also directs the Chemical Sciences Research Division at SLAC. Additionally, Bucksbaum has more than 200 publications. He has contributed to several areas of atomic physics and ultrafast science, including strong-field laser-atom interactions, Rydberg wave packets, ultrafast quantum control, and ultrafast X-ray physics.

Prof. David A. B. Miller

W. M. Keck Foundation Professor of Electrical Engineering
Professor by Courtesy of Applied Physics
Co-Director, *Stanford Photonics Research Center*
Stanford University

David Miller received a B. Sc. in Physics from St. Andrews University, and performed his graduate studies at Heriot-Watt University where he was a Carnegie Research Scholar. After receiving the Ph. D. degree in 1979, he continued to work at Heriot-Watt University, latterly as a Lecturer in the Department of Physics. He moved to AT&T Bell Laboratories in 1981 as a Member of Technical Staff, and from 1987 to 1996 was a Department Head, latterly of the Advanced Photonics Research Department. He is currently the W. M. Keck Foundation Professor of Electrical Engineering at Stanford University, and is Director of the the Solid State and Photonics Laboratory at Stanford, and a Co-Director of the Stanford Photonics Research Center. He also served as the Director of the E. L. Ginzton Laboratory at Stanford University from 1997-2006.

His research interests include the use of optics in switching, interconnection, communications, computing, and sensing systems, physics and applications of quantum well optics and optoelectronics, and fundamental features and limits for optics and nanophotonics in communications and information processing. He has published over 230 technical papers including 13 book chapters, a text bookQuantum Mechanics for Scientists and Engineers, delivered over 140 conference invited talks and over 40 short courses, and holds 69 patents. He has an h-index of 66.

He has been a member or chair of over 40 technical conference committees, and was General Co-Chair for the Conference on Lasers and Electro-Optics in 1996. He has been elected to the Boards of both the Institute of Electrical and Electronics Engineers (IEEE) Lasers and Electro-Optics Society (LEOS) and the Optical Society of America (OSA), was a member of the Defense Sciences Research Council for the Defense Advanced Research Projects Agency from 1991-2005, andalso served on several scientific journal editorial boards. He was President of the IEEE Lasers and Electro-Optics Society in 1995. He also has served on boards for several photonics companies.

He is a Member of the National Academy of Sciences and of the National Academy of Engineering, a Fellow of the Royal Society of London, the Royal Society of Edinburgh, the IEEE, the Optical Society of America and the American Physical Society, and was awarded the Doctor Honoris Causa by the Vrije Universiteit Brussel and an honorary Doctor of Engineering from Heriot-Watt University. For his work on semiconductor nonlinear optics, quantum well optical properties, and novel devices, he was awarded the 1986 Adolph Lomb Medal of the OSA, was co-recipient of the 1988 R. W. Wood Medal, and received the 1991 Prize of the International Commission for Optics. He was also an IEEE Lasers and Electro-Optics Society Traveling Lecturer in 1986-87. He was awarded an IEEE Third Millennium Medal in 2000.

Prof. Daniel Palanker

Associate Professor, Dept. of Opthalmology, School of Medicine
Hansen Experimental Physics Laboratory
Stanford University

Daniel Palanker is an Associate Professor in the Department of Ophthalmology and in Hansen Experimental Physics Laboratory at Stanford University. He studies interactions of electric field and light with biological cells and tissues, and develops their diagnostic, therapeutic and prosthetic applications. Two of his inventions - Pattern Scanning Laser Photocoagulator (PASCAL) and Pulsed Electron Avalanche Knife (PEAK) are in clinical use worldwide, and the Femtosecond Laser System for Cataract Surgery is currently in a clinical trial. His research in therapeutic applications includes multiphoton interactions, tissue response to transient hyperthermia, plasma-mediated discharges, and electronic control of vasculature. In the field of prosthetics he works on development of a high-resolution optoelectronic retinal prosthesis for restoring sight to patients blinded by retinal degeneration.

Prof. Sindy Tang

Assistant Professor, Dept. of Mechanical Engineering
Stanford University

Sindy K.Y. Tang joined the faculty of Stanford University in September 2011 as an assistant professor in the Department of Mechanical Engineering. She received her B.S. degree in Electrical Engineering from California Institute of Technology in 2003, M.S. from Stanford University in 2004, and Ph.D. from Harvard University in Engineering Sciences in 2010. Dr. Tang's research interests include optofluidics, microfluidics and nanophotonics for the development of tools for biology and smart materials

Career Panel Moderator

Prof. Robert L. Byer

William R. Kenan, Jr. Professor, School of Humanities and Sciences
Professor, Department of Applied Physics
Co-Director, *Stanford Photonics Research Center*
Stanford University

President, American Physical Society (2012)

Professor Robert L. Byer is the William R. Kenan, Jr. Professor of Applied Physics at Stanford University. He has conducted research and taught classes in lasers and nonlinear optics at Stanford University since 1969. He has made numerous contributions to laser science and technology including the demonstration of the first tunable visible parametric oscillator, the development of the Q-switched unstable resonator Nd:YAG laser, remote sensing using tunable infrared sources and precision spectroscopy using Coherent Anti Stokes Raman Scattering (CARS). Current research includes the development of nonlinear optical materials and laser diode pumped solid state laser sources for applications to gravitational wave detection and to laser particle acceleration.

He served as Chair of the Applied Physics Department from 1980 to 1983 and 1999 to 2002. He served as Associate Dean of Humanities and Sciences from 1984 to 1986 and served as Vice Provost and Dean of Research at Stanford University from 1987 through 1992. He served as the Director of Edward L. Ginzton Laboratory from 2006-2008 after serving as Director of Hansen Experimental Physics Laboratory from 1997 through 2006.

Professor Byer is a Fellow of the Optical Society of America, the Institute of Electrical and Electronics Engineers (IEEE), the American Physical Society and the American Association for the Advancement of Science and the Laser Institute of America. In 1985 Professor Byer served as president of the IEEE Lasers and Electro-optics Society. He was elected President of the Optical Society of America and served in 1994. He is a founding member of the California Council on Science and Technology and served as chair from 1995 - 1999. He was a member of the Air Force Science Advisory Board from 2002-2006 and has been a member of the National Ignition Facility Advisory Committee since 2000.

In 1996 Professor Byer received the Quantum Electronics Award from the Lasers and Electro-optics Society of the IEEE. In 1998 he received the R. W. Wood prize of the Optical Society of America and the A. L. Schawlow Award from the Laser Institute of America. In 2000 he was the recipient of the IEEE Third Millennium Medal. In 2008 he received the IEEE Photonics Award.

Professor Byer has published more than 500 scientific papers and holds 50 patents in the fields of lasers and nonlinear optics. Professor Byer was elected to the National Academy of Engineering in 1987 and to the National Academy of Science in 2000.

Alumni Panelists

Prof. Seth Bank

Assistant Professor, Dept. of Electrical & Computer Engineering
University of Texas at Austin

Seth R. Bank (S'95–M'06–SM'11) received the B.S. degree from the University of Illinois at Urbana-Champaign (UIUC), Urbana, IL in 1999 and the M.S. and Ph.D. degrees in 2003 and 2006 from Stanford University, Stanford, CA, all in electrical engineering.

While at UIUC, he studied the fabrication of InGaP–GaAs and InGaAs–InP HBTs. His Ph.D. research focused upon the MBE growth, fabrication, and device physics of long-wavelength VCSELs and low-threshold edge-emitting lasers in the GaInNAs(Sb)–GaAs material system. In 2006, he was a post-doctoral scholar at the University of California, Santa Barbara, CA where his research centered on the growth of metal–semiconductor hetero- and nano-structures (e.g. ErAs nanoparticles in GaAs). He is currently an Assistant Professor of Electrical and Computer Engineering at the University of Texas at Austin, Austin, TX. His current research interests are the MBE growth of novel heterostructures and nanocomposites and their application to silicon-based lasers, mid-IR lasers, THz generation and sensing, and high-speed/low-power transistors. He has coauthored over 150 papers and presentations in these areas.

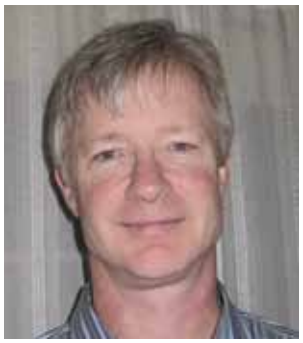
Dr. Bank is the recipient of a 2010 Young Investigator Program Award from ONR, a 2010 NSF CAREER Award, a 2009 Presidential Early Career Award for Scientists and Engineers (PECASE) nominated by ARO, a 2009 Young Investigator Program Award from AFOSR, the 2009 Young Scientist Award from the International Symposium on Compound Semiconductors, a 2008 DARPA Young Faculty Award, the 2008 Young Investigator Award from the North American MBE Meeting, and several best paper awards.

Dr. Amber Bullington

Physicist, Photon Science Division, NIF
Lawrence Livermore National Laboratory

Amber Bullington is a technical staff member in the Photon Science division of the National Ignition Facility (NIF) at Lawrence Livermore National Laboratory (LLNL). For the Laser Inertial Fusion Energy (LIFE) project, she is investigating thermally induced birefringence in glass slab amplifiers and nonlinear optical materials for electro-optic switches and frequency conversion. In addition to working on the LIFE project, she has also contributed to laboratory research on novel optical fiber geometries for high-power fiber lasers.

Amber received a B.S. degree from Cornell University and the M.S. and Ph.D. degrees from Stanford University. While at Stanford, she researched the effect of thermally loading high-power resonators for the Laser Interferometer Gravitational-wave Observatory (LIGO).



Dr. Geoff Fanning

Director of Product Development
nLIGHT Photonics Corporation

Geoff received Bachelor of Science degrees in Physics and Mathematics from Oregon State University in 1988. He then joined Tektronix as a manufacturing engineer for the Electro-Optic Products Group in Tektronix's Hybrid Component Operations. There he was introduced to the field of photonic packaging, concentrating primarily in the packaging of semiconductor lasers and detectors for fiber optic components.

In 1990 he helped start Photonic Packaging Technologies before attending graduate school. In 1991 Geoff joined Tony Siegman's group at Stanford University as an electrical engineering student and received the Master of Science degree in 1993 and Ph.D. in 1999, with a thesis on diode-pumped solid-state lasers with nonorthogonal eigenmodes.

Geoff joined Gemfire Corporation to develop lasers for display applications for a year before returning to Oregon to work for Flextronics' Photonics group as Product Engineering Manager, again focusing primarily on packaging and manufacture of active components for fiber optics.

Since 2006 Geoff has been at nLIGHT Photonics Corporation, most recently as Director of Product Development, where he enjoys combining his interests in diode-pumped solid-state lasers, device packaging, and manufacturing to create products for industrial and defense laser system integrators.

Dr. Thomas Lee

Strategic Marketing Manager
Enphase Energy

Thomas Lee is a Strategic Marketing Manager at Enphase Energy, the leading manufacturer of microinverters for solar PV systems, where he is responsible for long-term market forecasting and international expansion strategy. Thomas completed his Ph.D. in Electrical Engineering at Stanford University in 2008, where his research laid the groundwork for developing a single-chip optoelectronic system for imaging brain activity. He also holds M.S. and B.S. degrees in Electrical Engineering with concentrations analog and radio-frequency circuits and computer hardware, respectively.

Prior to Enphase, he worked as a management consultant at McKinsey & Company, where he served clients in clean technology, sustainability, and health care, and was an Investment and Energy Policy Associate at Greenstart, a clean energy technology startup accelerator.

In 2009, he served as an IEEE-USA Congressional Fellow in the office of Congressman Jay Inslee (1st District, Washington) where he was responsible for a range of issues including energy, climate change, science, and agriculture, and was heavily involved in the legislative process for the Waxman-Markey American Clean Energy and Security Act. Before embarking on his Ph.D. studies, he worked as an analog circuit designer at Barcelona Design, Inc. a Silicon Valley electronic design automation startup. He is an avid triathlete, cyclist, beverage enthusiast and foodie, and also enjoys sailing and skiing.

Workshop Speaker

Linda Chao

Senior Licensing Associate, Office of Technology Licensing
Stanford University

Linda Chao is a senior licensing associate at the Stanford University Office of Technology Transfer (OTL). Her areas of responsibility at OTL include photonics, nanotechnology, semiconductors, communications, and bio-engineering technologies. She is a registered patent agent with BS and MS degrees in electrical engineering, as well as an MBA, from MIT.

Newport. Brands That Have Built An Industry.

Newport was founded in 1969 to meet the specific needs of an emerging new laser industry and soon became the leader in vibration control solutions. As the broader photonics industry developed, Newport continued to advance its product portfolio, offering opto-mechanical components, optics, photonics instrumentation and precision motion control.

Today, Newport has grown to include a family of well-respected brands. Individually, each has a strong history of leadership and innovation in product excellence that has and continues to shape the photonics industry. Together, united as a family of brands, Newport is dedicated to continued product innovation and to providing our customers with an unsurpassed level and breadth of expertise.

For more information on Newport and its family of brands, visit **www.newport.com.**

Newport.
Experience | Solutions

A Small Token of our Gratitude

Thank You for Choosing Thorlabs for Your Photonics Needs

Hungry for Your Thoughts…

In line with our customer-focused philosophy, Thorlabs welcomes the opportunity to interact and partner with you, our customer. We encourage you to submit feedback through our website and will factor those responses into future product development ideas and improvements.

To share your ideas with us, please visit our website (www.thorlabs.com) and click on the icon of our Lab Snacks box. This feedback mechanism has proven to be an easy way to interact with our customers and has resulted in valuable discussions concerning product ideas, academic research, and individual life stories.

Share your product ideas at www.thorlabs.com

THORLABS

Friday Posters

Presenter	Poster Authors	Poster Title
Christy Amwake	Christy Amwake, Olav Solgaard	Low-cost portable microscope for stem-cell research applications
Kristen Boucher	Kristen Boucher, Cathy Jan, Joseph Kahn, Olav Solgaard	Imaging and Targeted Light Delivery through Multimode Fibers
Youngeun Jun	Youngeun Jun	Two photon excitation in Dual Axes Confocal Microscopy
Hsiao-lu Lee	Hsiao-lu Lee, Alison Ondrus, Shigeki Iwanaga, Justin DuBois, W.E. Moerner	Real-time super-resolution sampling of voltage gates sodium ion channel distribution on live neuronal model
Angie Lin	A.C. Lin, A.S. Markosyan, R. Bassiri, R. Route, B. Lantz, J.S. Harris, M.M. Fejer, A. Cumming, I. Martin, K. Haughian, S. Rowan	Growth and characterization of epitaxial mirror coatings for LIGO
Chandra Natarajan	Chandra M. Natarajan, Damien Bonneau, Mirko Lobino, Pisu Jiang, Michael G. Tanner, Sanders N. Dorenbos, Val Zwiller, Mark G. Thompson, Robert H. Hadfield and Jeremy L. O'Brien	Superconducting nanowire single photon detectors for quantum waveguide circuit operation at telecom wavelengths
Seonghyun Paik	Seonghyun Paik, Ken Leedle, James. S. Harris	2D PhC grating for high power low noise singlemode laser
Bryan Park	Bryan Park, Il Woong Jung, J Provine, Roger Howe, Olav Solgaard	Monolithic Photonic Crystal Fiber Tip Sensor
Dmitri Pavlichin	Dmitri Pavlichin, Michael Armen, Joseph Kerckhoff, Charles Limouse, Gopal Sarma, Michael Zhang, Hideo Mabuchi	3-D Fluorescence Tracking & Coherent Feedback for Quantum Error Correction
Jason Pelc	J. S. Pelc and M. M. Fejer	Efficient, High-Speed, and Low-Noise Single-Photon Detection at 1550 nm via Frequency Upconversion
Marina Radulaski	Marina Radulaski, Sonia Buckley, Kelley Rivoire, Jelena Vuckovic	Nonlinear Optics in III-V Photonic Crystal Cavities
Charles Rudy	Charles W Rudy, Michel JF Digonnet, and Robert L Byer	All-fiber, Mode-locked, Thulium-doped Figure-Eight Laser around 2 ¬µm
Armand Rundquist	Armand Rundquist, Arka Majumdar, and Jelena Vuckovic	Off-resonant coupling between a single quantum dot and a nanobeam photonic crystal cavity
Steffen Sahl	Steffen J. Sahl, Hsiao-lu D. Lee, Matthew D. Lew, W. E. Moerner	The double-helix microscope super-resolves extended biological structures by localizing single blinking molecules in three dimensions with nanoscale precision

Friday Posters

Presenter	Poster Authors	Poster Title
Gopal Sarma	Gopal Sarma, Ryan Hamerly, Dmitri S. Pavlichin, Dong-Bang Tsai, Nikolas Tezak, and Hideo Mabuchi	Photonic Circuits for Quantum Error Correction
Tomas Sarmiento	Tomas Sarmiento, Hopil Bae, Thomas O'Sullivan, and James S. Harris	GaAs-based long-wavelength GaInNAsSb lasers
Nicholas Sergeant	Nicholas Sergeant, Chu-En Chang, Peter Peumans, Shanhui Fan	Nanophotonic Approaches for Selective Absorption Enhancement
Limor Spector	Limor S. Spector, Maxim Artamonov, Shungo Miyabe, Markus Guehr, Song Wang, Joe Farrell, Brian McFarland, Todd Martinez, Tamar Seideman and Philip H. Bucksbaum	High Harmonic Generation in Rotating Quantum Asymmetric Tops Reveals New Aspects of Electronic Structure
Jung-Jung Su	Jung-Jung Su, and Yoshihisa Yamamoto	Coherent transport of indirect microcavity exciton-polariton
Alok Vasudev	Alok P. Vasudev, Jon A. Schuller, and Mark L. Brongersma	Nanophotonic light trapping with patterned transparent conductive oxides
Sonny Vo	Sonny Vo & James S. Harris	Nano-Aperture VCSELs for Near-Field Applications
Paul Yoon	Paul Yoon, Olav Solgaard	Fast AFM using area scan camera
Yuxin Zheng	Yuxin Zheng, Jason Ryan, Paul Hansen, Yao-Te Cheng	Nano-optical conveyer belt

Saturday Posters

Presenter	Poster Authors	Poster Title
Michal Bajcsy	M. Bajcsy, A. Majumdar, A. Rundquist, J vuckovic	Photon blockade with a four-level atom coupled to a microcavity
Ross Audet	Ross Audet, Elizabeth Edwards, Stephanie Claussen, Shen Ren, Rebecca Schaevitz, Emel Tasyurek, David Miller	Germanium quantum well modulators for optical interconnects
Chia-Ming Chang	Chia-Ming Chang and Olav Solgaard	Asymmetric Fano resonance in integrated silicon Bragg reflectors
Robert Chen	Robert Chen, Hai Lin, Yijie Huo, Theodore I. Kamins, J.S. Harris	MBE Growth of Ge1-xSnx Alloys for Direct-Bandgap Emission
Kirsten Frieda	Kirsten Frieda, Steven Block	Direct observation of cotranscriptional folding in an adenine riboswitch
Ryan Hamerly	Ryan Hamerly, Orion Crisafulli, Dmitri Pavlichin, Gopal Sarma, Nikolas Tezak, and Dong-Bang Tsai	Coherent Control of Linear Quantum Systems
Kevin Huang	Kevin C.Y. Huang, Min-Kyo Seo, Yijie Huo, Tomas Sarmiento, James S. Harris and Mark L. Brongersma	A Sub-wavelength Slot Waveguide Coupled Nano-Light-Emitting Diode
Tobias Lamour	T. P. Lamour and D. T. Reid	High-Pulse-Energy Cavity-Dumped Optical Parametric Oscillator in the Near- and Mid-Infrared
Lana Lau	Lana Lau, Yin Loon Lee, Steffen Sahl, Tim Stearns, W.E. Moerner	STED Superresolution Microscopy with Optimized Labeling Reveals 9-fold symmetry of a centriole protein
Nick Leindecker	Nick Leindecker, Alireza Marandi, Konstantin Vodopyanov, Robert Byer, Jie Jiang, Ingmar Hartl, Martin Fermann	Mid-Infrared Frequency Comb covering 3-6um from a Broadband OP-GaAs OPO pumped by an ultrafast Tm-fiber Laser
Matthew Lew	Matthew D. Lew*, Steven F. Lee*, Jerod L. Ptacin, Marissa K. Lee, Lucy Shapiro, & W. E. Moerner	Super-Resolution 3D Co-Localization of Protein Superstructures and the Cellular Surface in Live Caulobacter crescentus
Paul Lim	Paul Lim, Yuzuru Takashima, James Harris, Yoshio Nishi	Image Sensor for 3D Imaging
Alireza Marandi	Alireza Marandi, Nick C. Leindecker, Konstantin L. Vodopyanov, Robert L. Byer	Quantum Random Bit Generation Using Degenerate Optical Parametric Oscillator
Peter McMahon	Peter McMahon, Kristiaan De Greve, David Press, Qiang Zhang, Thaddeus Ladd, Christian Schneider, Sven Hoefling, Alfred Forchel, Yoshihisa Yamamoto	Control and Measurement of Spins in Quantum Dots

Saturday Posters

Presenter	Poster Authors	Poster Title
Christian Perez	Christian Perez, Van Nguyen, Steven Block	Simultaneous force-FRET measurements of single biomolecules
Aaswath Raman	Aaswath Raman, Zongfu Yu, Shanhui Fan	New limits on light trapping at the nanoscale
Gary Shambat	Gary Shambat, Sri Rajasekhar Kothapalli, J Provine, Kelley Rivoire, Aman Khurana, Kai Cheng, Tomas Sarmiento, James Harris, Heike Daldrup-Link, Sanjiv Sam Gambhir, Jelena Vuckovic	Photonic crystal cavity on optical fiber tip nanoparticle sensor for biomedical applications
Nikolas Tezak	Ryan Hamerly, Dmitri S. Pavlichin, Gopal Sarma, Dong-Bang Tsai, Nikolas Tezak	Photonic Circuits for Classical Sequential Logic
Sharon Vetter	Sharon Vetter, Jennifer Hastie, Stephane Calvez, James Harris	Design of a Compact Semiconductor Disk Laser for Operation in the Visible Spectrum
Ken Wang	Ken Xingze Wang, Zongfu Yu, Victor Liu, Yi Cui, Shanhui Fan	Absorption Enhancement in Ultrathin Crystalline Silicon Solar Cells with Antireflection and Light-Trapping Nanocone Gratings
Niklas Waasem	Niklas Waasem, Stephan Fieberg, Frank Kühnemann, and Karsten Buse	Absorption spectroscopy in lithium niobate using a highly sensitive photoacoustic spectrometer
Leo Yu	Leo Yu, Jason Pelc, Kristiaan De Greve, Christian Schneider, Sven Hofling, Shuichiro Inoue, Alfred Forchel and Yoshihisa Yamamoto	Quantum Frequency Conversion of nonclassical light

Saturday Activities Information

Welcome to the Asilomar Conference Grounds and the beautiful Monterey Bay region! There are a multitude of activities to take part in during the designated free hours (1:00-5:00pm Saturday) of the Photonics Retreat. Here we list a few suggested activities, but you are welcome to explore others. All activities are self-directed, but we will help participants organize themselves.

1. Big Sur Hiking
Pfeiffer Big Sur State Park
47555 Highway 1
Big Sur, CA 93920
(831) 667-2315
www.bigsurcalifornia.org/hiking-trails.html

Big Sur is located approximately 30 miles (50 min. drive) from Asilomar on scenic Highway 1. The numerous state parks feature redwood groves, waterfalls, beaches, and wildlife. Convenient day hikes can be found at this website. The trails are located in Pfeiffer Big Sur State Park, Andrew Molera State Park, and Julia Pfeiffer Burns State Park (all $10/vehicle).

2. Monterey Bay Aquarium
886 Cannery Row
Monterey, CA 93940
(831) 648-4800
www.montereybayaquarium.org

Current exhibits include: Kelp Forest, The Secret Life of Seahorses, Splash Zone, Open Sea, Sea Otters and more. The website is. The prices are $30 for students and $33 for adults.

3. Kayaking
Adventures by the Sea
299 Cannery Row
Monterey, CA 93940
(831) 372-1807 or (831) 648-7236
www.adventuresbythesea.com

Kayak rentals are $30 (kayak gear, paddling instruction, and wildlife orientation included).

4. Whale Watching

Monterey Bay Whale Watch
84 Fisherman's Wharf
Monterey, CA 93940
(831) 375-4658
www.gowhales.com

Monterey Bay Whale Watch offers a 3-4 hour afternoon trip on their large boats (50-60 passengers) to see humpback whales, blue whales, dolphins, and killer whales. Each trip has a marine biologist onboard and features ample time for sighting and photographing all sorts of marine life. Student price is $38.

5. Garrapata State Park

Carmel, CA
(831) 624-4909
www.parks.ca.gov/pages/579/files/Garrapata.pdf

The park has two miles of beach front, with coastal hiking and a 50-foot climb to a beautiful view of the Pacific. The park offers diverse coastal vegetation with trails running from ocean beaches into dense redwood groves. The park also features outstanding coastal headlands at Soberanes Point. Sea lions, harbor seals and sea otters frequent the coastal waters and California gray whales pass close by during their yearly migration.

The beach is located at gates 18 & 19 off of Highway 1 about 12 miles South from Asolimar.

6. Pacific Grove

Often referred to as one of America's last hometowns, Pacific Grove is known for its Victorian homes, Asilomar State Beach, its artistic legacy and the annual migration of the Monarch butterflies. The city is endowed with more Victorian houses per capita than anywhere else in America. The city is also known as the location of the Point Pinos Lighthouse, the oldest continuously-operating lighthouse on the West Coast, Pacific Grove Museum of Natural History, located in the historic downtown, the Stow-itts Museum & Library and one of the filming locations for Roger Spottiswoode's 1989 film Turner and Hooch.

7. Cannery Row

www.canneryrow.com

This historic waterfront district on Monterey Bay was made famous by John Steinbeck. The best of Monterey hotels, attractions and recreation, authentic Monterey restaurants, convenient shopping and exciting Monterey nightlife are found on Cannery Row, Monterey.

8. 17 Mile Drive

17-Mile Drive is a scenic road through Pacific Grove and Pebble Beach on the Monterey Peninsula in California, much of which hugs the Pacific coastline and passes famous golf courses and mansions. Part of it serves as the main road through the gated community of Pebble Beach. Inside this community, non-residents have to pay a toll to use the road ($9.50).
You can enter the 17-Mile Drive through any of five gates, where you will stop to pay the entry fee and pick up a map. These are the most common entry points:

- Highway 1 at Highway 68: This is the most convenient 17-Mile Drive entrance if you're coming from Monterey or are already on Highway 1
- Pacific Grove Gate: Get there from Sunset Drive
- Carmel: The toll booth is on San Antonio Ave

Ph: 415.663.8192.

Monterey Bay Area Map

Asilomar-Monterey Public Transit:

MST Route #1 runs conveniently from our location at Asilomar to Pacific Grove, the Monterey Bay Aquarium, Cannery Row and Fisherman's Wharf. Service is infrequent (hourly) but only $2. Please visit http://www.mst.org/maps-schedules/route-list/ for more details.

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