Optical Sensors (Sensors)

12 June - 15 June 2011, The Westin Harbour Castle, Toronto, Canada

APC Workshop: Biomedical Optical Sensors – Differentiators for Winning Technologies
Sunday, 12 June
14:00-18:00

In this workshop, experts will highlight developments in pertinent fields - and a panel discussion will tackle the question: ‘What are the key differentiators for winning biosensor technologies?’

APC Workshop Schedule and Speaker Abstracts

Sensors addresses all aspects of optical fiber sensors from fiber based signal sources and sensor fibers to detection schemes and applications.

Optical Sensors are used in numerous research, and commercial applications today. These sensors are used for quality and process control, medico technologies, metrology, imaging, and remote sensing to mention a few examples. Today there are many types of optical sensors; many based on the use of lasers, imaging systems, and/or fibers. In addition, novel sensor methods that enable more advanced sensing are continuously being developed for example by using novel materials, such as meta materials, micro and nano structured materials or by employing new frequency bands as for example THz radiation. In this meeting, papers reporting the development of devices to implement the various sensor types and their configuration into sensing elements will be presented. Some of the enabling technologies to be discussed include advances in short pulsed high power lasers, imaging methods, micro and nano-structured optical sensing systems, and THz sensing. This topical meeting will address various sensor types, and include all aspects of optical sensors from the components employed, their configuration through detection schemes and algorithms, and application of sensors.

Papers are being considered in the following topic categories:

- **Micro and Nano-Engineered Sensors**
  - Integrated Optical Waveguide Sensors
  - Microstructured Fiber Sensors
  - Microfiber and Nanowire Optical Sensors
  - Optical Resonant Microsensors
  - Nanoplasmonic Sensors
  - Photonic Crystal Biosensors
  - Photons Crystal Enhanced Fluorescence
  - Surface Enhanced Raman Spectroscopy
  - Micro/Nanofluidic Optical Sensors
- **THz sensing**
  - Sources and Detectors for THz Radiation
  - THz Spectroscopy for Sensing
  - THz Imaging
  - THz Gas Sensing
  - THz Sensing for Safety and Security Applications
  - THz Sensing in Industrial Environments
  - THz Optical Components and Devices
- **Imaging**
  - Bio-Imaging
  - Quantum Imaging
  - Nonlinear Imaging
  - Nanoscopy
  - Functional Imaging
  - Speckles
  - Opto-Acoustics
View the conference program and plan your itinerary for the conference

- Browse speakers and the agenda of sessions
- Browse sessions by type or day.
- Search by author, title, OCIS code and more.
- Plan and print your personal itinerary before coming to the conference

NEW!

Check out the Housing and Travel Page to find out how to Experience Toronto from the Water and get discounts on Toronto Bus and Walking Tours!

General Chairs

Karsten Rottwitt, Danmarks Tekniske Univ., Denmark
Ishwar Aggarwal, US NRL, USA

The 2010 meeting featured 62 presentations, with speakers representing 28 countries. In addition, nearly 51% of the contributed presentations were submitted by students.

Advanced Photonics Congress

- Access Networks & In-house Communications (ANIC)
- Integrated Photonics Research, Silicon and Nano-Photonics (IPR)
- Optical Sensors (Sensors)
- Signal Processing in Photonics Communications (SPPCom)
- Slow and Fast Light (SL)
- New! Specialty Optical Fibers

Sponsor:

OSA®
Advanced Photonics Congress

June 12-15 2011, The Westin Harbour Castle, Toronto, Canada

The Advanced Photonics 2011 Congress will be held 12-16 June 2011 at The Westin Harbour Castle in Toronto, Canada. This year's congress consists of six collocated meetings including one new meeting and five veteran meetings.

Each meeting consists of invited and contributed presentations. There are three Joint Plenary Sessions and one Joint Poster Session. Be sure to check back for updates on the Plenary speakers. For a complete list of invited speakers, please visit the meetings' Conference Program.

Several exciting special events are planned for the 2011 Advanced Photonics congress including a Welcome Reception, Banquet Dinner and "Optics Olympics" Student Event.

All of the technical sessions will be held at the The Westin Harbour Castle is located near the theater district, waterfront and popular attractions such as Harbourfront Centre, Queens Quay, the Hockey Hall of Fame, and the Toronto Island Ferry. For more information on Toronto and housing at the meeting, please visit Housing and Travel.

Want to start planning your trip today? View the congress' Meetings-at-a-Glance. Please remember that times listed below are not final, so check back often for updates.

NEW!

Check out the Housing and Travel Page to find out how to Experience Toronto from the Water and get discounts on Toronto Bus and Walking Tours!

View the conference program and plan your itinerary for the conference

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- Browse sessions by type or day.
- Search by author, title, OCIS code and more.
- Plan and print your personal itinerary before coming to the conference

Submit a Paper

Submit a paper? Please visit the Author Information page for your desired meeting.

More information about the individual meetings in the 2011 Advanced Photonics Congress can be found by clicking on the links below:

Advanced Photonics Congress

- Integrated Photonics Research, Silicon and Nano-Photonics (IPR)
  IPR covers all aspects of research in integrated photonics and nano-photonics, featuring innovative science and engineering results.
- Slow and Fast Light (SL)
  This topical meeting will bring together physicists and engineers in order to present and discuss the latest achievements within the area of light-speed control
- Access Networks & In-house Communications (ANIC)
  ANIC addresses all relevant research challenges and open research issues for FTTx technologies.
Advanced Photonics Local Organizing Committee

Dan-Xia Xu, Inst. for Microstrutual Sciences, National Research Council Canada, Canada

Joyce Poon, Univ. of Toronto, Canada

Ted Sargent, Univ. of Toronto, Canada

OSA Student Chapter President:
Fei Ye, Ph.D. candidate, University of Toronto, Canada

SPIE Student Chapter President:
Jason Grenier, University of Toronto, Canada

Special Events

APC Workshop: Biomedical Optical Sensors – Differentiators for Winning Technologies
Sunday, 12 June 2011
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Please visit the Workshop page for the full scope and list of speakers.

Optics Olympics
Sunday, 12 June 2011
16:30-21:00
Metro Ballroom West, Westin Harbour Castle

The OSA and SPIE Student Chapters at University of Toronto are pleased to invite all attendees (i.e., students, postdoctoral fellows, and all other researchers) of the 2011 Advance Photonics Congress to participate in the Optics Olympics competition on Sunday June 12th, 2011. The competition will have participants work together in teams of 4, to compete in 5 events designed to test and expand your optics skills. The Optics Olympics is an opportunity for conference attendees to meet each other at the start of the conference, have some fun applying their optics skills, and expand their professional network. Food and refreshments will be provided, and cash prizes will be awarded to the winners. Winners will be announced during the conference reception banquet on June 14th. Register early to avoid disappointment as the competition is limited to 64 participants. Registration is done individually and teams will be formed on-site at the beginning of the competition. We are looking forward to your participation in the Optics Olympics!

To register or for more information go to: http://osa.braveline.com/osautoronto/index.asp

FREE to Congress Registrants!
OIDA Workshop on Photonic Integration for High-Capacity Data Transport: Commercial Needs, Opportunities and Deployment
Monday, 13 June
08:00 - 17:00
Advanced Photonics Congress registrants are invited to attend the OIDA Workshop on Photonic Integration for High-Capacity Data Transport: Commercial Needs, Opportunities and Deployment on Monday, 13 June at the Westin Harbour Castle Hotel. To learn more about the workshop program and register visit the OIDA Workshop website.

OIDA Workshop Luncheon
Monday, 13 June
12:00 - 13:30

Congress registrants are invited to attend the OIDA Workshop Luncheon. The featured speaker will be announced shortly on the OIDA Workshop website. The fee is $25 USD and may be added to your congress registration.

Advance Photonics Congress Welcome Reception
Monday, 13 June 2011
18:30 - 20:00
Metro Ballroom West, Westin Harbour Castle

Free to all Technical Attendees of the Congress: Get the meeting off to a great start by attending the welcome reception after a full day of technical sessions! Meet with colleagues from around the world and enjoy light hors d’oeuvres.

Advance Photonics Congress Reception and Banquet Dinner
Tuesday, 14 June 2011
18:30 - 21:30
Location: Hart House, Univ. of Toronto
Tickets: $25 USD per person

Come join us at this great event! The Hart House was completed in 1919, Hart House is a crown jewel in the University of Toronto’s architectural, academic and social history. Designed by architect Henry Sproatt, one of the last North American masters of the Gothic form, and engineer Ernest Rolph, the building is named for Vincent Massey's grandfather, Hart. Hart House was gifted to the University of Toronto by the Massey Foundation as a gathering place for students. Today, Hart House enjoys a reputation as a signature arts, creativity and event destination in the City of Toronto. The Hart House permanent art collection comprises nearly six hundred works by renowned Canadian artists, including works considered national treasures by the Group of Seven, major works by the Automatistes and Painters Eleven, as well as contemporary works by artists from across the country.

Transportation WILL be provided. Shuttle transportation to the Hart House will pick up outside of the main Westin Harbour Castle entrance at 18.15. Buses will be available between 21.15 - 21.45 outside of the Hart House entrance to transport guests back to the Westin Harbour Castle. Please note that the Westin Harbour Castle and the Hart House are the only two destination points the shuttle transportation will pick up and drop off guests. For more information, please ask your OSA representative at Registration on-site.

JTuB: Congress Joint Poster Session
Tuesday, 14 June 2011
13:30 - 15:30
Metro Ballroom West, Westin Harbour Castle

Poster sessions are an integral part of the technical program and offer a unique networking opportunity, where presenters can discuss their results one-to-one with interested parties. Each author is provided with a 4 ft. x 8 ft. (1.22 m x 2.44 m) board on which to display the summary and results of his or her paper.

Postdeadline Sessions
Postdeadline sessions are an opportunity to showcase the most late-breaking innovations in the field.

Sponsors
Exhibitors

Interested in being an Exhibitor at the Advanced Photonics Congress?

Exhibit space at this Congress is very limited, so be sure to sign up for your tabletop exhibit space today! This Congress provides you an audience of 400 scientists. Call Regan Pickett at 202-416-1474 or e-mail exhibitsales@osa.org for more information.

Sponsor:

OSA®
Optical Sensors (Sensors)

12 June - 15 June 2011, The Westin Harbour Castle, Toronto, Canada

Conference Program

Optical Sensors are used in numerous research, and commercial applications today. These sensors are used for quality and process control, medico technologies, metrology, imaging, and remote sensing to mention a few examples. Today there are many types of optical sensors; many based on the use of lasers, imaging systems, and/or fibers. In addition, novel sensor methods that enable more advanced sensing are continuously being developed for example by using novel materials, such as meta materials, micro and nano structured materials or by employing new frequency bands as for example THz radiation. In this meeting, papers reporting the development of devices to implement the various sensor types and their configuration into sensing elements will be presented. Some of the enabling technologies to be discussed include advances in short pulsed high power lasers, imaging methods, micro and nano-structured optical sensing systems, and THz sensing. This topical meeting will address various sensor types, and include all aspects of optical sensors from the components employed, their configuration through detection schemes and algorithms, and application of sensors.

If you would like to be considered as a presenter, please review the topic categories below and the author/presenter information for submission guidelines.

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  - THz Sensing in Industrial Environments
  - THz Optical Components and Devices

- **Imaging**
  - Bio-Imaging
  - Quantum Imaging
  - Nonlinear Imaging
  - Nanoscopy
  - Functional Imaging
  - Speckles
  - Opto-Acoustics

A number of distinguished invited speakers have been invited to present at the meeting. In addition, the organizers have planned a number of special events to make your meeting experience more enjoyable!
**Meeting-at-a-Glance**

A tentative general schedule of the meeting (as well as all meetings in the Congress) is listed below. Please check back frequently for updates.

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**Optics Olympics**
Sunday, 12 June 2011
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Please note that transportation is to and from the event is on your own.
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Integrated Photonics Research, Silicon and Nano-Photonics (IPR)

Optical Sensors (Sensors)

Signal Processing in Photonics Communications (SPPCom)

Slow and Fast Light (SL)

Specialty Optical Fibers (SOF)

12-14 June, 2011,
The Westin Harbour Castle
Toronto, Canada

2011 Advanced Photonics:
OSA Optics & Photonics Congress

Conference Program
The Organizers of the Advanced Photonics:
OSA Optics & Photonics Congress and Table Top Exhibit
thank the following sponsors for their generous support.

The Edward S. Rogers Sr. Department
of Electrical & Computer Engineering
UNIVERSITY OF TORONTO
Congress Highlights

IPR Workshop: Biomedical Optical Sensors—Differentiators for Winning Technologies
Harbour Salon C
Sunday, 12 June 2011
14:00-18:00

The market for biosensors is becoming progressively more diverse and is expected to grow significantly in the coming years. Currently, the bulk of revenue comes from the point-of-care medical diagnostics market, but this situation is likely to change with newer application research. Progress in biosensors has mainly been due to a combination of improvements in the biological components and the implementation of microsystem technologies. In the photonics community, there has been an explosion of research activity in recent years, and various different photonic biosensor concepts have been proposed and demonstrated. Sensitivity continues to improve and single molecular detection has been reported. But the transport of target molecules to the sensing surface still relies on diffusion or on fluid flow. Specimen preparation and pre-concentration remain serious challenges.

Are there already too many types of biosensor? Which applications are the best implementations of different sensors? What are the key issues that must be resolved? What is required to bring today’s research to tomorrow’s point-of-care diagnostic instruments? In this workshop, experts will highlight developments in pertinent fields and a panel discussion will tackle the question: ‘what are the key differentiators for winning biosensor technologies?’ We expect that all attendees will have the opportunity to make a contribution to a successful workshop.

Confirmed Speakers (as of 13 May):

Gilberto Brambilla, Univ. of Southampton, UK
Pierre Berini, Univ. of Ottawa, Canada
Richard De La Rue, Univ. of Malaya, Malaysia
Kishan Dholakia, St. Andrews Univ., UK
Martin Kristensen, Univ. of Aarhus, Denmark
Holger Schmidt, Univ. of California at Santa Cruz, USA
Ian White, Univ. of Maryland, USA
DanXia Xu, NRC Ottawa, Canada
Anatoly Zayats, King’s College London, UK

Optics Olympics
Metro Ballroom West, Westin Harbour Castle
Sunday, 12 June 2011
18:00-22:00

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The five challenging yet fun games that comprise the competition are listed below:

1. Image competition
2. Laser Khet (Laser chess game)
3. Optics triathlon
4. Laser graffiti
5. Hitting targets

We are looking forward to your participation in the Optics Olympics!

Sponsored by*: Institute of Optical Sciences, Univ. of Toronto
OSA - The Optical Society
Simbol Test Systems

*as of 19 May 2011

Advanced Photonics Congress Welcome Reception
Metro Ballroom West, Westin Harbour Castle
Monday, 13 June 2011
18:30 - 20:00

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Advanced Photonics Congress Reception and Banquet Dinner
Hart House, Univ. of Toronto
Tuesday, 14 June 2011
18:30 - 21:30
Tickets: Limited seating available. $35 USD per person.

Come join us at this great event! The Hart House was completed in 1919, Hart House is a crown jewel in the University of Toronto’s architectural, academic and social history. Designed by architect Henry Sproatt, one of the last North American masters of the Gothic form, and engineer Ernest Rolph, the building is named for Vincent Massey’s grandfather, Hart. Hart House was gifted to the University of Toronto by the Massey Foundation as a gathering place for students. Today, Hart House enjoys a reputation as a signature arts, creativity and event destination in the City of Toronto. The Hart House permanent art collection comprises nearly six-hundred works by renowned Canadian artists, including works considered national treasures by the Group of Seven, major works by the Automatistes and Painters Eleven, as well as contemporary works by artists from across the country.

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OIDA Workshop
Photonic Integration for High-Capacity Data Transport: Commercial Needs, Opportunities and Deployment
Monday, 13 June 2011
Queen’s Quay, The Westin Harbour Castle, Toronto, Canada

We’re bringing together the field’s leading innovators in the areas of high data rate, high density, high capacity optical communications and the companies which are exploring photonic integration, monolithic and hybrid, as a data transport solution for a unique, one-day workshop - join us!

Luncheon Speaker
David F. Welch
Co-Founder, Executive Vice President and Chief Strategy Officer, Infinera Corporation

Schedule at-a-Glance
Sunday, 12 June
14:00 – 18:00 Registration

Monday, 13 June
07:30 – 08:30 Registration & Continental Breakfast
08:30 – 12:30 Session
12:00 – 13:30 Lunch* featuring a presentation from David Welch, Co-Founder, Executive Vice President and Chief Strategy Officer, Infinera Corporation
13:30 – 17:30 Session
18:00 – 19:30 Networking Reception

There is an ever-increasing world-wide commercial need for higher and higher rates of data transport. Despite the cyclical nature of the general economy, the volume of electronic communication has been on a steady growth path. The increasing need for moving large volumes of data has considerably impacted the area of long haul optical transmission. Aggregate long haul data rates, in the C band of the optical fiber spectrum, are expected to reach 25Tbit/s per fiber. This creates a compelling need for both line and client side systems capable of very high data rate transport and switching within a very small volume of space and reduced power consumption. Fulfilling this need requires creative innovations in the field of optical components, and photonic integration has been increasingly proposed and utilized as a solution in this application space.

http://www.oida.org/events/integration11

* Congress registrants are invited to attend the OIDA Workshop Luncheon. The fee is $25 USD and may be purchased at the registration desk. Limited seating available.
Keynote and Plenary Speakers

**Slow Light Enhanced Nonlinear Effects in Periodic Structures**
JMA1 • 8:45, Harbour Salon B

Benjamin Eggleton; Univ. of Sydney, Australia

Benjamin J. Eggleton is an ARC Federation Fellow and Professor of Physics at the University of Sydney and is the founding Director of CUDOS, the ARC Centre of Excellence for Ultrahigh-bandwidth Devices for Optical Systems. He obtained Ph.D. degree in Physics from the University of Sydney. In 1996, he joined Bell Laboratories, Lucent Technologies as a Member of Staff and was subsequently promoted to Director within the Specialty Fibre Business Division of Bell Laboratories, where he was engaged in forward-looking research supporting Lucent Technologies business in optical fibre devices. Eggleton has published more than 300 journal publications (with over 7500 citations and an h-index of 44) and has filed over 35 patents. He is a Fellow of the OSA, IEEE and the Australian Academy of Technological Sciences and Engineering. Eggleton received numerous awards for his contributions, including the 2003 International Commission on Optics (ICO) Prize, the 1998 Adolph Lomb Medal from the OSA and the IEEE/LEOS Distinguished Lecturer Award. He was President of the Australian Optical Society from 2008-2010 and is Editor for Optics Communications.

**Prospects and Challenges in High Power Fiber Laser Technology**
SOMA1 • 8:45, Pier 5

Andreas Tünnermann1,2,  'Fraunhofer Inst. for Applied Optics and Precision Engineering, Germany; 'Inst. for Applied Physics, Friedrich-Schiller-Univ., Germany

Andreas Tünnermann received a diploma and PhD degrees in physics from the University of Hannover in 1988 and 1992, respectively. His habilitation was related to topics on ultrastable light sources for interferometric gravitational wave detectors. In 1998 he joined the Friedrich-Schiller-University in Jena, Germany as a Professor and Director of the Institute of Applied Physics. In 2003 he became the Director of the Fraunhofer Institute of Applied Optics and Precision Engineering in Jena. He is known for his pioneering work in fiber laser technology and the application of high power femtosecond lasers for materials processing. Professor Tünnermann’s research activities on optics and applied quantum electronics have been awarded with the Roentgen-Award 1997, WLT-Award 1998, Otto-Schott-Award 2003, Leibinger Innovation Award 2004 and the Gottfried-Wilhelm-Leibniz-Award 2005.

**Progress and Technical Challenges for Integrated Optics**
JTuA1 • 10:30, Harbour Salon B

Katsunari Okamoto; AiDi Corp., Japan.

Dr. Katsunari Okamoto received the B.S., M.S., and Ph.D. degrees in electronics engineering from Tokyo University, Tokyo, Japan, in 1972, 1974, and 1977, respectively. He joined Ibaraki Electrical Communication Laboratory, Nippon Telegraph and Telephone Corporation (NTT), Ibaraki, Japan, in 1977, and was engaged in the research on transmission characteristics of multimode, dispersion-flattened single-mode, single-polarization (PANDA) fibers, and fiber-optic components. He proposed for the first time the dispersion-flattened fiber (DFF) and succeeded in fabrication of DFF that had chromatic dispersion less than +/-1 ps/km/nm over a wide spectral range. From September 1982 to September 1983, he worked as a guest researcher at Optical Fiber Group, Southampton University, Southampton, England, where he was engaged in the research on birefringent optical fibers. At NTT Photonics Laboratories, he has developed various kinds of AWGs ranging from 8ch-300nm spacing AWGs to 128ch-25GHz AWGs, flat spectral response AWGs and integrated-optic reconfigurable add/drop multiplexers (ROADM). 200 GHz to 50 GHz spacing AWGs are now widely used in the commercial WDM systems. From July 2006, he worked as Professor of Electrical and Computer Engineering at the University of California at Davis (UC Davis). His research at UC Davis includes passive and active photonics devices and silicon photonics. He is currently working as CTO at AiDi corporation aiming at the miniature lightwave spectroscopic sensors for environmental sensing and health diagnostics. He has published more than 285 papers in technical journals and international conferences. He authored and co-authored 8 books including “Fundamentals of Optical Waveguides (Elsevier).” Dr. Okamoto is a member of the Institute of Electrical and Electronics Engineers (Fellow), Optical Society of America and the Institute of Electronics Information and Communication Engineers of Japan.

**Shaping the Future of Nanobiophotonics**
JTuA2 • 11:15, Harbour Salon B

Kishan Dholakia, Univ. of St Andrews, UK

Kishan Dholakia is Professor of Physics at the University of St Andrews Scotland and an honorary adjunct Professor at the Centre for Optical Sciences at the University of Arizona, USA.

He heads a large (~25) group working in various aspects of photonics including beam shaping, micromanipulation and biophotonics. He has published over 300 journal/conference papers and his group won the European Optics Prize in 2003. He was elected to the position of Fellow of the Royal Society of Edinburgh in 2007, Fellow of the Optical Society of America in 2008 and SPIE Fellow in 2009.
Tutorial Speakers

Photonic Crystal Fibers
SOMD3 • 17:00, Pier 5

William Wadsworth; Univ. of Bath, UK

William Wadsworth has been designing, fabricating and using photonic crystal fibres (PCFs) since 1999 when he joined the University of Bath as a post-doc. His previous work developing high power lasers and low-cost tunable lasers has informed a particular interest in the use of PCF for compact and versatile light sources.

Optical fiber sensors and their Specialty Fiber Needs
SOTuC5 • 17:15, PierSTutorial

Alexis Mendez, MCH Engineering, LLC, USA

Alexis Mendez received a PhD. degree in Electrical Engineering from Brown University, in 1992. He is President of MCH Engineering LLC, a consulting firm specializing in optical fiber sensing technology, and has over 20 years of experience in optical fiber technology, sensors and instrumentation. Dr. Mendez was the former Group Leader of the Fiber Optic Sensors Lab within ABB Corporate Research (USA) where he led R&D activities for the development of fiber sensors for use in industrial plant, oil & gas, and high voltage electric power applications. He has written 60 technical publications, taught several short courses on fiber sensors, holds 5 US patents and is recipient of an R&D100 award. Dr. Mendez is a Fellow of SPIE and was past Chairman of the 2006 International Optical Fiber Sensors Conference (OFS-18), past Technical Chair of the 2nd Workshop on Specialty Optical Fibers and their Applications (WSOF21010), and is co-editor of the “Specialty Optical Fibers Handbook”.

Advanced Photonics: OSA Optics & Photonics Congress • 12–15 June 2011
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Jiri Janousek, Australian Natl. Univ., Australia
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Lionel Kimerling, MIT, USA
Damien Lambert, Infinera Inc., USA
Gunther Roelkens, Univ. of Ghent, Belgium
Matsuo Shinji, NTT Photonics Lab, Japan, Japan
Meint Smit, Eindhoven Univ. of Technology, The Netherlands
Devices and Components
Michael Watts, MIT, USA, Chair
Ray Beausoleil, HP Labs, USA
Tobias Kippenberg, Max Planck Inst. for Quantum Optics, Germany
Solomon Assefa, IBM T. J. Watson Res., USA
Joyce Poon, Univ. of Toronto, Canada
Laurent Vivien, Inst. d’Electronique Fondamentale, Univ. of Paris Sud, France
Zhiping Zhou, Peking Univ., China
Lars Zimmermann, Technische Univ. Berlin, Germany
Peter Rakich, Sandia Natl. Labs, USA
Koji Yamada, NTT Microsystem Integration Labs, Japan

Modeling, Numerical Simulation and Theory
Hung-chun Chang, Natl. Taiwan Univ., Taiwan, Chair
Allan D. Boardman, Univ. of Salford, UK
Anand Gopinath, Univ. of Minnesota, USA
Philippe Lalanne, Inst. d’Optique, Univ. Paris-Sud, France
Ya Yan Lu, City Univ. of Hong Kong, China
Philip Sewell, Univ. Park, UK
Christoph Waechter, Fraunhofer Inst. for Applied Optics and Precision Engineering, Germany
Vien Van, Univ. of Alberta, Canada
Junji Yamauchi, Hosei Univ., Japan
James Pond, Lumerical, Canada

Nanophotonic Devices and Applications
Gary Wiederrecht, Argonne National Lab., USA, Chair
Sergey Bozhevolnyi, Southern Denmark Univ., Denmark
Mark Brongersma, Stanford Univ., USA
Din Ping Tsai, Natl. Taiwan Univ., Taiwan
Edwin Pun, City Univ. of Hong Kong, China
Sailing He, Zhejiang Univ., Joint Res. Center of Photonics of the Royal Inst. of Technology (Sweden), China/Sweden
William Whelan-Curtin, Univ. of St. Andrews, UK
John Rogers, Univ. of Illinois at Urbana-Champaign, USA
Edward Sargent, Univ. of Toronto, Canada
Yasuhiro Arakawa, Univ. of Tokyo, Japan
Masaya Notomi, NTT Basic Research Labs., Japan
Explanation of Session Codes

<table>
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<tr>
<th>Meeting Name</th>
<th>Session Designation (alphabetically)</th>
<th>Number (presentation order within the session)</th>
<th>Day of the Week</th>
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<td>ATuA4</td>
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<td>J</td>
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<td>M</td>
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</tbody>
</table>

The first letter of the code designates the conference (A=Access Networks and In-house Communications, S=Optical Sensors, SP=Signal Processing in Photonics Communications, SL=Slow and Fast Light, I=Integrated Photonics Research, Silicon and Nano Photonics, SO=Specialty Optical Fibers, J=Joint). The second element denotes the day of the week (Monday=M, Tuesday=Tu, Wednesday=W). The third element indicates the session within the particular day the talk is being given. Each day begins with the letter A and continues alphabetically. The number on the end of the code signals the position of the talk within the session (first, second, third, etc.). For example, a presentation coded ATuA4 indicates that this paper is part of Access Networks and In-house Communications (A) and is being presented on Tuesday (Tu) during the first session (A), and is the fourth paper (4) presented in that session.
### Agenda of Sessions — Sunday, 12 June

<table>
<thead>
<tr>
<th>Time</th>
<th>Event</th>
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</thead>
<tbody>
<tr>
<td>10:00–18:30</td>
<td>Registration Open, Harbour Ballroom Foyer</td>
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<tr>
<td>14:00–18:00</td>
<td>Workshop: Biomedical Optical Sensors-Differentiators for Winning Technologies, Harbour Salon C</td>
</tr>
<tr>
<td>17:00–22:00</td>
<td>Optics Olympics, Metro West</td>
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</tbody>
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### Agenda of Sessions — Monday, 13 June

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<thead>
<tr>
<th>Time</th>
<th>Event</th>
</tr>
</thead>
<tbody>
<tr>
<td>7:00–18:30</td>
<td>Registration Open, Harbour Ballroom Foyer</td>
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<tr>
<td>7:30–19:30</td>
<td>OIDA Workshop, Queen's Quay, The Westin Harbour Castle</td>
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<tr>
<td>8:30–8:45</td>
<td>AMA • Network, Market and Operator View</td>
</tr>
<tr>
<td>8:45–10:00</td>
<td>IPR/SL Opening Remarks, Harbour Salon B</td>
</tr>
<tr>
<td>10:00–16:00</td>
<td>Exhibits Open, Pier 4/ Harbour Ballroom Foyer</td>
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<tr>
<td>10:00–10:30</td>
<td>Coffee Break/Exhibits, Pier 4/ Harbour Ballroom Foyer</td>
</tr>
<tr>
<td>10:30–12:30</td>
<td>AMB • Green Access and Operations</td>
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<tr>
<td>12:30–13:30</td>
<td>Lunch Break (on your own)</td>
</tr>
<tr>
<td>13:30–15:30</td>
<td>AMC • OFDM-PON</td>
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<tr>
<td>15:30–16:00</td>
<td>Coffee Break/Exhibits, Pier 4/ Harbour Ballroom Foyer</td>
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<tr>
<td>16:00–18:00</td>
<td>AMD • Hybrid and WDM-PON</td>
</tr>
<tr>
<td>18:30–20:00</td>
<td>Advanced Photonics Congress and OIDA Welcome Reception, Metro Ballroom West</td>
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</table>

### Key to Conference Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>ANIC</td>
<td>Access Networks and In-house Communications</td>
</tr>
<tr>
<td>Sensors</td>
<td>Optical Sensors</td>
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<tr>
<td>SPPCom</td>
<td>Signal Processing in Photonics Communications</td>
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<tr>
<td>SL</td>
<td>Slow and Fast Light</td>
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<tr>
<td>IPR</td>
<td>Integrated Photonics Research, Silicon and Nano Photonics</td>
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<tr>
<td>SOF</td>
<td>Specialty Optical Fibers</td>
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**Advanced Photonics: OSA Optics & Photonics Congress • 12–15 June 2011**
## Agenda of Sessions — Tuesday, 14 June

<table>
<thead>
<tr>
<th>Time</th>
<th>Venue</th>
<th>Sessions</th>
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<tbody>
<tr>
<td>7:30–18:00</td>
<td>Registration Open, Harbour Ballroom Foyer</td>
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</tbody>
</table>
| 8:30–10:00| Pier 9, Pier 7 & 8, Harbour Salon B, Harbour Salon C | ATuA • Basic Technologies for NG-PON (starts at 8:00)  
SPTuA • Coding I (ends at 9:30)  
ITuA • Devices and Components II  
ITuB • Nanophotonics: Plasmonics and applications I  
SLTuA • Slow/Fast Light in SOAs and Photonic Crystals  
STuA • High Intensity and Broadband THz Sources  
SOTuA • Supercontinuum Fiber Lasers |
| 10:00–16:00| Exhibits Open, Pier 4/ Harbour Ballroom Foyer |
| 10:00–10:30| Coffee Break/Exhibits, Pier 4/ Harbour Ballroom Foyer |
| 10:30–12:30| Pier 2 & 3, Harbour Salon C | ATuB • Radio over fiber and OCDMA  
SPTuB • Advanced Modulation (ends at 11:45)  
JTuA • Joint IPR/SL Plenary Session, Harbour Salon B  
STuB • THz Spectroscopy and Imaging Applications  
SOTuB • Chalcogenide and Tellurite Fibers (ends at 12:15) |
| 12:30–13:30| Lunch Break (on your own) |
| 13:00–15:30| JTuB • Congress Joint Poster Session, Pier 4/ Harbour Ballroom Foyer |
| 15:30–16:00| Coffee Break/Exhibits, Pier 4/ Harbour Ballroom Foyer |
| 16:00–18:00| Pier 5 | ATuC • Inhouse: Fiber and Wireless  
SPTuC • DSP (ends at 17:30)  
ITuC • Photonic Integration I  
ITuD • Nanophotonics: Plasmonics and Applications II  
SLTuB • Methods and Fundamentals  
STuC • Terahertz Waveguides, Applications, and Device Technology  
SOTuC • Fiber Sensors |
| 16:30–21:30| Advanced Photonics Congress Reception and Banquet, Hart House, University of Toronto |

### Key to Conference Abbreviations
- **ANIC** Access Networks and In-house Communications
- **Sensors** Optical Sensors
- **SPPcom** Signal Processing in Photonics Communications
- **SL** Slow and Fast Light
- **IPR** Integrated Photonics Research, Silicon and Nano Photonics
- **SOF** Specialty Optical Fibers
## Agenda of Sessions — Wednesday, 15 June

<table>
<thead>
<tr>
<th>Time</th>
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<th>Harbour Salon B</th>
<th>Harbour Salon C</th>
<th>Pier 2 &amp; 3</th>
<th>Harbour Salon A</th>
<th>Pier 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>7:30–17:00</td>
<td>SPPCom</td>
<td>IPR</td>
<td>IPR</td>
<td>SL</td>
<td>Sensors</td>
<td>SOF</td>
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### Registration Open, Main Foyer

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<th>Time</th>
<th>Session</th>
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<tbody>
<tr>
<td>8:30–10:00</td>
<td>SPWA • Nonlinearities</td>
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<td>(starts at 9:00)</td>
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<td>IWA • Modeling</td>
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<td>and Simulation III:</td>
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<td>Lasers and Emitters</td>
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<td>IWB • Active</td>
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<td>nanophotonics, quantum</td>
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<td>dots, and nanocavities</td>
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<td></td>
<td>SLWA • Nonlinear</td>
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<td>Optics and Waveguide</td>
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<td>Technologies</td>
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<td></td>
<td>SWA • Biochemical</td>
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<td>Sensors I</td>
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<td>SOWA • 1um Fiber Lasers</td>
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<td>(ends at 9:45)</td>
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### Coffee Break, Harbour Ballroom Foyer

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<thead>
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<tr>
<td>10:00–10:30</td>
<td>SPPCom</td>
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<td>Sensors</td>
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### Lunch Break (on your own)

<table>
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<td>Sensors</td>
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<td>SOF</td>
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### Concluding Remarks (ends at 17:45)

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<td>IPR</td>
<td>Integrated Photonics Research, Silicon and Nano Photonics</td>
</tr>
<tr>
<td>SOF</td>
<td>Specialty Optical Fibers</td>
</tr>
</tbody>
</table>
8:00–10:00
AMA • Network, Market and Operator View
Thomas Pfiefner, Alcatel-Lucent, Germany, Presider

8:00–10:00
AMA1 • Invited
BT NGA Deployment & Evolution Strategy as Drivers for NG-PON2 Requirements, Albert Rafel 1; 1Innovation & Design, Adastral Park, Martlesham Heath, UK. This paper outlines the current regulatory situation in the UK and BT’s open access operating model. It presents BT’s current FTTP architecture and design giving details of the interconnection points for unbundling purposes at Ethernet level as well as the components making the design future proof.

8:00–10:00
AMA2 • Invited
Next Generation Optical Access Networks, Ronald Hero 1; 1Access CTO Team, Alcatel-Lucent, Canada. Future optical access networks must support increased rate, reach, split, multi-operator access & wireline/wireless convergence. This paper outlines the role, challenges and breakthroughs of NG technologies including TDM-PON, WDM-PON & TWDM-PON.

8:30–10:00
JMA • IPR/SL Keynote Speaker Session
Jacob B. Khurgin, Johns Hopkins Univ., USA, Presider
Luc Thévenaz, École Polytechnique Fédérale de Lausanne, Switzerland, Presider

8:30–10:00
JMA1 • Plenary
Slow Light Enhanced Nonlinear Effects in Periodic Structures, Benjamin Eggleton; Univ. of Sydney, Australia. The generation of intense single-cycle THz pulses by tilted-pulse-front techniques for probing ultrafast nonlinear THz dynamics in semiconductors is described. Full-field imaging of THz Cherenkov waves and novel THz pulse detection methods are also discussed.

8:30–10:00
JMA2 • Plenary
Monitoring and Controlling Slow Light in Photonic Crystals, Daryl M. Beggs 1, Isabella H. Rey 1, Tobias Kampfrath 1, Thomas Krauss 2, Kobus Kuipers 1; 1FOM Inst. AMOLF, Netherlands; 2School of Physics & Astronomy, Univ. of St Andrews, UK. By performing ultrafast pump-probe experiments, we show the 0.3THz adiabatic frequency conversion of pulses in a slow-light photonic crystal waveguide with 80% efficiency. We demonstrate the use of this conversion scheme in a delay line.

8:30–10:00
SMA • Sensors Keynote Speaker Session
John Ballato, Clemson Univ., USA, Presider

8:30–10:00
SMA1 • Keynote
Prospects and Challenges in High Power Fiber Laser Technology, Andreas Tünnermann 1,2, Jens Limpert 1; 1Fraunhofer Inst. for Applied Optics and Precision Engineering, Germany; 2Inst. for Applied Physics, Friedrich-Schiller-Univ., Germany. Solid-state lasers are attractive sources of coherent radiation for various applications. At present fiber lasers and amplifiers are capturing the different markets. Novel developments and challenges in high-power fiber laser technology are reviewed.

10:00–10:30
Coffee Break, Pier 4/ Harbour Ballroom Foyer

10:00–16:00
Exhibits Open, Pier 4/ Harbour Ballroom Foyer
Technologies Res. Inst. (PSATRI), Saudi Arabia. We found that our system has recovery time 0.5ms system for the ring-and-spur long reach PON. We review recent progress on high spectral efficiency optical transmission with per-channel data rates beyond 100 Gb/s. Enabling technologies such as high-level QAM modulation and multiband superchannel transmission are discussed.

Chromatic Dispersion-Tolerant Higher-Order Multilevel Transmission with Optical Delay Detection, Nobuhiko Kikuchi1,2; 1Central Research Labs., Hitachi, Japan. We present a practical receiver-side chromatic dispersion (CD) compensation scheme for higher-order multilevel signaling using optical delay-detection, and up to 40-Gbit/s 16QAM signaling experiments have been demonstrated with large tolerance to CD (±40-km SMF) and laser phase noise (1-MHz linewidth).

Ultra High Capacity Transmission Based on High-Order QAM for Future Optical Transport Networks, Takayuki Kobayashi1, Akihide Samo1, Akihide Matsumura1, Tadana Nakagawa2, Eiji Yoshida1, Motoyoshi Yatsuki1; NTT Network Innovation Laboratories, NTT, Japan. High-capacity transmission using high-order QAM enhanced by powerful DSP is being intensely investigated. In this paper, we review recent high capacity transmission approaches and propose a 400-Gb/s superchannel configuration for future OTNs.

A. Koonen, Technische Univ. Eindhoven, Netherlands, Presider

The problem of installed fiber plants and the issue of energy consumption are two challenging points in the current technically and economically environment. This paper addresses the investment and interface technology level in Optical Distribution Network (ODN).

Presider

10:30–12:30
SPMA • High Spectral Efficiency
Ezra Ip, NEC Labs, USA, Presider

Optical Fiber in Passive Nanoscale Structures: New Functionalities for Nanophotonic Circuits, Olivier Martin1,2; 1Swiss Federal Inst. Of Technology, Lausanne (EPFL), Switzerland. We study in detail the modeling requirements for realistic plasmonic nanostructures and show that strong field gradients created at their vicinity can be used to trap nanostructures; this plasmonic trapping is also demonstrated experimentally.

Theoretical Investigation of CMOS-Compatible Metal-Oxide-Silicon-Oxide-Metal Waveguides, Min-Suk Kwon1; 1Optical Engineering, Sejong Univ., Republic of Korea. We propose a metal-oxide-silicon-oxide-metal (MOSOM) waveguide that is a hybrid plasmonic waveguide, and we discuss its fabrication process based on standard CMOS fabrication tools. Its characteristics are theoretically investigated and explained.

We study in detail the modeling requirements for realistic plasmonic nanostructures and show that strong field gradients created at their vicinity can be used to trap nanostructures; this plasmonic trapping is also demonstrated experimentally.

We propose a metal-oxide-silicon-oxide-metal (MOSOM) waveguide that is a hybrid plasmonic waveguide, and we discuss its fabrication process based on standard CMOS fabrication tools. Its characteristics are theoretically investigated and explained.

The problem of installed fiber plants and the issue of energy consumption are two challenging points in the current technically and economically environment. This paper addresses the investment and interface technology level in Optical Distribution Network (ODN).

Ultra High Capacity Transmission Based on High-Order QAM for Future Optical Transport Networks, Takayuki Kobayashi1, Akihide Samo1, Akihide Matsumura1, Tadana Nakagawa2, Eiji Yoshida1, Motoyoshi Yatsuki1; NTT Network Innovation Laboratories, NTT, Japan. High-capacity transmission using high-order QAM enhanced by powerful DSP is being intensely investigated. In this paper, we review recent high capacity transmission approaches and propose a 400-Gb/s superchannel configuration for future OTNs.

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A new type of all optical delay line is realized in fibers. A local dynamic grating reflector can be generated everywhere in the fiber, demonstrating >1 us delay for 650 ps pulses.

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SPMA • High Spectral Efficiency—Continued

SPMA4 • 12:00 Performance of Digital Nyquist-WDM, Gabriella Bocca1, Victorio Carr2, Andrea Carana1, Pierluigi Poggiolini1, Fabrizio Forghieri1; ‘Politecnico di Torino, Italy; ‘Cisco Photonics Italy, Italy. We investigate by simulation the performance of Nyquist-WDM signals generated using high-speed digital-to-analog converters (DACs) with either PM-QPSK or PM-16QAM modulation, taking into account speed and bandwidth properties of state-of-the-art DACs.

SPMA5 • 12:15 Real-Time Nyquist Pulse Modulation Transmitter Generating Rectangular Shaped Spectra of 112 Gbit/s 16QAM Signals, Rene Schmogrow3, Marcus Winter3, Matthias Meyer3, David Hillerkus3, Bernd Nebendahl3, Joachim Meyer3, Michael Dreschmann3, Michael Huebner3, Jurgen Leuthold3; ‘Institute of Photonics and Quantumelectronics, Karlsruhe Institute of Technology, Germany; ‘Institute for Information Processing, Karlsruhe Institute of Technology, Germany; ‘Agilent Technologies, Germany. A real-time software-defined transmitter generating Nyquist pulses with nearly rectangular spectra is demonstrated at 56 Gbit/s for PDM-QPSK and 112 Gbit/s for PDM-16QAM.

IMA • Modeling and Simulation I: Plasmonics—Continued

IMA4 • 11:45 High-Accuracy Calculations of Light Scattering by Plasmonic Cylinders Using the Legendre Pseudospectral Frequency-Domain (PSFD) Method, Chih-Yu Wang1, Shih-Yung Chang3, Chun-Hao Teng1, Chung-Ping Chen1, Hung-chun Chang2; ‘Electrical Engineering, Natl. Taiwan Univ., Taiwan; ‘Applied Mathematics, National Chiao Tung Univ., Taiwan. A high-order accurate pseudospectral frequency-domain (PSFD) method is used to analyze light scattering by plasmonic cylinders. Field coupling and enhancement within the gap of close spaced cylinders are examined.

IMA5 • 12:00 Polarizability of Single Split-Ring Nanoresonators at Optical Frequencies, Yuriy Tereshko1, Anton V. Zhuravlev1, Gennady V. Belokopytov1; ‘Oscillations Department, M.V. Lomonosov Moscow State Univ., Russian Federation. Full polarizability matrix including magneto-electric cross-components of single SRR was calculated by finite elements method. Three plasmon modes which defines resonance behavior of polarizability were identified.

IMA6 • 12:15 Low-loss Dielectric-coated Hollow Rectangular Plasmonic Waveguide supporting TIRs Guidance, B. M. Azizur Rahman1, Anita Quadri1, Huda Tanvir2, Ken T. V. Grattan3; ‘Electrical Electronic and Information Engineering City Univ. London, UK. Modal characteristics of a THz waveguide using an H-field based finite element method is presented. It is shown that by introducing Teflon coating, propagation loss of a hollow-core rectangular plasmonic waveguide can be significantly reduced.

IMB • Nanophotonics: Waveguides, Optomechanics, and SOI-based Technologies—Continued

IMB5 • 11:45 Design and Fabrication of Thermo-Optic Tunable Guided-Mode Resonance Filters, Mohammad J. Uddin1, Robert Magnusson2, ‘Electrical Engineering, Univ. of Texas at Arlington, USA. A novel thermo-optic tunable guided-mode resonance filter is designed and fabricated. The fabricated filter has a spectral width of 12 nm, tuning range of 15 nm, and tuning efficiency of 0.15 nm per degree Celsius.

IMB6 • 12:00 Highly Efficient Broadband Silicon-on-Insulator Grating Couplers for the Short Wave Infrared Wavelength Range, Bart Kayken1, Nam-nicha Wattanawet1, Diedrich Vermeulen2, Shankar K. Selvaraja1, Wim Bogaerts1, ‘William Green’, Roel Baets2, ‘FRG Ghent, FRG Ghent Univ./imec, Belgium; ‘IBM TJ Watson Res. Ctr., USA. We demonstrate broadband silicon-on-insulator fiber-to-chip grating couplers for the short wave infrared region. The devices show a peak coupling loss of -15.2 dB at 2150 nm and a 3 dB bandwidth of 160 nm.
SLMA • Applications of Slow/Fast Light—Continued

SLMA4 • 11:45
Phase Locking of SBS Slow Light in a 2.2-km Single-Mode Fiber, Joseph E. Vornehm1, Aaron Schweinsberg1, Zhimin Shi1, Robert Boyd1,2; 1Inst. Of Optics, Univ. of Rochester, USA; 2Dept. of Physics, Univ. of Ottawa, Canada. A stimulated Brillouin scattering (SBS) slow light system in a 2.2-km single-mode fiber was phase locked to a reference signal. Optical pulses of 6.5 ns duration were delayed 0.9 pulse width while maintaining lock.

SLMA5 • 12:00 • Invited
Microwave Photonics Applications Using Slow and Fast Light Effects, Juan Sancho1, Juan Lloret1, Ivana Gasulla2, Salvador Sales3, Jose Capmany2; 1TEAM Res. Inst., Univ. Politecnica Valencia, Spain. We review the potential applicability of SFL techniques to the field of Microwave photonics. The main results obtained for several applications such as filtering, phased array antennas, arbitrary waveform generation and OEO will be analyzed.

SMB9 • 11:45
Ultra-Sensitive (Acoustic) Pressure Sensor with High Temporal Resolution, Balthasar Fischer1, Ernst Wintner1; 1Photons Institute, Univ. of Technology Vienna, Austria. A novel all-optical pressure sensor is presented. Based on a rigid Fabry-Pérot, the transducer detects refractive index changes induced by pressure fluctuations. This design is so sensitive that the miniaturized device is applicable as microphone.

SMB8 • 12:00
Infrared radiation detector interrogated by Optical Frequency Domain Reflectometer (OFDR), Kivilcim Yüksel1, Christophe Caucheteur1, Jean-Michel Renoir2, Patrice Mégret1, Marc Debliquy2, Marc Wuilpart1; 1Electromagnetism and Telecommunications, U-MONS, Belgium; 2Material Science Unit, Univ. of Mons, Belgium. We experimentally demonstrated a fast infrared radiation sensor. The system is applicable in a quasi-distributed configuration to cover a large area using a single interrogation unit (OFDR) for early fire detection.

SMB7 • 12:15
Truly Continuous-Wave Spatial-Domain Cavity Ring-Down Technique Based on Frequency-Shifted Interferometry, Fei Ye1, Bing Qi1, Li Qian1; 1Department of Electrical and Computer Engineering, University of Toronto, Canada. We present a novel spatial-domain cavity ring-down technique using frequency-shifted interferometry, by monitoring the intensity decay of a continuous-wave beam circulating in a fiber-loop cavity. It was applied to fiber bend loss measurements.

12:30–13:30 Lunch Break (on your own)
Pandelis Kourtessis, UK, Presider

**AMC1 • 13:30**

The “Five W’s” of OFDM for Optical Access: What, Why, Where, When and How? Neda Cvetkovic; 1NEC US, USA. The “Five W’s” of OFDM-based optical access are addressed, covering technology principles and recent progress, application scenarios for future PON systems, the near-term development timeline, and the practical outlook for key DSP-based enabling technologies.

**AMC2 • 14:00**

A Novel Upstream Link Scheme for OOFDM-PON, Qingyi Cao1, Kan He2, Xian Li, Weiping Huang; 1Dept. of Electrical and Computer Engineering, McMaster Univ., Canada. We propose an efficient OOFDM-PON scheme: orthogonal subcarrier multiplexing at the ONU with colorless laser diode, and all-optical FFT at the OLT for high speed demultiplexing. The deterioration caused by laser perturbation is also investigated.

**AMC3 • 14:15**

Dynamic Subcarrier Allocation for OFDMA-PONs with Monitoring Mechanism, Wansu Kim, Pandelis Kourtessis, Milos Miliaourides, John Senesi; 1Optical Networks Group, Science and Technology of China, China; 2City Univ. of Hong Kong, Hong Kong, USA. A new protocol design for 10G OFDMA-PONs is reported, demonstrating dynamic subcarrier allocation based on monitoring of each ONU’s queuing status 0.7 ms packet delay and 540 Mbps throughput were achieved for 505 ONU.

**AMC4 • 14:30**

Benchmarking Comparison of Physical Layer Performance for Various Implementations of OFDM Access Networks, Ioannis Tomkos, Elias Giacoumidis, Athanasios Kavaztidis, Ivan Caneva, Josep Prat; 1AIT, Greece; 2UPC, Spain. An overview of the transmission techniques based on Orthogonal Frequency Division Multiplexing (OFDM) is presented. The characteristics and power budget/transmission performance of these methods are evaluated on optical access networks.

**SPMB1 • 13:30**

Digital Signal Processing for Multi-gigabit Real-time OFDM, Qiang Yang; State Key Laboratory of Optical Communication Technologies and Networks, China. We summarize the digital signal processing for multi-gigabit real-time optical OFDM. Various OFDM procedures and algorithms are discussed with a focus on OFDM receiver implementation.

**SPMB2 • 14:00**

Low-Complexity Multi-Band Polyphase Filter Bank for Reduced-Guard-Interval Coherent Optical OFDM, Alex Tzoumas, Mohd. Nazirun, EE, Technion, Israel. Smart multi-band signal processing yields substantial reduction of FDE FFT complexity for recent Reduced Guard Interval (RGI) techniques emerging in ultra-broadband long-haul OFDM, providing the simplest high-performance QPSK-OFDM system.

**SPMB3 • 14:30**

Compensation for Dispersion-Enhanced Phase Noise in Reduced-Guard-Interval Co-OFDM Transmissions, Qunyi Zuo, David V. Plant; 1Electrical & Computer Engineering, McGill University, Canada. We propose a dual-polarization grouped maximum-likelihood algorithm to compensate for the dispersion-enhanced phase noise of reduced-guard-interval (RGI) CO-OFDM. The laser linewidth tolerance is increased to 2 MHz after a 4000 km transmission.

**SPMB4 • 14:45**

Full Vectorial Finite-Difference Scheme for the Analysis of Thin Layered Structures, Cheng-Han Dai, Yih-Peng Chou; 1Graduate Inst. of Photonics and Optoelectronics, Natl. Taiwan Univ., Taiwan; 2Dept. of Electrical Engineering, Natl. Taiwan Univ., Taiwan. We develop a full-vectorial finite-difference formulation for layered structures. Fields and their derivatives across the layers are related by matrices. Sampled points can step over multiple layers. The computation is greatly saved.
Observed in atomic systems, we demonstrate that the transmission of π/2 rad are seen with a transmission of 95%.

Induced rotations of greater than π/2 rad are seen with a transmission of 95%. A 1.5-μm-diameter microfiber was embedded in a microchip for high sensitivity evanescent field absorption detection. The sensitivity of the device was investigated by measuring the absorbance of Methylene Blue, achieving a detection limit of 2.8 μM.
Novel 16QAM Detection Scheme for Optical Access Networks, Nicolas Sotropoulou, Haug de Waardt, A. Koomeu; 1Electrical Engineering, Eindhoven Univ. of Technology, Netherlands. In this paper, incoherent detection of a square 16QAM signal is demonstrated for the first time using simulations and the scheme’s suitability for future optical access networks, along with conventional coherent detection, is explored.

We investigated the feasibility of Alberta, Canada.

We will present a CMOS integrated silicon nano-photonics technology, which can enable future Exa-scale supercomputers by connecting racks, modules, and chips together with ultra-low power massively parallel optical interconnects.

We introduce recent progress on the control of light propagation in three-dimensional (3-D) photonic crystals. We demonstrate 3-D guiding within photonic crystal-embedded waveguides. A novel controlling approach using the surface of crystals is also discussed.

We experimentally demonstrate highly efficient coupling to a slotted photonic crystal waveguide using a mode converter and a photonic crystal impedance taper. Measurements show a -2dB insertion loss for coupling in/out of the slow light waveguide.

Simple incoherent interferometry technique is demonstrated and applied for accurate real-time group-delay monitoring of a dispersion-compensating fiber and of a 10m-long chirped fiber grating over up to 70nm-bandwidth at 15frames/s update rate.

The tests with broadband multimedia services of the SARDANA multi-layer prototype prove the feasibility of scalable hybrid DWDM/TDM-PON FTTH networks with resilient optically-integrated ring-trees architecture.

Noise ICI Mitigation for CO-OFDM Transport Systems, Mohammad Ebrahim Mousa Pasandi, David V. Plant; McGill University, Canada. We study the effects of clipping and quantization noise on the performance of an optical OFDM system. To this end we derive a closed-form formula that links optimum clipping with the bit resolution of signal converters.

To process and thermal variations. In this work, we investigated tradeoffs between sensitivity and overall length. The discussion includes plans for commercial fabrication.

We present novel ring resonator based bio-chemical sensors on silicon-nanowire-optical-waveguide and show that the sensitivity can be increased by an order of magnitude as compared to Silicon-on-insulator based ring resonators.

A 60 enhancement of transmittance is achieved at light incident angles 8-0°-75°.

Extending the reach of PON beyond 60 km utilizing incoherent detection of a square 16QAM signal is demonstrated for the first time using simulations and the scheme’s suitability for future optical access networks, along with conventional coherent detection, is explored.

Experimental Demonstration of Ultra-Low Loss Coupling into Slow Light Slotted Photonic Crystal Waveguide on Silicon Nanomembrane, Che Yon Lee, Xiaolong Wang, Swapnajit Chakravarty, Wei-Cheng Lai, Yi Zou, Ray T. Chen; 1Electrical and Computer Engineering, Univ. of Texas at Austin, USA; 2Omega Optics, USA. We experimentally demonstrate highly efficient coupling to a slotted photonic crystal waveguide using a mode converter and a photonic crystal impedance taper. Measurements show a -2dB insertion loss for coupling in/out of the slow light waveguide.

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Photonics Bio-Chemical Sensors on SNOW Ring Resonators, Mohammadreza Rokhassoninejad, Anant M. P. Anantham, Samirajit Saini; Univ. of Waterloo, Canada; Univ. of Washington, USA. In this paper we propose novel ring resonator based bio-chemical sensors on silicon-nanowire-optical-waveguide and show that the sensitivity can be increased by an order of magnitude as compared to Silicon-on-insulator based ring resonators.

We investigated the feasibility of Alberta, Canada.

We introduce recent progress on the control of light propagation in three-dimensional (3-D) photonic crystals. We demonstrate 3-D guiding within photonic crystal-embedded waveguides. A novel controlling approach using the surface of crystals is also discussed.

We present novel ring resonator based bio-chemical sensors on silicon-nanowire-optical-waveguide and show that the sensitivity can be increased by an order of magnitude as compared to Silicon-on-insulator based ring resonators.
SLMB • Applications of Slow/Fast Light II—Continued

SLMB5 • 15:00
Tunable Light-Storage for almost 1 Microsecond, Thomas Schneider1, Stefan Preisler1, Kambiz Jamshidi1; 1HFT, HfTL-Leipzig, Germany. We describe the latest results of the investigation of a new method to store optical packets called Quasi-Light-Storage (QLS). We discuss the method and show experimental results with a delay-bandwidth product of around 700 Bit.

SLMB6 • 15:15
All-Optical Control of the Group Velocity, Central Frequency and Spectral Bandwidth of a Laser Pulse, Stefano Cavalleri1, Emiliano Salì1, Emilio Ignesti1, Roberto Buﬁa2, Lorenzo Faini1, Marco Tognetti1; 1Physics, Univ. di Firenze, Italy; 2Physics, Univ. di Siena, Italy; LENS, Univ. di Firenze, Italy. We present recent results on different schemes (involving both coherent and incoherent interactions) that allow all-optical control of several properties of a large-spectral-bandwidth (up to 3.3 GHz) laser pulse propagating in an atomic medium.

SMC • Spectral and Biomedical Imaging—Continued

SMC6 • 15:00
Characterization of a Low-Cost Long-Period Fiber Grating Induced by a Polymeric Microstructure, Jorge A. Soto-Olmos1, Juan Hernández-Cordero2, Laura Ortega Ramón3; 1Departamento de Electrónica, Facultad de Ingeniería, Univ. Nacional Autónoma de México, Mexico; 2Inst. de Investigaciones en Materiales, Univ. Nacional Autónoma de México, Mexico. In this paper a low-cost long-period fiber grating induced by a polymeric microstructure is reported. Fabrication and characterization of the device and experimental results of the spectrum variations due to external pressures are presented.

SMC7 • 15:15
A Simple Bend Sensor Based on Multimode Interference and a Twin Core Fiber Mach-Zehnder Interferometer, Aissa Harhira1, Jorge A. Soto-Olmos2, Laura Ortega Ramón3; 1Departamento de Electrónica, Facultad de Ingeniería, Univ. Nacional Autónoma de México, Mexico. An optimized Bend Sensor based on a multimode interference combined with a twin-core fiber is proposed. The bend induced wavelength shifts on the interference fringes is experimentally monitored. Losses in multimode fiber are studied.

SOMC • Novel Glass and Fluoride Fibers—Continued

SOMC5 • 15:00
Fluoride Glass Fibers, Mohammad Saad1; 1IR-Photonics Canada, Canada. There is an increasing demand on high quality optical fibers that transmit over 2 microns, where silica fibers are opaque, for applications as divers as spectroscopy and sensing, laser power delivery, fiber lasers, fiber amplifiers, defense (IRCM). The talk will focus on latest development of fluoride fibers.

16:00–18:00 SLMC • Atomic and Rare-Earth Systems and Applications
John Howell, Univ. of Rochester, USA, Presider

SLMC1 • 16:00 Invited
Chip-Scale Platform for Quantum Interference-Based Slow Light in Atoms, Bin Wei1, John Hultebrink2, Katie Harv1; 1Electrical Engineering, Technion, Israel. We present a scheme to extend the frequency operation of phase shifters based on slow light in semiconductor optical amplifiers. We show that phase-shifting can be performed on microwave signals at frequencies approaching 180 GHz.

SLMC2 • 16:30
Extended Frequency Operation of Slow Light in Semiconductor Optical Amplifiers, Sean O’Duell1, Gadi Eisenstein1; 1Electrical Engineering, Technion, Israel. We describe the latest results of the investigation of a new method to store optical packets called Quasi-Light-Storage (QLS). We discuss the method and show experimental results with a delay-bandwidth product of around 700 Bit.

SLMC3 • 16:30
Microwave Light Storage, Thomas Schneider1, Stefan Preisler1, Kambiz Jamshidi1; 1HFT, HfTL-Leipzig, Germany. We describe the latest results of the investigation of a new method to store optical packets called Quasi-Light-Storage (QLS). We discuss the method and show experimental results with a delay-bandwidth product of around 700 Bit.

SOMC4 • 15:00
Flexible Optical Fiber Nanowire, Kambiz Jamshidi1, Stefan Preisler1; 1HFT, HfTL-Leipzig, Germany. We describe the latest results of the investigation of a new method to store optical packets called Quasi-Light-Storage (QLS). We discuss the method and show experimental results with a delay-bandwidth product of around 700 Bit.

16:00–18:00 SMD • SMD
Presider to Be Announced

SMD1 • 16:00 Invited
Multispectral Imaging in Combustion Analysis, Marshall B. Long1; 1Mechanical Engineering and Materials Science, Yale Univ., USA. Optical techniques employing a variety of light scattering mechanisms and detection strategies are important tools for studying combustion. Developments in lasers and detectors have enabled increasingly detailed measurements in these complex systems.

SMD2 • 16:30 Invited
Infrared and Raman Spectroscopic Imaging for Histopathology, Rohit Bhargava, Univ. of Illinois, USA. We present a new approach to recognizing cell types and disease states in tissue using vibrational spectroscopic imaging. Theory, instrumentation, pattern recognition algorithms and applications in specific areas will be discussed.

16:00–18:00 SOMD • Microstructured Fibers
Andreas Tunnermann, Friedrich Schiller Univ., Jena, Germany

SOMD1 • 16:00 Invited
New Prospect of Tellurite Microstructured Fibers, Yasutake Ohishi1,2; 1Research Center for Advanced Photon Center, Toyota Technological Inst., Japan; 2Research Center for Advanced Photon Center, Toyota Technological Inst., Japan. Dispersion tailored microstructured fibers and nanowires are developed using tellurite glasses. We demonstrate low threshold single-mode supercontinuum generation by using a tellurite nanowire under the pump of a picosecond fiber laser.

SOMD2 • 16:30 Invited
Multi-Material Optical Fiber Fabrication and Applications, Ayman Abouraddy1; 1Univ. of Central Florida, USA. Multi-material optical fiber fabrication and applications.

Sessions continue on page XX.
Continued and high-split WDM PONs. Using these technologies, we demonstrate the feasibility of implementing practical long-reach WDM PON technologies achieved at KAIST. We review the recent progresses in the coherent optical phase regeneration using phase sensitive based phase control method is investigated for all-optical phase regeneration using phase sensitive amplification. The phase Q factor is improved by 5.3-7.3 dB for a sampling rate of 312.5 MSa/s.

**AMD • Hybrid and WDM-PON—Continued**

**SPMC • Optical Techniques I—Continued**

**SPMC3 • 16:45**

Scalable Photonic-Assisted Wideband Frequency Converter, Charles Middleton1, Richard DeSalvo2; 1Harris Corporation, USA. We present a photonic-assisted wideband tunable RF frequency converter with low phase noise to provide RF to IF frequency translation, and demonstrate 121 dBHz^-1/3 spar-free dynamic range at 20 GHz RF and 2 GHz IF.

**SPMC4 • 17:00**

Performance of a DSP Phase Control Method for Phase Regenerators Based on Phase Sensitive Amplification, Shu Zhang1, John Cartridge2; 1Electrical and computer engineering, Queen’s University, Canada. A digital signal processor based phase control method is investigated for all-optical phase regeneration using phase sensitive amplification. The phase Q factor is improved by 5.3-7.3 dB for a sampling rate of 312.5 Ms/s.

**SPMC5 • 17:15**

Modeling Polarization in a Bidirectional Fiber System, William Le1, Li Qian1; 1ECE, University of Toronto, Canada. We present, for the first time, methods to model the polarization of the output lightwave of a bidirectional fiber-optic system, in which the lightwave propagates through polarization control elements in both directions.

**IME • Devices and Components I—Continued**

**IME3 • 16:45**

Athermal Silicon Waveguides Using the Sub-wavelength Grating Effect, Jens H. Schmidt1, Marc Bruins2, Paul Cheben1, Jean Lapointe2; 1Siegfried Jutz1, Przemek J. Bock1, Adam Demmone1, Robin Ma2, Winnie N. Ye1, Dan-Xia Xu2; 1Inst. for Microstructural Sciences, Natl. Res. Council Canada, Canada; 2Dept. of Electronics, Carleton Univ., Canada. We present a method for designing athermal silicon waveguide devices using the subwavelength grating effect. Photonic wire waveguides are patterned with periodic gaps and filled with SU-8 polymer to cancel the silicon thermo-optic effect.

**IMEF • Nanophotonics: Photonic Crystals and Nanowires—Continued**

**IMEF3 • 16:45**

Enhanced Light Emission from Silicon Using Photonic Crystal Nanocavities, Liem O’Faolain1, Matteo Galli2, Abdul Shakoor1, Roberto Lo Savio1; 1Simone Portaliuppi1, Karl Wulfs1, Dario Gera2, Giorgia Giuzzetti2, Lucio Claudio Andreanti2, Thomas Krauss3, Alessia Irrera3, Giorgia Franzina3, Francesco Prida3, 1SUPA, School of Physics and Astronomy, Univ. of St Andrews, UK; 2Dipartimento di Fisica “A. Volta”, Univ. Degli Studi di Pavia, Italy; 3MATS-IMM-CN R, Italy. Using Photonic crystal nanocavities, we first dramatically enhance third harmonic generation from silicon. Then, by virtue of a strong Purcell factor, we significantly increase defect state photoluminescence and greatly suppress thermal quenching.

**IMEF4 • 17:00**

Silicon Photonic Wire Bragg Grating for On-chip Wavelength (De)Multiplexing Employing Ring Resonators, Paul Maisner1, Roman Bruck1, Matthias Karl1, Matthias Bau1, Torsten Wahlbrink1, Rainer Hainberger1; 1Health & Environment, AIT Austrian Inst. of Technology GmbH, Austria. We present the design and experimental demonstration of a highly reflective silicon photonic wire Bragg grating operated for TM-polarized light at a wavelength of 1550 nm.

**IMEF5 • 17:15**

Photonic Band Structure of Circular Photonic Crystals in Silicon-on-Insulator Slab by Surface Coupling Reflectivity Technique, Jian H. Lin1, Dukh Bich Do1, Georg W. Regens1, Jeff F. Young1, Hung Chih Kao1, Chia Chen Hsu2; 1Dept. of Physics, National Chung Cheng Univ., Taiwan; 2Graduate Inst. of Opto-Mechatronics, Natl. Chung Cheng Univ., Taiwan. We characterized the photonic band structure of a two dimensional (2D) circular photonic crystal (CPC) silicon membrane slab waveguide with surface coupling reflectivity (SCR) technique.
Control of Slow and Fast Light by Incoherent Interactions in Atomic Schemes, Stefano Cavalieri1, Emilio Ignesti, Marco Tognetti, Roberto Buffa, Lorenzo Fino, Emiliano Salti, Federico Temmanni. Physics, Univ. di Firenze, Italy; Physics, Univ. di Siena, Italy; LENS, Univ. di Firenze, Italy. We present recent theoretical and experimental results concerning both retardation and acceleration of light pulses in schemes involving a second ‘control’ laser field but that do not involve any coherent preparation of the atomic medium.

Simultaneous Two-Channel Slow Light, Anil K. Patnaik, Paul S. Hsu, Sukesh Roy, James R. Gord, AFRL, USA; Physics, Wright State Univ., USA; Spectral Energies, LLC, USA. Simultaneous control of light speed in two channels in a single delay element of a rubidium vapor cell is demonstrated.

Optical Precursors in Slow and Fast Light Media, Shengwang Du, Jiefei Chen, Michael M. Loy, George K. Wong. Physics, Hong Kong Univ. of Science and Technology, Hong Kong. We observe optical precursors generated from slow and fast light cold atomic media. Using constructive interference between sequenced precursors, we produce optical transient pulses with peak powers of about 9 times the input power.

Multi-Megahertz OCT: Technology, Recent Developments and Advantages, Thomas Klein, Wolfgang Wieser, Benjamin R. Biedermann, Christopher Eigenwillig, Robert Haber. Ludwig-Maximilians-Universität München, Germany. Fourier domain mode locked lasers enable unprecedented line rates in optical coherence tomography for completely new imaging protocols and data analysis approaches. The optical design and potential benefits for clinical diagnosis will be discussed.

Photonic Crystal Fibers, William Wadsworth. University of Bath, UK. This tutorial covers the concepts and properties of photonic crystal fibers, also known as microstructured or holey fibers. The similarities and differences between PCFs and specialty step-index fibers are discussed, together with fabrication and applications.
These concurrent sessions are grouped across two pages. Please review both pages for complete session information.

AMD • Hybrid and WDM-PON—Continued

Optical Subsystems for Next Generation Access Networks, Jose A. Lazaro1, V. Polo1, B. Schrënk1, F. Bonadé1, J. Cana1, E. T. Lopez1, C. Kazmierk1, G. de Valcour1, R. Brenot1, J. Beaulieu1, X.-Z. Qiu1, P. Oiseier1, M. Forzati1, P.-J. Rigole1, I. T. Monroy1, E. Tanglehoff1, M. Marotz1, L. Nicolau2, A. L. Teixeira2, D. Erazo2, D. Klonidis2, I. T. Monroy3, J. Prat3, C. Koulemanou4; 1Univ. Politècnica de Catalunya, Dept. TSC, Spain; 2Alcatel-Thales III-V labs, a joint Laboratory of “Alcatel Lucent Bell Labs” and “Thales Research & Technology” Campus Polytechnique, France; 3INTEC/IMEC-Ghent University, Gent, Belgium; 4Lynxall National Institute & Univ. College Cork, Ireland; 5Network and Transmission Laboratory, Acreo AB, Sweden; 6IGNIS, Törsö Hawaiian, Sweden; 7Danmarks Tekniske Universitet (DTU), Denmark; 8Technische Universität Eindhoven (TU/e), The Netherlands; 9Nanophotonics Research Centre, National Technical University ofAthens, Greece. Recent optical technologies are providing higher flexibility to next generation access networks: on the one hand, providing progressive FTTx and specifically FTTH deployment, progressively shortening the copper access network; on the other hand, also opening fixed-mobile convergence solutions in next generation PON architectures. It is provided an overview of the optical subsystems developed for the implementation of the proposed NG-Access Networks.

IMF • Nanophotonics: Photonic Crystals and Nanowires—Continued

IMF6 • 17:30 Temperature-enhanced Light Emission from Er:TeO2 Photonic Crystals, Pao T. Lin1, Michiel Vanhoute2, Jurejun Hsu3; 1Materials Science and Engineering, Massachusetts Inst. of Technology, USA; 2Materials Science and Engineering, Univ. of Delaware, USA. Photonic crystals are fabricated in Er-doped TeO2 films. Strong photoluminescence around 1530 nm is observed by 488-532 nm laser pumping. 98x enhanced emission is demonstrated after annealing the thin films at 600C.

IMF7 • 17:45 Thermal Radiation from Patterned Platinum Microstructures, Gábor Vásile1, Mustafa Arikan1, Snorri Ingvarsson1; 1Science Inst., Univ. of Iceland, Iceland; 2Natl. Inst. of Res.-Development for Cryogenics and Isotopic Technologies, Romania. We investigate thermal radiation from Pt microheaters with Au nanoparticles deposited. Polarization resolved thermal radiation was measured. Measurements show intensity of radiation is multiplied by factor of 2-3 for NP’s deposited microheaters.

18:30–20:00  Advanced Photonics Congress and OIDA Welcome Reception, Metro Ballroom West
Optical Pulse Differentiation Based on a Resonant Slow & Fast Light System, Sanghoon Chin, Tae-Jung Ahn, Luc Thévenaz; ‘Ecole Polytechnique Federale de Lausanne, Switzerland; ‘Photonics Engineering, Chosun Univ., Republic of Korea. We experimentally demonstrate that temporal differentiation of optical pulses can be realized in a slow & fast light system based on a resonance. The waveform of a 13 ns Gaussian pulse was experimentally first-order differentiated.

A Near-Infrared LED-based Material Classification Sensor System, Oliver Schwaneberg, Uwe Kockemann, Holger Steiner, Norbert Jung; ‘Computer Science, Bonn-Rhine-Sieg Univ. of Applied Sciences, Germany; ‘DFG Research Training Group 1564, Univ. of Siegen, Germany. In safety applications it is often desired that certain materials do not enter a dangerous area. This paper presents a near-infrared LED-based sensor system for robust material classification and ranging up to a distance of 1,000mm.

Enhanced Echo Retrieval Efficiency Using Ultraslow Light, J. Hahn, Byoung S. Hahn; ‘School of EE, Inha Univ., Republic of Korea. Using ultraslow light phenomenon, we report two-orders of magnitude enhanced photon echo efficiency in a rare-earth doped solid medium, where the enhancement is due to lengthened photon-atom interaction time in a dilute optical medium.

Resonant Cavity Enhanced LWIR Sensing in Polycrystalline Pb1-xSnxTe, Timothy W. Zens, Piotr Becla, Lionel Kimerling, Anu Agarwal; ‘Microphotonics Center, Massachusetts Inst. of Technology, USA. Polycrystalline Pb1-xSnxTe LWIR photodetectors have been fabricated in resonant cavity structures on Si platforms. We describe the fabrication process and report detector performance demonstrating the feasibility of monolithic LWIR detectors-on-ROIC.
Tuesday 14 June

These concurrent sessions are grouped across two pages. Please review both pages for complete session information.

8:00–10:00

**AtUa • Basic Technologies for**

**NG-PON**

José Pratt, Univ. Politecnica de Catalunya, Spain, Presider

**AtUa1 • 8:00**

Semiconductor Optical Amplifiers in Extended Reach PONs, Jiurg Leuthold, W. Freude, C. Koss, R. Bonk, S. Koenig, D. Hillerkuss, R. Schmogrow; Institute of Photonics and Quantum Electronics (IPQ) & Institute of Microstructure Technology (IMT) at Karlsruhe Institute of Technology, Germany. Design guidelines for semiconductor optical amplifiers (SOAs) in extended reach PON networks are discussed. Important parameters such as the input saturation power or the alpha factor and their impact in PON networks are discussed.

**AtUa2 • 8:30**

WDM PON Based on Silicon Photonic Micro-ringing Modulators, Keven Bergman; Columbia Univ., NY, USA. We demonstrate an optical access network architecture uniquely enabled by CMOS compatible silicon micro-rings. The wavelength selective behavior of micro-ring modulators enables single-sideband modulation, which simultaneously generates downstream signals and centrally distributed carriers for upstream re-modulation.

**AtUa3 • 9:00**

Burst Mode, Overlapping Sub-Carrier Multiplexed (SCM) WDM PONs, David V. Plant,1 A. El-Sahn,2 Jonathan M. Buset1, Bhavin J. Shastri1,1 McGill Univ., Canada. A symmetric WDM PON architecture using an innovative overlapped-SCM scheme that maximizes the spectrum usage of a bandwidth-limited ROA is demonstrated. In addition, burst mode receivers for this application are discussed.

8:30–9:30

**SPTUa • Coding I**

**Moshe Nazarathy, Technion - Israel Inst. of Technology, Israel, Presider**

**SPTUa1 • 8:30**

Implementation and Evaluation by Hardware Emulator of Soft-Decision Forward Error Correction for 100G Systems, Kiyoshi Onohara1, Yoshikumi Miyata1, Kenya Sugihara1, Takashi Sughan1, Kazuo Kubo1, Hideo Yoshida1, Kazunari Koguchi1, Takashi Mizouchi1, Mitsubishi Electric Corp., Japan. We discuss implementation and performance evaluation of LDPC(4608,4080) for 100Gb/s throughput by hardware emulator. We expect that an NGC of the LDPC code concatenated with enhanced FEC is 10.8 dB at a BER of 10^-15.

**SPTUa2 • 9:00**

Alamouti Code against PDL in Polorization Multiplexed Systems, Santi Mantzaris, Ghasy Rekaya-Ben Othman2, Yves Juarez1, Jungki Li2, Swen Koenig2, Rene Schmogrow2, Jiurg Leuthold2; 'Comete, Telecom ParisTech, France; 'Institute of Photonics and Quantumelectronics, Karlsruhe Institute of Technology (KIT), Germany. We theoretically and experimentally investigate the performance of the Alamouti polarization-time code to mitigate PDL. We show that due to the orthogonal structure of its codewords, it can entirely compensate PDL.

**SPTUa3 • 9:15**

On the Joint Optimization of Modulation and Channel Coding for High Data-Rate Optical Communication Systems, Paolo Lommi1, Stefano Calabro1, Berthold Lankl1, Bernhard Spindler1; 'UniversitÄÈä der Bundeswehr MÄÈÈchen, Germany; 'Nokia Siemens Networks GMBH & Co KG, Germany. We present a method to jointly optimize modulation and channel coding for high data-rate, non-differentially encoded optical systems, taking phase noise into account. Applied to 100G systems, it shows that constellation expansion might be beneficial.

8:30–10:00

**ItUa • Devices and Components II**

**Peter Rakich, Sandia Natl. Labs, USA, Presider**

**ItUa1 • 8:30**

Nano-Optomechanical Systems, Hong Tang1, 2 Yale Univ., USA. We describe the convergence of NEMS and nanophotonics in novel optomechanical circuits. Through active coupling of NEMS with high Q cavities, we demonstrate further scaling of NEMS in size, mass, sensitivity, frequency, and damping rate.

**ItUa2 • 9:00**

Compact and Widely Wavelength Tunable Lasers Based on Flexible Polymer Bragg Reflection Waveguide, Kyung Ho Kim1, Jon Whie Kim1, Min-Chol Oh2; 'Electrical Engineering, Pusan National University, Republic of Korea. Widely tunable and reproducible operation of tunable laser is demonstrated based on the extraordinary elastic property of flexible polymer Bragg reflector. Compact tunable laser package is also demonstrated by incorporating a small PZT actuator.

**ItUa3 • 9:15**

High-Finesse Cavities Fabricated by Buckling Self-Assembly of a Si/SiO2 Multilayers, Trevor Allen1, Josh Silverstone1, Ray DeCorby1, Nakeeran Quidant1; 1Mitsubishi Electric Co., Japan. We demonstrate an optical access network architecture uniquely enabled by CMOS compatible silicon micro-rings. The wavelength selective behavior of micro-ring modulators enables single-sideband modulation, which simultaneously generates downstream signals and centrally distributed carriers for upstream re-modulation.

8:30–10:00

**ItUb • Nanophotonics: Plasmonics and Applications I**

**Pierre Berini, Univ. of Ottawa, Canada, Presider**

**ItUb1 • 8:30**

Molding Light in Plasmonic and Metamaterial Structures, Dragomir N. Neshev1, 2 Nonlinear Physics Centre, RSPE, Australian Natl. Univ., Australia. We present our advances on manipulation of light in metallic nanostructures, including arrays of nanodots and left-handed fishnet metamaterials. In particular we show experimentally the nonlinear tuning of liquid crystal infiltrated metamaterials.

**ItUb2 • 9:00**

All Optical and Electro Optical Active Plasmonic Telecom Components, Sukanya Randhawa1, Alexey V. Krausov2, Jan Renger2, Anatoly Zayats1, S. Lazeche1, Alex Bouhelier1, Romain Quaidant1; 'Plasmon nano-optics, Inst. of Photonic Sciences, Spain; 'King’s College, UK; ‘Inst. Carnot de Bourgogne, France. We demonstrate numerically and experimentally all optical and electro optic switching of the SPP transmission at telecom wavelengths, utilizing a compact and highly sensitive ring resonator.

**ItUb3 • 9:15**

Metals - Metamaterials in Flexible Substrates at Visible Wavelengths, Andrea D. Forlaci1, Thomas A. Krauss2; 'School of Physics and Astronomy, Univ. of St Andrews, UK. We discuss our recent results in the realization and characterization of Metalens, for different plasmonic structures, including a novel mechanism yielding to ultra-narrow spectral features in flexible plasmonics.
These concurrent sessions are grouped across two pages. Please review both pages for complete session information.

8:30–10:00
SLTuA • Slow/Fast Light in SOAs and Photonic Crystals
Thomas Krauss, Univ. of St. Andrews, UK, Presider

STuA1 • 8:30
Invited
All-Optical Processing in III-V Photonic Crystals, Alfredo de Rossi1, Sylvain Combris2, Pierre Colman1, Chad Hauk2, Chee W. Weng1, Isabelle Sagnes3, Isabelle Cester1, Vardit Eckhouse1, Gad Elserstein1, Thales Res. and Technology, France; ‘Optical Nanostructure Lab., Columbus, USA; ‘Lab. de Photonique et de Nanostructure (CNRS UPR 20), France; ‘Electrical Engineering Department, Technion, Israel. Efforts made to improve the Photonic Crystal Waveguides against linear and nonlinear losses have made the promises of this technology possible. We discuss some of the major achievements, particularly the demonstration of optical solitons on-chip.

SOTuA3 • 9:15
Characterization of Fiber Supercontinuum by Chromatic Scattering, Eugeni F. Martynovich1, V. P. Dresvianski1, A. A. Starchenko1, S. M. Kobtsev2, S. V. Kukarin2, S. N. Bagayev1, 1Institute of Institute of Laser Physics SB RAS, Russian Federation; Novosibirsk State University, Russian Federation; Institute of Laser Physics SB RAS, Russian Federation. Chromatic scattering has been proved to characterize the polarization state of the fiber supercontinuum spectral components during propagation in media. Applications are considered for novel technology of multi-layer data recording.

8:30–10:00
STuA • High Intensity and Broadband THz Sources
Peter Jeppesen, Technical Univ. of Denmark, Denmark, Presider

STuA1 • 8:30
Invited
Filamentation THz generation in air, Leong Chin, Universite Laval, Canada. Experiments on THz pulse generation from single and multiple filaments in air using single or two-color technique will be discussed. Its application to sensing molecular rotational wave packet revival will be given. Stand-off detection of THz from a distance through monitoring nitrogen fluorescence in a filament was observed. The physics seems to be due to population trapping in the wake of strong field interaction with nitrogen molecules inside the filament.

SOTuA2 • 9:00
Frequency Unlimited Optical Delay Lines Based on Slow and Fast Light in SOAs, Perrette Boyer1,2, Romeo Bourderionnet1, Minthao Phu1, Kristian Vind1, Fabian Bretenaker1, Daniel Dolfi1, Mehdi Alouini4, 1Thales Res. and Technology, France; 2Lab. Aimé Cotton, CNRS-Univ. Paris Sud 11, France; ‘DTU Fotonik, Dept. of Photonics Engineering, Technical Univ. of Denmark, Denmark; ‘Inst. de Physique de Reims, USMR CNRS 6231, France. We experimentally demonstrate that up-converted coherent population oscillations (CPO) in SOA open the possibility to conceive integrated optical tunable delay lines beyond the carrier lifetime limit, up to THz frequencies.

STuA1 • 9:00
Invited
Transient Reflective Ultra-broadband THz Spectroscopy, David Cooke1, Lyudok Tsveta1, Tyler L. Cocke2, Fredrik C. Krebs3, Ali Meldave1, Franck Haynau3, Peter U. Speiser1, ‘Physics, McGill University, Canada; ‘Physics, University of Alberta, Canada; ‘Riso National Laboratory, Technical University of Denmark, Denmark; ‘Photonics Engineering, Technical University of Denmark, Denmark. We discuss recent experiments using a novel time-domain THz spectrometer using air plasma to generate and detect ultra-broadband THz pulses. Using this novel setup, we map the ultrafast carrier response of organic and nanocrystalline semiconductors.

SOTuA2 • 9:00
Characterization of Fiber Supercontinuum by Chromatic Scattering, Eugeni F. Martynovich1, V. P. Dresvianski1, A. A. Starchenko1, S. M. Kobtsev2, S. V. Kukarin2, S. N. Bagayev1, 1Institute of Institute of Laser Physics SB RAS, Russian Federation; Novosibirsk State University, Russian Federation; Institute of Laser Physics SB RAS, Russian Federation. Chromatic scattering has been proved to characterize the polarization state of the fiber supercontinuum spectral components during propagation in media. Applications are considered for novel technology of multi-layer data recording.

8:30–10:00
SOTuA • Supercontinuum Fiber Lasers
Alain Villeneuve, Genia Photonics Inc., Canada, Presider

SOTuA1 • 8:30
Invited
UV/Vis Supercontinuum and Apps, John Clowes1. Abstract not available.

SOTuA2 • 9:00
Characterization of Fiber Supercontinuum by Chromatic Scattering, Eugeni F. Martynovich1, V. P. Dresvianski1, A. A. Starchenko1, S. M. Kobtsev2, S. V. Kukarin2, S. N. Bagayev1, 1Institute of Institute of Laser Physics SB RAS, Russian Federation; Novosibirsk State University, Russian Federation; Institute of Laser Physics SB RAS, Russian Federation. Chromatic scattering has been proved to characterize the polarization state of the fiber supercontinuum spectral components during propagation in media. Applications are considered for novel technology of multi-layer data recording.

STuA3 • 9:15
Broadband Enhanced 26 MV/cm THz Radiation in Uniform Nano-slit Arrays, Mostafa Shalaby1, Marco Peccianti2, Luca Razzari1, Gargi Sharma1, Thomas Fereur1, Anja Weber1, Hans Sigl1, Bruce Patterson1, INRS-EMT, Canada; ‘Institute of Applied Physics University of Bern, Switzerland; ‘Institute for Chemical and Physical Processes, Italy; ‘Laboratory for Micro- and Nanotechnology, Paul Scherrer Institut, Switzerland; ‘SwissFEL, Paul Scherrer Institute, Switzerland. We investigate a 1D uniform array of nano-slit capable to induce broadband plasmon-mediated field enhancement exceeding 100 in the range 0.2 to 2 THz, with a peak value of 760 at 0.2 THz.

STuA3 • 9:15
Taper Topography Control of Instabilities and Rogue Waves in Supercontinuum Fibers, Benoit Barviau1, Arnaud Mussot1, Alexandere Kudlinski2, John Dudley1, ‘University of Lille, France; ‘FEMTO-ST, France. Longitudinal variation of dispersion and nonlinearity in tapered photonic crystal fiber dramatically improves the noise characteristics of supercontinuum generation. Experimental results are interpreted in terms of modified rogue wave dynamics.

Sessions continue on page XX.
in the electronic domain, thus avoiding complex optical domain buffering. In OBS networks, this is achieved through control packet-based contention resolution techniques. Here, we present a new approach that employs multi-server polling in LR-EPON and adaptive threshold-based burst assembly in OBS networks.

**AfU4 • Devices and Components II—Continued**

**AfU4 • 9:30**

First Demonstration of Cavity-Resonator-Integrated Guided-Mode Resonance Filter, Kenji Hatanaka, Shogo Ura, Junji Nishii; National Institute of Advanced Industrial Science and Technology, Japan; *Dept. of Electronics, Kyoto Inst. of Technology, Japan; Research Inst. for Electronic Science, Hokkaido Univ., Japan.* A guided-mode resonance filter integrated in a waveguide cavity resonator was designed and fabricated for miniaturization of aperture size. A high-reflection filter at around 850-nm wavelength was experimentally demonstrated for the first time.

**AfU5 • 9:45**

Resonant Cavity Enhancement of Polycrystalline PbTe Films for Two-Color IR detectors on Si-ROIC. Timothy W. Zens, Jianfei Wang, Michelle Y. Xu; Microphotonics Center Alumni, Massachusetts Inst. of Technology, USA; *Microphotonics Center Alumni, Massachusetts Inst. of Technology, USA.* Dual color (1.5 and 3.5 µm) resonant-cavity-enhanced IR photodetectors on a silicon platform have been demonstrated. We describe the fabrication process and report detector performance demonstrating the feasibility of monolithic IR detectors-on-ROIC.

**AfU5 • 9:45**

Dielectric Strip Grating Embedded Trapezoidal Plasmonic Waveguide, Michelle Y. Xu, Stewart Aitchison; *Univ. of Toronto, Canada.* Novel dielectric strip grating embedded trapezoidal SPP waveguides are designed, fabricated, and characterized in air and under index matching oil. The resonance has a 1100 nm/RIU sensitivity and is validated by calculation.

**AfU8 • Nanophotonics: Plasmonics and Applications I—Continued**

**AfU8 • 9:30**

Hybrid Plasmonic Waveguide Devices for Silicon on Insulator Platform, Muhammad Adam; *Stewart Aitchison, Mo Mojahedi; Univ. of Toronto, Canada.* Properties of the modes supported by the hybrid metal-low index waveguide are strongly polarization dependent. We present designs of a number of hybrid waveguide devices for silicon on insulator platform that utilizes this property.

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**NOTES**

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These concurrent sessions are grouped across two pages. Please review both pages for complete session information.

**SLTuA • Slow/Fast Light in SOAs and Photonic Crystals—Continued**

**SLTuA • 9:30 Invited**

Direct Observation of Temporal Solitons and Pulse Acceleration in III-V Semiconductor Photonic Crystal Waveguides, Timothy Karle1, Paul Monnier1, Sylvain Combrié2, Alfredo de Rossi2, Fabrice Raineri1, Rama Raj1; 1LPN-CNRS, France; 2Thales Res. and Technology, France. Temporal mapping of 20pJ pulse propagation in a 2DPhC waveguide show of soliton formation. For high signal powers the photonic band is modified influencing the group velocity leading to an acceleration of the pulse propagation.

**STuA • High Intensity and Broadband THz Sources—Continued**

**STuA • 9:30 Invited**

High Power Terahertz Pulse Generation, Imaging, and Detection, Frank Hegmann; The generation of intense single-cycle THz pulses by tilted-pulse-front techniques for probing ultrafast nonlinear THz dynamics in semiconductors is described. Full-field imaging of THz Cherenkov waves and novel THz pulse detection methods are also discussed.

**SOTuA • Supercontinuum Fiber Lasers—Continued**

**SOTuA • 9:30 Invited**

Infrared Supercontinuum Fiber Sources, L. Brandon Shaw1, Rafael Gattass1, Jas Sanghera1, Ishwar Aggarwal2; 1NRL, USA; 2Sotera Defense Solutions, USA. IR supercontinuum generation in chalcogenide glass fiber is reviewed. Modeling for optimizing supercontinuum generation, fiber design and fabrication, and experimental results are presented.

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**10:00–10:30 Coffee Break, Pier 4/ Harbour Ballroom Foyer**

**10:00–16:00 Exhibits Open, Pier 4/ Harbour Ballroom Foyer**
Joint

Tuesday 14 June

10:30 – 12:30
AuBu • Radio Over Fiber and OCDMA
Thomas Pfeiffer; Alcatel-Lucent, Germany, Presider

AuBu1 • 10:30 Invited
Techniques, Applications, and the Outlook of Radio-over-Fiber Networks, Anthony Xigoma1; Cerming Inc, USA. We discuss key RoF system challenges, including MIMO and mm-wave signal transmission at 60 GHz. We propose practical solutions and successfully demonstrate practical RoF system implementations capable of delivering >30 Gb/s wireless data signals.

AuBu2 • 11:00
Research on OFDM-ROF system at Millimeter-wave Band Employing Optical External Modulator Generation, Zhe Kang2, Jiayu Ren3, Dong Wang4, Jingjing Liu5, Yingying Gao6; 1Dalian Polytechnic Univ., Res. Inst. of Photonics, China; 2Beijing Univ. of Posts and Telecommunications, Information and Electronics Technology Lab, China. A 40GHz Radio-over-Fiber system is proposed to transmit 2.5Gb/s 16QAM-OFDM wireless signals with only 20GHz RF source. Simulation results show that a reliable EVM value is obtained after 40km SMF transmission.

AuBu3 • 11:15 Wireless Convergence over Next Generation OFDMA-PONs, Milos Milesevic1, Pandelis Kourtessis2, John Senior3; 1Univ. of Hertfordshire, UK. This paper demonstrates the feasibility of optical/wireless convergence based on DoF propagation. Network modelling results confirm the transmission of 16 CPRI signals up to 100km OFDMA-PON infrastructures achieving 40 Gbit/s total aggregate rates.

AuBu4 • 11:30 Invited
OCDMA and OFDMA Technologies for NG-PON, Ken-ichi Kitayama1, 2Chuka Univ, Japan. OCDMA and OFDMA are promising for NG-PON2, aiming at a revolution change after 2015. OCDMA and OFDMA can implement new demands for soft-capacity on-demand, high data confidentiality, high bandwidth efficiency as well as low-power consumption.

AuBu5 • 12:00 Influence of the MAI Distribution over the BER Evaluation in a Multirate, Multiclass OCDMA System, Thiago R. Raddo1, Anderson Sanchez2, Jose Valdemar dos Reis3, Jr, Ben-Hur V. Borges4; 1Electrical, Sao Paulo Univ, Brazil. We propose a BER expression based on binomial distribution for a multirate OCDMA system. We compare it with Possion assumption for MAI and show the later underestimates the number of users for a given BER.

AuBu6 • 12:15 Point-to-point and Point-to-multipoint CDMA Access Network with Enhanced Security, Alfredo A. Ortega1, Victor A. Bettacheini2, Jose Ignacio Alvarez-Hamelin3, 4Diego F. Gress2; 5Optoeléctronica, ITBA (Inst. Tecnol. de Buenos Aires), Argentina; 6CONICET (Argentinian Council of Scientific and Technological Res.), Argentina. We propose a network implementation with enhanced security at the physical layer by means of time-hopping CDMA, supporting cryptographically secure point-to-point and point-to-multipoint communication.

10:30 – 11:45
SPTuB • Advanced Modulation
Rene Schmogrow, Karlsruhe Institute of Technology, Germany, Presider

SPTuB1 • 10:30 Invited
Ideal POL-QAM Modulation for Coherent Detection Schemes, Henning Buelow1, 2; 1EE/ON, Alcatel-Lucent, Germany; 2LIT, University Erlangen, Germany. The gain of POL-QAM at high OSNR can only be kept at low OSNR by increasing the complexity of the FEC decoder indicating that DSP effort has to be considered for a comparison versus PDM-QAM.

SPTuB2 • 11:00 Performance Evaluation of Coherent PS-QPSK (HEXA) Modulation, Gabriele Bosco1, Andrea Carnemi2; Politecnico di Torino, Italy. We investigate the performance of the 8-point four-dimensional PS-QPSK (HEXA) modulation format in uncompensated WDM long-haul optical transmission systems, comparing it to standard 16-point FM-QPSK and 4-point FM-BPSK constellations.

SPTuB3 • 11:30 A Modified CMA for PS-QPSK, Pontus Johannisson1, Martin Sjödin2, Magnus Karlsson2; 1Photonics Laboratory, Department of Microtechnology and Nanoscience, Chalmers University of Technology, Sweden. A modified constant modulus algorithm (CMA) is presented that allows polarization demultiplexing of polarization-switched QPSK. The suggested algorithm has been found to work well on both numerical and experimental data.

10:30 – 12:30
JTuA • IPR/SL Joint Session
John Howell, Univ. of Rochester, USA, Presider

JTuA1 • 10:30 Plenary
Progress and Technical Challenges for Integrated Optics, Katsunari Okamoto1; AiDi Corp., Japan. The paper reviews progress of integrated optics and discuss technical challenges of silicon photonics devices. It also describes a novel planar waveguide spectrometer based on Fourier transform spectroscopy.

JTuA2 • 11:15 Plenary
Shaping the Future of Nanobiophotonics, Kishan Dholakia1, Tomas Cizmar1, Michael Mazilu1, Joerg Baumgartl1, Praveen Ashok1, Xanthi Tsampoula1, Frank Gunn-Moore1; 1Univ. of St Andrews, UK. We describe the emerging field of Nanobiophotonics with an emphasis on shaping light and integration. Examples of advances in super resolved imaging, optical manipulation, Raman analysis and cell transfection will be presented.

JTuA3 • 12:00 Invited
Slotted Photonic Crystal Slow Light Modulators, Juerg Leuthold1, W. Freude1, K. Koiz1, L. Alliart2, D. Korn3, R. Palmer4, J.M. Brisco5; 1Institute of Photonics and Quantum Electronics (IPQ) & Institute of Microstructure Technology (IMT) at Karlsruhe Institute of Technology, Germany. CMOS-compatible electro-optic modulators offering highest-speed signal processing with little power consumption are reviewed. Emphasis is given to slotted photonic crystal modulators fabricated by taking advantage of the silicon-organic hybrid platform.

12:30-13:30 Lunch Break (on your own)
10:30–12:30  
**STuB • THz Spectroscopy and Imaging Applications**  
David Cooke; McGill Univ., Canada, Presider

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**STuB1 • 10:30**  
Invited  
Science and Technology in the Submillimeter with High Resolution Techniques, Frank C. De Lucia;  
3Physics, Ohio State University, USA. With emphasis on high-resolution systems, the interaction of the  
physics of the spectral region with the physics of applications will be discussed. It will be shown how  
this leads to optimal choices of system strategies.

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**STuB2 • 11:00**  
Ultrafast Imaging of Terahertz Pulse Generation by Cherenkov Radiation in LiNbO3, Zhanyou  
Wang; Physics department, University of Alberta, Canada. We demonstrate full-field imaging of terahertz  
waves induced by a point focused pulse in lithium niobate. The group velocities of the optical  
and THz pulses as well as the Cherenkov radiation angle are directly measured.

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**STuB3 • 11:15**  
Spatio-temporal Characteristics of THz Emission at the Subwavelength Scale via Optical Rectifica-  
tion, Sze Phing Ho1,4, Matteo Clerici1, Marco Pecianti1, Fabrizio Buccheri1, A. Busacca 3, Tsanevski  
Osaki1, Jaliil Ali1, Roberto Morandotti1; 3INRS Energie, Matériaux et Télécommunications, Canada;  
1IPCF-CNRS, UOS Roma, Italy; 4DIEET, University of Palermo, Italy; 3DIEET, University of Palermo,  
Italy; 5Nanophotonics Research Alliance, Universiti Teknologi Malaysia, Malaysia. Highly localized THz  
emission via optical rectification in thin nonlinear crystals is a promising method for subwavelength microscopy. We present here the peculiar  
THz spatio-temporal characteristics induced by the non-paraxial generation regime.

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**STuB4 • 11:30**  
Time and Frequency-resolved Terahertz Microscopy with a Photoconductive Near-field Probe, Jan  
Wallauer1, Alex Ortmann1, Andreas Bützer1, Stefan Waselikowski1, Markus Walther1, 3Physics, University  
Freiburg, Germany. Using a photoconductive antenna as scanning THz near-field probe we demonstrate  
mapping of electric and magnetic fields close to microstructures. Our approach visualizes the near-fields  
with sub-ps temporal and sub-wavelength spatial resolution.

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**STuB5 • 11:45**  
Dielectric Properties of Heavy Oils Using Terahertz Time-Domain Spectroscopy, Amin Kabir1,  
Ayesheshim Ayesheshim1, Lyubov Titova1, Zhenyou Wang1, Patrice Abivin2, Yuesheng Cheng2, Kentaro  
Freiburg, Germany.

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**STuB6 • 12:00**  
Towards 1-mW THz Photocative Switches and Photomixers that can be driven by fiber mode-locked  
and cw-diode lasers, respectively. The average power of the PC switches is approaching 1 mW.

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10:30–12:15  
**SOTuB • Chalcogenide and Tellurite Fibers**  
John Ballato, Clemson Univ., USA, Presider

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**SOTuB1 • 10:30**  
Invited  
Applications of Chalc Fibers, Dan Hewak1, K. Kahn1, C. C. Huang1; 1University of Southhampton, UK.  
Chalcogenide glass optical fibers have been extensively studied since 1967, when sulphide based fibers  
and their potential applications were first proposed. In this paper we describe our current work on  
the fabrication and application of chalcogenide fiber and our vision for their practical implementa-  
tion in the future.

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**SOTuB2 • 11:00**  
Chalcogenide Microstructured Optical Fibers for IR Photonics, Jean-Luc Adam1, Johann Trolës1,  
Laurent Brilland2; 1U. of Rennes-CNRS, France; 2Perfos, France. Chalcogenide glasses show broad IR  
transparency and high N.L. refractive index. Singlemode chalcogenide microstructured fibers were  
obtained with losses around 0.3dB/m in the mid-IR. Fibers with small or large effective mode areas  
were demonstrated.

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**SOTuB3 • 11:30**  
Chromatic Dispersion Engineering in Chalcogndide Microporous Fibers for the Middle-infrared,  
Bora Ung1, Maksim Skorobogatyi; 1Engineering physics, Ecole Polytechnique de Montreal, Canada. Tun-  
ing of the microporosity in the core of chalcogenide fibers provides extensive dispersion engineering  
that allows red-shifting of zero-dispersion points and flattened dispersion profiles. The porosity also  
significantly lowers propagation losses.

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**SOTuB4 • 11:45**  
Ragg Grazing in Sub-wavelength Chalcogenide Wires, Baja Ahmad1, Martin Rochette1; 1Electrical and  
Computer Engineering, McGill University, Canada. We report the photo-inscription of Bragg gratings  
in chalcogenide (As2Se3) fibers tapered down to 1 µm. A transmission dip of <-30 dB at a wavelength  
of 1573 nm is achieved after 9 minutes of exposure time with 633 nm light.

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**SOTuB5 • 12:00**  
Tungstate-Tellurite Optical Fibers for Special Applications, Alexey Kozolapov1, Yury Yatsenko1,  
Vitaly Nazaryants1, Maxim Astapovich1, Victor Potschchenko1, Alexander Mateev1, Vitaly Dseufope1,  
Gennady Snopatin2, Mikhail Churbanov2, Evgeny Dianov2; 1Fiber Optics Research Center of RAS, Rus-  
sian Federation; 2Institute of Chemistry of High-Purity Substances, Russian Federation. Different types  
of optical fibers with losses less than 100 dB/km were produced from high-purity tungstate-tellurite  
glasses. The microstructured fiber for supercontinuum generation in the range 3-5 µm with optical  
loss of 4 dB/m has been fabricated.
**JTuB1**

Fast Light in Erbium Doped Fibers Based on Coherent Population Oscillations with Nonlinear Negative Absorption, Francesco Arista-Yañez, Sonia Melle, Oscar G. Calderón; Optics, Universidad Complutense de Madrid, Spain.

**JTuB2**

Amplitude-Preserving Tunable Pulse Delay in AlGaAs-InP Active Ring-Resonators, Andrea Mollen, Antonio Canciamilla, Carlos Ferrari.

**JTuB3**

Simultaneous Slow and Fast Light, Bin Luo, Hong Guo; School of Electronics Engineering and Computer Science, Peking Univ., China.

**JTuB4**

Destructive Interference of Dark Resonances in a Room Temperature Tripod System, Santosh Kumar, Thomas Langpre, Fabien Bretenaker, Rupamamuri Ghosh, Fabienne Goldjahr; Javaulahar Nehru Univ., India; Lab Ame Cotton, France. We explore the response of a tripod system in AlGaInAs-InP under excitation by perpendicularly polarized pump and probe beams in the presence of a transverse magnetic field. Destructively interfering dark resonances are observed and interpreted.

**JTuB5**

Few-cycle Self-Induced Transparency Solitons, Yuan-Tao Lin, J-Hong Chen, R-Yu Kang, C-Hsien Lee; Inst. of Photonics Technologies, National Tsing Hua Univ., Taiwan.

**JTuB6**

Localized Dynamic Brillouin Gratings Permanently Induced by Chalcogenide Materials, Santagostina, Leonora Usini; Dept. of Information Engineering, CNIT, Univ. of Padova, Italy. A method to permanently induce localized, dynamic Brillouin gratings is proposed and numerically demonstrated. It exploits the threshold correlation of chaotic lasers signals.

**JTuB7**

Novel Highly Nonlinear Composite Tellurite Microstructured Optical Fibers for SC Generation, Qingzhi Du, Meijong Liu, Xin Yin, Weiqing Guo, Takenobu Suzuki, Yosuke Ohnishi; Toyota Technological Inst., Japan. We prepared a novel composite tellurite MOFs consisting of two different glasses as core and clad to freely control chromatic dispersion. Broad and flattened SC spectra were demonstrated in the fiber under femtosecond laser pumping.

**JTuB8**

Enhanced Low-Index Field Confinement by Radially Stratified Micro Optical Fibers, Wenfu Zhang, Jianwei Ma; Weiping Huang, Wei Zhao; State Key Lab. of Transient Optics and Photonics, Xian Inst. of Optics and Precision Mechanics, Chinese Academy of Sciences, China; Graduate School of the Chinese Academy of Sciences, China; Electrical and Computer Engineering, McMaster Univ., Canada. The modeling results show that light can be concentrated in nanometer-thin low-index rings with very high confinement efficiency.

**JTuB9**

High-Purity Tungstate-Tellurite Glasses and Single-Mode Fibers: Fabrication and Studies, Vitaly Derovetski, Alexander Moussev, Mikhail Churkunov, Billy Richards, Antineh Jalil, Alexey Kosolapov, Evgeny Dianov; Inst. of Chemistry of High-Purity Substances of RAS, Russian Federation; Inst. of Materials Research, Univ. of Leeds, UK; Fiber Optics Research Center RAS, Russian Federation. The single-mode optical fibers were fabricated from TeO2-WO3-La2O3-Bi2O3 glasses with low content of impurities and absorption losses less than 100 dB/km (1.56 μm). Rode-in-tube as well as monolith preform stretching techniques were used.

**JTuB10**

A Mode Coupled Erbium Doped Fiber Structure for All-Optical Regeneration of DPSK and OOK Signals, Scott Shepard, Richard Lang; Louisiana Tech Univ., USA; CenturyLink, USA. We numerically demonstrate all-optical regenerators based on mode coupled EDFAs. These are phase transparent for DPSK signals and improve the SNR of OOK signals by over 3 dB.

**JTuB11**

Ring-Based WDM-PON with Suppression of Rayleigh Backscattering, Interferometric Noise, Chi Wai Chow, Chin-Hung Yeh, Yu-Fu Wei, Fa-Yuan Shih, Sien Chi; Industrial Technology Res. Inst., Taiwan; Natl. Chiao Tung Univ., Taiwan. We demonstrate a ring-based WDM-PON. Rayleigh backscattering (RB) can be suppressed since the upstream signal and the RB are traveling in different directions. We also analyze the network performance when upgrading to 40-Gb/s.

**JTuB12**

40 Gbps Long Reach Access Network with Multi-Video Services Broadcasting, Chien-Hung Yeh, Chi Wai Chow, Lin-Gung Yang, Yi-Liang Liu; C-Ling Pan; Industrial Technology Res. Inst., Taiwan; Natl. Chiao Tung Univ., Taiwan; National Taiwan Hsu Univ., Taiwan. We propose and demonstrate the 40 and 40 Gb/s downstream and uplink traffic in long-reach PON architecture with multi-services broadcasting, such as CATV, DVB-T, IPTV and HD-TV etc., in 100 km fiber access transmission.

**JTuB13**

Adjustment of Uplink Data Rate in RSOA-Based ONU in PON Access, Chien-Hung Yeh, Chi Wai Chow, Lin-Gung Yang, C-Ling Pan; Industrial Technology Res. Inst., Taiwan; Natl. Chiao Tung Univ., Taiwan; Natl. Tsing Hua Univ., Taiwan. We first propose and investigate the dynamic uplink traffic rate adjustment employing RSOA-based optical network unit (ONU) in current PON and long reach PON systems, according to the injected power level of downlink signal.

**JTuB14**

Modeling and Design Optimization of Discrete Mode Lasers for High Speed Single-Mode Operation in Optical Communication Networks, Yu Li, Yangping Xi; Weiping Huang; Electrical and Computer Engineering, McMaster Univ., Canada. Static and dynamic characteristics of discrete mode laser are investigated theoretically by a rigorous time-domain traveling wave model. Design optimization is carried out on key parameters of the laser for single-mode operation in optical networks.

**JTuB15**

Optimization of CMOS-Compatible Hybrid Plasmonic Waveguides for Nonlinear Applications, Ke-Tao Wang, Amy C. Foster; Electrical and Computer Engineering, Johns Hopkins Univ., USA. We design the design and optimization of three CMOS-compatible hybrid plasmonic waveguide structures for nonlinear interactions. Our proposed hybrid waveguide structure provides the largest nonlinear phase shift compared to other designs.

**JTuB16**

Enhanced Absorption of Ultrathin Film a-Si Solar Cell Based on Ultrathin Metal Grating, Sangjun Lee, Sangin Kim, Jazin Lee, Hanjo Lim; Ajay Univ., Republic of Korea. We present enhanced absorption of solar cell composed of an ultrathin absorbing layer embedded between a metal reflector and an ultrathin metal grating. Absorption improvement for both TE and TM polarizations is achieved.

**JTuB17**

Surface Roughness Effect on Q-Factor of Ge Whispering Gallery Mode Microdisk Resonator, Songyeong Choi, Sunheon Koo, Akyangwan Lim, Evan B. Pickert, Namkoo Park, Theodore I. Kamins; Byung-Gook Park; James S. Harris; Electrical Engineering, Stanford Univ., USA. In this paper, the surface roughness effect on Q-factor of Ge whispering gallery mode microdisk resonator is thoroughly investigated by 2-D and 3-D FDTD simulations with variations on roughness indices.

**JTuB18**

Refractive Index Profiling of an Optical Waveguide with Optical Path Perturbation, KaiHsun Tsai, Kun-Ying Ding, Wan-Shuai Tsai; Dept. of Applied Materials and Optoelectronics Engineering, Natl. Chi-Nan Univ., Taiwan. Two-dimensional index profile of an optical fiber was reconstructed with the measured differential optical axial length by perturbing the optical path in the end-fire coupling measurement. Good results were obtained compared with the known index profile.

**JTuB19**

Design Optimization of High Performance Single-mode Fabry-Perot Lasers Based on Quantum Dot Materials, Laxsin Deng, Lin Han, Yapping Xi; Xun Li; Weiping Huang; Electrical and Computer Engineering, McMaster Univ., Canada. The inhomogeneous and homogeneous broadening of quantum-dot Fabry-Perot laser is discussed by a rate-equation model. With optimum values, the single-longitudinal mode laser is designed and the requirement of the inhomogeneous broadening is discussed.

**JTuB20**

Benzocyclobutene Multimode Interference Power Splitters Fabricated by Ultraviolet Laser Illumination, Yu-Shaun Cheng, Wan-Shuai Tsai, Way-Sern Wang; Graduate Inst. of Photonics and Optoelectronics, National Taiwan Univ., Taiwan; Dept. of Applied Materials and Optoelectronics Engineering, Natl. Chi-Nan Univ., Taiwan; Dept. of Electrical Engineering, Natl. Taiwan Univ., Taiwan. Various MMI power splitters fabricated by laser illumination on benzocyclobutene are compared. With suitable beam expansion ratios, experimental results show the devices can be fabricated with high accuracy, short time, and good controllability.
JTuB21 Numerical Simulations of Temperature Dependence of High Efficiency Multi-Junction Solar Cells Under Concentrated Sunlight, Jeffrey Wheeldon1, Alex W. Walker1, Olivier Theriault1, Mark Esmail1, Karin Hinzer1; 1Univ. of Ottawa, Canada. The temperature dependence of GaInP/GaAs/Ge multi-junction solar cells are numerically modeled. The temperature dependence of the solar cell dark current and the spectral sensitivity of the solar cell are demonstrated.

JTuB22 Automatic Extraction of Chirp Parameter of DFB Laser, Lin Han1, Yefeng Wen1, Weiping Huang1; 1Electrical and Computer Engineering, McMaster Univ., Canada. A new method is proposed for extracting DFB laser chirp parameter by fitting the side-band strengths ratio curve obtained from spectrum measurement. It is validated by comparing with the result obtained from fiber dispersion measurement.

JTuB23 High Power Pulse Trains Envelop Severance in Quasi-Phase-Matched Waveguide, Shih-Chiang Lin1; 1I-SHOU Univ., Taiwan. A method of 2-ps pulse trains generation in QPM waveguide is proposed. The mechanism of pulse train envelop severance, due to group velocity mismatched, is studied.

JTuB24 Step Index POF Link Power Budget Calculation Today and Tomorrow, Olaf Ziemann, S. Loquai, Roman Kruglov; Univ. of Nueremberg, Germany. The correct calculation of the optical power budget is very important for the present standardization. This paper will present a present example and will show options for future improvements with optimized components.

15:30-16:00 Coffee Break, Pier 4/ Harbour Ballroom Foyer
Tuesday 14 June

**Pier 9**
Access Networks and In-house Communications

**Pier 7 & 8**
Signal Processing in Photonics Communications

**Harbour Integrated Photonics Research, Silicon and Nano Photonics B**

**Harbour Salon C**
Integrated Photonics Research, Silicon and Nano Photonics

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These concurrent sessions are grouped across two pages. Please review both pages for complete session information.

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16:00–18:00
**AuTuC • Inhouse: Fiber and Wireless**
Jaeg Leuthold; KIT, Germany, Presider

**AuTuC1 • 16:00**
Options for a 1 Gbit/s Standard POF Interface Report on the German Standardization Activities, Olaf Zimmerle, Christian-Alexander Bunse1, Juri Vinogradov1, S. Loquai1, Roman Kruglov1, Univ. Nueumberg, Germany. A German standardization group works since Sep. 2009 on a guideline for a future 1 Gbit/s POF interface. This paper will summarize the recent activities and will present the current status.

**AuTuC2 • 16:30**
Invited
Converged In-home Networks Using 1-mm Core Size Plastic Optical Fiber, Edward Tangdiongga1, Davide Visani1, Hejie Yang1, Yan Shi1, Chigo M. Okonkwo1, Henri van den Boom1, Giovanni Tartarini1, A. Keon1, Electrical Engineering, COREA Res. Inst., TU Eindhoven, Netherlands; DIEIS, Univ. of Bologna, Italy. Broadband wireline and wireless transmission systems over 1-mm core size 50-m long POF is discussed. Transmission capacity of 2.2 Gbit/s DMT and 528-MHz UWB wireless signals is achieved, having performance complying with requirements.

**AuTuC3 • 17:00**
Invited
Ultra-broadband Optical Wireless for Indoor Applications, Thas A. Nirmalathas1,2, Ke Wang1, Christina Lim1, Efthymios Shafik1,2, Dept of Electrical and Electronic Engineering, Univ. of Melbourne, Australia; Victoria Res. Lab., NTCA, Australia. In this paper, we demonstrate an experimental 4x12.5 Gb/s ultra-broadband optical wireless system incorporating wavelength division multiplexing.

16:00–17:30
**SPTuC • DSP**
Gabriella Bosco, Politecnico di Torino, Italy, Presider

**SPTuC1 • 16:00**
Integrated Carrier Phase and Frequency Estimation for Coherent Detection based on Multi-Symbol Differential Detection (MSDD), Mario Nazarathy1, Nettia Signor1, Igor Tsvetkin2, EE, Technion, Israel. We present new results on MSDD carrier recovery for optical coherent detection. The frequency and phase estimation functions are jointly accomplished with lowest complexity, high performance and automatic adaptation to the channel statistics.

16:00–18:00
**IuDc • Photonic Integration I**
Valery Tolstikhin; OneChip Photonics Inc., Canada, Presider

**IuDc1 • 16:00**
Large-Scale Monolithic Integration of PM-QPSK Modulation Architecture in 500 Gb/s Transmitters, Scott Corzine1, Peter Evans1, Matthew Fisher1, Andrew Denton1, Ranjan Mathur1, Randal Salvador1, Adam James1, Pavel Studenkov1, Eva Strelecka1, Thomas Vallantin1, Forrest Sedgwick1, Matthias Kunte1, Vibrant Ltd1, Masaki Kato1, Mauda Rabanu1, Agui Spammag1, Wayne Williams1, Shashank Agashe1, Arnold Cher1, Damien Lambert1, John Thomson1, Doug Christie1, Don Pavinski1, Parmajit Sama1, Jianping Zhang1, Tungong Lai1, Babak Behnia1, Jeffrey Bastak1, Vince Dominic1, Alan Nilsson1, Brian Taylor1, Jeff Ruth1, Glad Goldfajn1, Vinayak Dang1, Mike Van Leuven1, Han Sun1, Kuang-Tuan Wei1, Matthew Mitchell1, Iacov Picuncek1, Mark Missy1, Radia Nagaranj1, Rick Schneider1, James Stewart1, Mike Refl1, Tim Butrie1, Charles Joyner1, Charles Joyner1, Mehrdad Ziat1, Fred Kohl1, Dave Welch1; Infineon, USA. We describe the monolithic integration of 10 InP-based phase-modulated transmitter channels employing polarization multiplexing and quadrature phase-shift keying coherent modulation format to provide an aggregate 500 Gb/s bandwidth on a single chip.

**IuDc2 • 16:30**
Invited
InP-Based Transmitter PICs, Hiroikyo Ishii1, Hiromi Ohashi1, NTT Photonics Laboratories, Japan. InP-based photonic integrated circuits (PICs) that contain semiconductor lasers are promising as compact high-performance transmitters for future photonic networks. Recent activity on InP-based transmitter PICs is described.

**IuDc3 • 17:00**
Guided-Mode Resonance Enabled Absorption in Amorphous Silicon for Thin-Film Solar Cell Applications, Tantzia Khiloque1, Junwoong Youn1, Wenhai Wu1, Mehrdad Shoosh-Sarani1, Robert Magnusson1; Electrical Engineering, Univ. of Texas at Arlington, USA. Nanoscale patterns with 300-nm periods fabricated on thin films of amorphous silicon on glass substrates. Around 50% integrated absorption enhancement compared to unpattered silicon reference samples is observed for the 400–950-nm wavelength range.

**IuDc4 • 17:00**
Filter Response of Feedback Plasmonic Junctions, Mohamed A. Swillam1, Amir S. Helmy1; ECE, University of Toronto, Canada. We propose a novel filter structure for plasmonic circuits. The proposed structure is based on creating a feedback junction. The unique characteristics of the structure are analyzed using a simple and accurate analytical model.

Sessions continue on page XX.
Specialty Optical Fibers

Semiconductor Optical Amplifier

Slow Light Using Cross Gain Modulation in a Quantum Dash

spectra of CROWs rely on a proper choice of the defect length. The transmission grating resonators. The defect sections between resonators control the coupling coefficients and frequency detuning. The transmission spectra of CROWS rely on a proper choice of the defect length.

Understanding Propagation Loss in Slow Light Waveguides, Sebastian A. Schultz, William Whelan-Curtin, Isabella H. Rey, Thomas Krauser; School of Physics and Astronomy, Univ. of St Andrews, UK. Engineering dispersion and loss in photonic crystal waveguides allows us to control propagation up to moderate group indices. Novel results on over-engineered waveguides give insights into loss vs. both propagation constant and group index.

We theoretically study CROWS based on modulated grating resonators. The defect sections between resonators control the coupling coefficients and frequency detuning. The transmission spectra of CROWS rely on a proper choice of the defect length.

Coupled-Resonator Optical Waveguides (CROWs) Based on Grating Resonators with Modulated Bandgap, Ho-Chun Liu, Christos Santis, Amnon Yariv; Electrical Engineering, California Inst. of Technology, USA; Applied Physics, California Inst. of Technology, USA. We theoretically study CROWS based on modulated grating resonators. The defect sections between resonators control the coupling coefficients and frequency detuning. The transmission spectra of CROWS rely on a proper choice of the defect length.

Slow Light Waveguide (CROW) from its discrete impulse response calculated from the frequency response of the through port.

We present a method for extracting the coupling coefficients and the resonant frequency detunings of a coupled resonator optical waveguide (CROW) from its discrete impulse response calculated from the frequency response of the through port.

Extraction of CROW Parameters Using Scattering Tree, Roman Novotnik, Jacob Schuer, Ben Z. Steenberg; ’Tel-Aviv Univ., Israel. We present a method for extracting the coupling coefficients and the resonant frequency detunings of a coupled resonator optical waveguide (CROW) from its discrete impulse response calculated from the frequency response of the through port.

Industrial Applications of Pulsed Terahertz Radiation, Philip Taday; ’TeraView Limited, UK. Terahertz pulsed applications have long been thought to be a physics laboratory tool. In this paper I discuss recent advancements in bringing terahertz sensors in real world practical applications in industry.

We experimentally characterize the spatial mode inside a finite-width parallel-plate waveguide using a subwavelength probe. We observe a transition from a TEM-like spatial mode at low frequencies to a plasmon-like mode at high frequencies.
A1uC • Inhouse: Fiber and Wireless—Continued

**A1uC • 17:30**
Background Light Induced Noise and Its Effects on Indoor Gigabit Optical Wireless Communication Systems, Ke Wang1,2, Amalavanapillai Nirmalathas1,2. Efstatios Skafidas1,2, National ICT Australia-Victoria Research Laboratory (NICTA-VRL), Univ. of Melbourne, Australia; 2Dept. of Electrical and Electronic Engineering, Univ. of Melbourne, Australia. We experimentally study the receiver sensitivity and power-penalty due to shot noise induced by the background light in indoor gigabit optical wireless communication systems. This noise typically causes several dB power-penalties in the system.

**A1uC • 17:45**
Securing Free Space Optics Communications through Optical Chaos, Fabrizio Chiarello1, Marco Santagiustina1, Leonora Ursini1, 1Dept. of Information Engineering, CNIT, Univ. of Padova, Italy. A free space optical chaotic communication system for the secure transmission of a digital message at hundreds Mb/s is presented. The performance of the system is investigated including the indoor infrared channel impairments.

**SPuC • 17:15**
Complexity Analysis of Block Equalization Approach for PolMux QAM Coherent Systems, Mehrez Selmi1, Philippe Ciblat1, Yves Jauvren2, Christophe Gorot1; 1Gecoma ParisTech, France. The computational load of block CMA equalizers is addressed. Compared to the adaptive CMA, we show block approaches increase the convergence speed by ~10 but only the complexity by ~4 in 112Gbit/s PolMux 16QAM systems.

**SPTuC • DSP—Continued**

**SPTuC • 17:15**
Single Step Epitaxial Growth of Ge-on-Si for Active Photonic Devices, Rodolfo E. Camacho-Aguilar1, Jonathan Bessehte2, Yan Cai1, Xiaosman Duan1, Jiequn Liu1, Lionel Kimerling1, Jurgen Michel3; 1MIT, USA; 2Dartmouth College, USA. Germanium for integrated photonic devices has been grown selectively on Si, using a single step epitaxial process, eliminating the standard highly dislocated Ge or SiGe buffer layer to accommodate the Ge-Si lattice mismatch.

**ITuC • Photonic Integration I—Continued**

**ITuC • 17:30**
High n-type Doping for Ge Lasers, Jonathan Bessehte1, Rodolfo E. Camacho-Aguilar2, Yan Cai1, Lionel Kimerling1, Jurgen Michel3; 1MIT, USA. We present evidence of enhanced n-type doping of epitaxial Ge-on-Si for integrated light emitting devices. SMS, Hall Effect, and photoluminescence measurements confirm dopant concentrations as high as 4 × 10^19 cm^-3 with efficient PL emission.

**ITuC • 17:45**
Novel Designs for On-chip Mid-Infrared Detectors Integrated with Chalcogenide Waveguides, Vivek Sing1, Juejun Hu2, Timothy W. Zens1, Jianfei Wang1, Pao T. Lin1, Jacklyn Wilkinson3, Spencer Novak1, J. David Musgraves3, Lionel Kimerling1, Jurgen Michel3; 1School of Materials Science and Engineering, Massachusetts Inst. of Technology, USA; 2Dept. of Materials Science and Engineering, Univ. of Delaware, USA; 3School of Materials Science and Engineering, COMSET, Clemson Univ., USA. We present novel designs and corresponding simulation results showing a reduction in reflection for a waveguide-integrated, on-chip detector for the mid-infrared regime, using chalcogenide glass waveguides integrated with a PbTe detector.

**ITuD • Nanophotonics: Plasmonics and Applications II—Continued**

**ITuD • 17:45**
On-chip Nanofocusing Using a Hybrid Plasmonic-Dielectric Tapered Waveguide, Ye Luo1, Ali Adibi1, Maysamreza Chamanzar1, Ali Asghar Eftekhar1; 1School of ECE, Georgia Inst. of Technology, USA. We present a novel on-chip plasmonic nanofocusing technique based on tapering the metal layer of a hybrid Si-Au waveguide. Input optical energy becomes strongly concentrated and highly localized at the metallic tip.
**Advanced Photonics: OSA Optics & Photonics Congress • 12–15 June 2011**

**Pier 2 & 3**  
Slow and Fast Light

**Harbour Salon A**  
Optical Sensors

**Pier 5**  
Specialty Optical Fibers

*These concurrent sessions are grouped across two pages. Please review both pages for complete session information.*

**SLTuB • Methods and Fundamentals—Continued**

**SLTuB5 • 17:15**  
Electromagnetic Energy Velocity in Slow Light, Marco Santagastina; Dept. of Information Engineering, CNIT - Univ. of Padova, Italy. Group and electromagnetic energy velocities in structural and material slow light are compared. They are equal for structural slow light; the enhancement of linear and nonlinear effects depends on energy velocity.

**SLTuB6 • 17:30**  
On Fast Light and Signal Detection Latency, Levent Kayilli, Mo Mojahedi; Edward S. Rogers Sr., Dept. of Electrical and Computer Engineering, Univ. of Toronto, Canada. Through the calculation of time-varying error probability, we show that a reduction in signal latency can be obtained in a practical active medium with negative group velocity (negative group delay) in the presence of noise.

**SLTuB7 • 17:45**  
Myths and Reality of the “Slow” and “Fast” Light, Valeri Kovalev, Nadezhda E. Kotova; Physics, Heriot-Watt Univ., UK; P.N. Lebedev Physical Inst., Russian Federation. Experimentally observed pulse delays usually attributed to the group velocity phenomenon cannot be such since not all necessary conditions for this phenomenon are met. Observations are accountable for by nonlinearity of resonant absorption or gain.

**STuC • Terahertz Waveguides, Applications, and Device Technology—Continued**

**STuC5 • 17:30**  
Ultrafast THz Pulse Shaping: Generation of Half-cycle Pulse from Multi-cycle THz Pulse, Mostafa Shalaby, Marco Peccianti; Luca Razzari, Gargi Sharma, Roberto Monardetti; INRS-EMT, Canada; Institut de physique et de physique des matériaux, France; Instituto di Elettronica e Fisica delle Materia, Italy. Using optical pump/THz probe technique in InP, we demonstrate ultrafast slicing of a multi-cycle THz pulse into single- and half-cycle THz pulses.

**STuC6 • 17:45**  
Characteristics of Terahertz Antenna Pulsed Sources Made on Fe-Implanted InGaAsP/InP Photoconductive Materials, Andre Fekecs, Maxime Bernier, Martin Chicoine, François Schiettekatte, Richard Arè, Denis Morris; Institut interdisciplinaire d’innovation technologique - 3IT, Université de Sherbrooke, Canada; Département de physique, Université de Montréal, Canada. Pulsed terahertz emitters were fabricated on Fe-implanted InGaAsP/InP photoconductive materials. The THz signals are detected by electro-optic sampling using fs-pulses at 790 nm or at 1.55 µm. Characteristics of this new THz source are discussed.

**STuC7 • 18:00**  
Dynamics of Noise in THz Photomixers as a Receiver Sensor, Barmak Heshmat, Hamid Pahlevaninezhad, Jinye Zhang, Thomas Edward Darcie; University of Victoria, Canada. We present an analytical estimation and experimental measurement of noise spectral density and noise average power in THz photomixers as receivers in heterodyne THz sensing. This includes generation-recombination, thermal, and flicker noise.

**SOTuC • Fiber Sensors—Continued**

**SOTuC5 • 17:15**  
Optical fiber sensors and their Specialty Fiber Needs, Alexis Mendez; MCH Engineering, LLC, USA. This tutorial will review the basic principles, applications, and specialty fiber needs for optical fiber sensors. Key technical trends will be identified along with relevant commercial opportunities and challenges.

**SOTuC6 • 18:30**  
Dynamics of Noise in THz Photomixers as a Receiver Sensor, Barmak Heshmat, Hamid Pahlevaninezhad, Jinye Zhang, Thomas Edward Darcie; University of Victoria, Canada. We present an analytical estimation and experimental measurement of noise spectral density and noise average power in THz photomixers as receivers in heterodyne THz sensing. This includes generation-recombination, thermal, and flicker noise.

**18:30–21:30 Advance Photonics Congress Reception and Banquet, Hart House, Univ. of Toronto**
Nonlinearity Compensation using Digital Backward Propagation, Eduardo Mateo¹, Fatih Yamani¹, Ting Wang¹, Guanglei Li²; ¹NEC Laboratories America, USA; ²CREOL, The college of Optics and Photonics, University of Central Florida, USA. Compensations of fiber impairments using advanced DPS techniques will play a fundamental role in future communications systems. In particular, technologies for nonlinearity compensation using digital backward propagation are discussed in this paper.

Reducing the Complexity of Electronic Pre-compensation for the Nonlinear Distortions in a Directly Modulated Laser, Abdullah S. Kasar¹, John Carlgarte¹, James Harkey¹, Kim Roberts¹; ¹Electrical and Computer Engineering, Queen’s University, Canada; ²Ciena Corporation, Canada. A simplified expression relating the required input current for a directly modulated laser to a target output optical power is obtained and used experimentally in mitigating the laser nonlinear distortion by digital signal processing.

Numerical Simulation of Dicke Superradiance in a Semiconductor Laser Device, Xiaohua Gao¹, Kevin A. Williams¹, Yoitych F. Oliver¹, Adrian Wonfor¹, Richard V. Penty¹, Ian H. White¹; ¹Dept. of Engineering, Univ. of Cambridge, UK. This paper reports a theoretical model for Dicke Superradiance in semiconductor laser devices. Simulations agree well with previously-observed superradiance properties and are used to optimize driving conditions and device geometry.

Erbium-Doped Chalcogenide Glass Micro-Disks as Monolithic Mid-IR Laser Sources, Fatih M. Atalay¹, Clara Dimas¹, Hejun Hao¹, Anu Agarwal¹, Lionel Kimerling¹; ¹Materials Science and Engineering, Massachusetts Inst. of Science and Technology, United Arab Emirates; ²Micro photonics Center, Massachusetts Inst. of Technology, USA; ³Department of Materials Science & Engineering, Univ. of Delaware, USA. The feasibility of Mid-Infrared (MIR) lasing in Erbium-doped Gallium Lanthanum Sulfide (GLS) micro-disk was investigated. Based on state-of-the-art Chalcogenides micro-disk resonators parameters, lasing was simulated and shown to be possible.

Optical Field Molding within Near-Field Coupled Twinned Nanobeam Cavities, Benoît Cluzel¹, Kevin Fouvert¹, Laszlo Alnás¹, Emmanuel Picaud¹, Jean Delinger², David Pyrade³, Frédérique de Fornel³, Emmanuel Hauff³; ¹INAC/SP2M, CEA, France; ²LICB, CNRS, France; ³LTM, CNRS, France. Twinned high Q nanobeam cavities can be optically coupled while being placed in the optical near-field of each other. They form a new optical system which supports discrete field maps addressable by wavelength selection.

Quantum-Tuned Two-Junction Solar Cells, Xihua Wang¹, Ghada Kolesar¹, Edward Sargent¹; ¹Electrical and Computer Engineering, Univ. of Toronto, Canada. We report quantum-size-effect tuned tandem solar cells. Our two-junction photovoltaic devices employ light-absorbing material of a single composition and use two rationally-selected nanoparticle sizes to harvest the sun’s broad spectrum.
Light Storage Enhancement by Reducing the Brillouin Band
Laupretre 1, Rupamanjari Ghosh 2, Sylvain Schwartz 3, Fabienne
Goldfarb1, Fabien Bretenaker1; 1Laboratoire Aime Cotton, France;
4He* creating slow or fast light. This lifetime is shown to depend
on the group velocity of light. Ultimate performances of fast light
is composed of multilayer dielectric layers. A 60 % enhancement of
transmittance is achieved at light incident angles θ=0°-75°.

Cold atoms inside a hollow core fiber provide an unique system for
studying optical nonlinearities at the few-photon level. We present
our experimental apparatus and discuss results regarding all-optical
switching at ultra-low light levels.

In high-birefringence fibers are theoretically predicted. Delay can be
controlled through the pump polarization.

We measure the photon lifetime in a cavity containing
4He* creating slow or fast light. This lifetime is shown to depend
on the group velocity of light. Ultimate performances of fast light
gyro's are discussed.

SLWA2 • 9:00
Slow and Fast Light in High-Birefringence Fiber Parametric
Amplifiers. Marcos Santagostino; ‘Dept. of Information Engineer-
ment, CNIT, Univ. of Padova, Italy. Slow and fast light effects in
high-birefringence fibers are theoretically predicted. Delay can be
controlled through the pump polarization.

SLWA3 • 9:15
Decay time in a Cavity in Slow or Fast Light Regime. Thomas
Laupret1, Rupamanjari Ghosh1, Sylvain Schwartz1, Fabienne
Goldfarb1, Fabien Bretenaker1, Laboratory Aime Cotton, France;
We measure the photon lifetime in a cavity containing
4He* creating slow or fast light. This lifetime is shown to depend
on the group velocity of light. Ultimate performances of fast light
gyro's are discussed.

Light Storage Enhancement by Reducing the Brillouin Band-
width. Stefan Preussler1, Kamibiz Jamshidi1, Andrzej Wiatrek1,
Thomas Schneider1, ‘Inst. für Hochfrequenztechnik, Hochschule
für Telekommunikation Leipzig, Germany. To achieve higher stor-
age times for a new method for the storage of optical pulses called
Quasi-Light-Storage we reduced the SBS gain bandwidth. In our
experiments we achieved an enhancement of 40%.

SLWA4 • 9:30
High Density Ink Jet Printing of Bio-molecules for Photonic
Crystal-based Microarray Applications. Wei Cheng Lin1, Kathryn
Moriyasu1, Swapnali Chakvanwai1, Xiaolong Wang1, Che Yen Lin1,
Chien I. Chang1, Ray Y. Chen1; ‘Electrical and Computer Engineer-
ing, The University of Texas at Austin, USA; ‘Division of Medicinal Chem-
istry, College of Pharmacy, Texas University at Austin, USA;
‘Omegas Optics Inc, USA. High density inkjet printing of protein
solutions was investigated for photonic crystal based microarray
applications. Spacing of 60um has been demonstrated between
unique inkjet-printed spots on a silicon substrate.

Ultra Broadband Mid-IR Detectors Using Multilayer
Anti-reflection Coupling, Pan T. Lin1; ‘Materials Science and
Engineering, MIT–EAPS, USA. Ultra broadband mid-IR detector
is demonstrated in the spectral region at 2-4 um. The light coupler
is composed of multilayer dielectric layers. A 60 % enhancement of
transmittance is achieved at light incident angles 8=0°-75°.
Physical Layer Constraints in Dynamic Optical Mesh Networks with or without inline dispersion compensation. We evaluate quantization effect BER performance degradation and discuss corresponding FPGA implementation.

Quasi-Cyclic LDPC based on PEG Construction for Optical Communications, Sami Mumtaz, Ghaya Rekaya-Ben Othman, Yos Jaouen; Comelie, Telecom ParisTech, France. A new construction of quasi-cyclic LDPC codes based on the progressive edge growth algorithm is presented. These codes perform better than most LDPC codes proposed for optical transmissions and design parameters can be chosen without constraint.

Growth algorithm is presented. These codes perform better than most LDPC codes proposed for optical transmissions and design parameters can be chosen without constraint.

We present a silicon photonics platform combining silicon processing and heterogeneously integrated III-V materials. This enables passive and active photonic functions on silicon, such as waveguides, filters, modulators, photodetectors and lasers.

BiCM and TCM Comparison in 100 Gbps Optical Coherent Links in Nonlinear Regime, Tommaso Foggi, Roberto Magri; CNIT, Italy; Ericsson S.p.A., Italy. The popular single-carrier QPSK modulation format is compared with 8PSK BiCM and TCM schemes in 100 Gbps optical links in linear and nonlinear regime, with or without inline dispersion compensation.

Soft Differential Decoding with Non-redundant Error Correction for Dispersion Managed Optical Transmission System, Zhuhong Zhang, Fabrin N. Hauke, Chiaunoung Li, Yanping Zhu, Yanning Li, Fei Zhu, Yudong Bai; Ottawa ReD Center, Huawei Technologies, Canada; Europe Research Center, Huawei Technologies, Germany; US ReD Center, Huawei Technologies, USA. Considering DSP implementation constraints, we demonstrate that soft differential decoding with NEC provides the best performance when co-propagating 10G PDM-QPSK with 10G OOK channels over dispersion managed links at 50GHz channel.

Physical Layer Constraints in Dynamic Optical Mesh Networks with or without inline dispersion compensation. We evaluate quantization effect BER performance degradation and discuss corresponding FPGA implementation.

Experimental Demonstration of PDL Mitigation using Polarization-Time Coding in PDM-OFDM Systems, Sami Mumtaz, Jingbo Li, Soen Koeng, Yos Jaouen, Rene Schmogrow, Ghaya Rekaya-Ben Othman, Jurgen Leuthold; Comelie, Telecom ParisTech, Paris, France; Institute of Photonics and Quantumelectronics, Karlsruhe Institute of Technology (KIT), Karlsruhe, Germany. For the first time, we demonstrate experimentally that PDL can be highly mitigated by the use of Polarization-Time coding in OFDM transmissions. We show that Silver code performs better than Golden and Alamouti codes.

Optimally Coupled Hybrid III-V Photonsics Crystal Wave Cavity CW Lasers on Passive SOI Waveguides, Yacine Haloua, Alexandre Bazin, Timothy Karle, Paul Monnier, Isabelle Sagnes, Rama Raj, Fabrice Raineri; CNRS-LPS, France; Intes-Photonics group, Ghent Univ., Belgium; Universite Paris Diderot, France. CW Laser operation of an efficiently coupled III-V wire-cavity to a silicon wire is demonstrated. Transmission characteristics of the system are explored in a pump-probe experiments revealing high coupling efficiency (~80%).
We present experimental and theoretical studies of EIT-based quantum memory that go beyond three-level system and account for enhanced nonlinear interactions at high optical depth.

By Phase Control

Francisco Ramos1, Salvador Sales 1, José Capmany 1; 1iTE Research Inst., Spain.

We present experimental sensing results achieved using a novel technique based on the use of photonic bandgap structures where only the output power from a broadband source is monitored, providing a real-time and low-cost system.

Confinement Loss of Tube Lattice and Kagome Fibers

Liang Dong, Clemson Univ., USA, Presider

We study the loss mechanisms in novel antiresonant hollow-core fibres and demonstrate the importance of optimising the air-cladding thickness and reducing the node size. Based on these rules we fabricate fibres with wide-bandwidth and low-loss.

Hollow-Core Photonic Bandgap Fiber

Low Loss Antiresonant Hollow core Fibres, Francesco Poletti1, J. R. Hayes2; 1Optoelectronics Research Centre, Southampton University, UK; 2Edward S. Rogers Sr. Department of Electrical and Computer Engineering, University of Toronto, Canada; 2Edward S. Rogers Sr. Department of Electrical and Computer Engineering, University of Toronto, Canada. We study the loss mechanisms in novel antiresonant hollow-core fibres and demonstrate the importance of optimising the air-cladding thickness and reducing the node size. Based on these rules we fabricate fibres with wide-bandwidth and low-loss.

We present the experimental sensing results achieved using a novel technique based on the use of photonic bandgap structures where only the output power from a broadband source is monitored, providing a real-time and low-cost system.
IWC • Photonic Integration II—Continued

IWC5 • 12:00
Heterogeneous Integrated InGaAsSb Detectors on SOI Waveguide Circuits for Short-Wave Infrared Applications, Nannicha Hattasan1, Gassenq Alban1, Bart Kayken2, Laurent Cerutti1, Jean-Batiste Rodriguez2, Eric Tournie2, Gunther Roelkens1; 1Univ. of Gent - DTec, Belgium; 2Univ. Montpellier 2, France. We present evanescently coupled, heterogeneous integrated InGaAsSb photodetectors on SOI waveguide circuits for short-wave infrared applications. A responsivity of 0.13 A/W is obtained at a wavelength of 2.17µm. The dark current is 3.5 µA at -1V.

IWC6 • 12:15
Hybrid Transmitter Cells for DWDM Systems, Hua Zhang1, Matt Pearson1, Serge Bidnyk1, Ashok Balakrishnan1; 1Enablence Technologies Inc., Canada. A compact 10 Gb/s transmitter cell for 100 Gb/s DWDM transmission has been successfully developed using hybrid PLC technology. It is confirmed that the hybrid transmitter cell provides high performance on output power and wavelength stabilization.

12:30-1:30 Lunch Break (on your own)

IWD • Modeling and Simulation IV: Coupled Waveguides and Resonators—Continued

IWD6 • 12:00
Design of One-Dimensional Photonic Crystal Coupled Resonator Optical Waveguides Embedded in Air-Slot Waveguide, Yuki Kawaguchi1, Kunimasa Saitoh1, Masanori Koshiba1; Hokkaido Univ., Japan. We propose design methods of slow-light slot waveguide based on one-dimensional photonic crystal coupled resonator optical waveguides (1-D PC-CROWs). We show that slot waveguides proposed here realize small group velocity and low-loss simultaneously.
These concurrent sessions are grouped across two pages. Please review both pages for complete session information.

**Pier 2 & 3**

Slow and Fast Light

**Harbour Salon A**

Optical Sensors

**Pier 5**

Specialty Optical Fibers

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**SLWB • Slow/Fast Light Systems—Continued**

**SLWB6 • 12:00**

Loss-induced dead zone in CROW rotation sensor, Roman Novitski, Jacob Scheuer, Ben Z. Steinberg; Tel-Aviv Univ., Israel. We study the properties of a lossy coupled resonator optical waveguide subjected to rotation. A loss-induced dead-zone is found at low rotation rates while no impact is found for high rotation rates.

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**SWB • Biochemical Sensors II—Continued**

**SWB6 • 12:00**

Liquid filled hollow core photonic bandgap fiber sensor, Hang Que, Bora Ung, Maksim Skorobogatiy; École Polytechnique de Montréal, Canada. We propose a low-refractive-index-contrast hollow-core Bragg fiber sensor operating with a resonant sensing principle. Clear transmission spectrum shifts are obtained when filling the fiber with liquid analytes of different refractive indices.

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**SWB7 • 12:15**

Optical Current Transducers Incorporating Polymeric Integrated Optical Chip, Min-Cheol Oh, Woo-Sung Cha, Kyung-Io Kim; Electrical Engineering and Cogno-Mechatronics Engineering, Pusan National University, Republic of Korea. Various optical devices are integrated on a single chip to construct optical current transducers based on polarization rotated reflection interferometry, which consists of couplers, polarizers, polarization converters, and TO phase modulators.

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12:30-1:30 Lunch Break (on your own)

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**NOTES**
Advanced Photonics: OSA Optics & Photonics Congress • 12–15 June 2011

SPWC • Transmission Systems

13:30–15:30

SPWC1 • 13:30

Digital Signal Processing for Coherent Optical Communications: Current State of the Art and Future Challenges, Kim Roberts; 'Ciena, Canada. This paper reviews examples of signal processing for current coherent transmission systems and the challenges faced by system designers to realize increased bit rates.

SPWC2 • 14:00

capacity Limits of Optical Fibre Based Communications, Andrew Ellis; 'Abstract not available.

SPWC3 • 14:30

Optical Fiber Capacity at its Limits: From Spectrally Efficient Modulation to Spatial Multiplexing, Peter Winzer; 'Alcatel-Lucent Bell Labs, USA. We will discuss the state-of-the-art in high-spectral-efficiency optical transmission systems as well as their theoretical and practical scalability limits. We will then examine spatial multiplexing as an energy- and cost-efficient method to scale beyond WDM.

SPWC4 • 15:00

Advanced Signal Processing: Two Recent Trends and Challenges, Christopher Doerr; Bell Laboratories, Alcatel-Lucent, USA, President

IWF • Devices and Components III

13:30–15:30

IWF1 • 13:30

Silicon-Organic Hybrid (SOH) Electro-Optical Devices, Christian Koo1, Luca Allott1, Dietmar Korn1, Robert Palmer1, David Hillerkus1, Jingbo Li1, Anna Barklund1, Malena Dans1, Ewan Williams1, Maryse Fourmiguere1, Jean-Marc Fedeli1, Hui Yu2, Vlm Bogertse2, Pieter Damon1, Roel Baets1, Wolfgang Freude1, Juerg Leuthold1; 'Inst. of Photonics and Quantum Electronics (IPQ), Karlsruhe Inst. of Technology (KIT), Germany; 'GigOptix Inc., USA; 'CEA / LETI, France; 'Photonics Research Group, Ghent Univ., Belgium. Silicon-organic hybrid integration enables electro-optical devices that combine high modulation speed with low power consumption. We give an overview on SOH modulator concepts, underlying material systems, and recent experimental demonstrations.

IWF2 • 14:00

Germanium on Silicon Lasers and Detectors, Jurgen Michel1; 'Masachusetts Inst. of Technology, USA. This paper discusses the most recent advances of Germanium photodetectors and lasers that can be monolithically integrated into a Silicon CMOS process.

IWF3 • 14:30

Waveguide-based Mid-Infrared Up-Conversion Detectors, Kai-Daniel F. Büchter1, Harald Herrmann1, Wolfgang Sohler1; 'Applied Physics, Univ. of Paderborn, Germany. Nonlinear optical up-conversion detectors for 3 µm radiation are realized using Ti:PPMgF4 waveguides. Both, sum-frequency and difference-frequency generation are investigated. Overall power conversion efficiencies of more than 8% are achieved.

IWF4 • 14:45

Nonlinear Notch Blue-Shift in AlGaAs Bragg Grating Waveguides, Pamela Tannouri1, Michael J. Strain1, Matteo Clerici1, Marco Piacentini1, Alessia Pasqualetti1, Sze Flong Ho1, Ian Rowe1, Kataryna Ruskowski1, Marc Sorel1, Roberto Marandotti1, EIB RS-EMT, Canada; 'Univ. of Glasgow, UK; 'IPCF-CNR, Italy; 'Univ. Technology, Malaysia; 'Warsaw Univ. of Technology, Poland. We present an investigation on the nonlinear dynamics of intense pulses in an AlGaAs Bragg waveguide and we report the experimental observation of an intensity dependent blue-shift of the Bragg notch spectral line.

sessions continue on page xx.
13:30–15:30

**SWC • Photonic Crystal Sensors**

Limin Tong, Zhejiang University, China, Presider

**SWC1 • 13:30**

Metamaterials, Plasmonics, and Nanofluidics for Ultrasensitive Spectroscopy and Bio-detection, Hatice Altug1, Ahmet Ali Yilmaz2, A. E. Celini2, A. Artar1, M. Huang1; 1Electrical and Computer Engineering, Boston University, USA; 2Photonics Center, Boston University, USA. We present on-chip integrated plasmonic and metamaterial systems for ultrasensitive spectroscopy and biodetection. We will also introduce opto-fluidic systems for targeted analyte delivery as well as for optical trapping and manipulation.

**SWC2 • 14:00**

Self-optimized Metal Coatings for Fiber Plasmonics by Electroless Deposition, Aliaksandr Bialiayeu1, Christophe Caucheteur2, Nor Ahmaad3, Anatoli Ianoul3, Jacques Albert1; 1Electronics, Carleton U., Canada; 2Electromagnetism and Telecom Unit, Université de Mons, Belgium; 3Chemistry, Carleton U., Canada. Observation of the polarization dependent loss spectrum of a tilted fiber Bragg grating during electroless deposition of gold on the fiber allows the process to be stopped exactly when the surface Plasmon resonances are maximized.

**SWC3 • 14:15**

Role of Localized Surface Plasmon Resonance in Various Nano-structures for Sensing, Taerin Lee1, Soohyang Roh1, Byoungso Lee1; 1Inter-University Semiconductor Research Center and School of Electrical Engineering, Seoul National University, Republic of Korea. We numerically investigate the role of localized surface plasmon resonance produced at diverse nano-structures when illuminating visible light for enhanced sensing. The comparisons of optical properties in various nanostructures are illustrated.

**SWC4 • 14:30**

A New Optical Bio-sensor: Wet-chemical Synthesis and Surface Treatment of Nanocrystalline Zn 1-xS: Mn 2x, Ahmet Ali Yilmaz1,2, A. E. Celini1, A. Artar1, M. Huang1; 1Electronics, Carleton U., Canada; 2Electromagnetism and Telecom Unit, Université de Mons, Belgium. ZnS:Mn nanocrystals were prepared via microemulsion route and the new optical bio-sensors were synthesized after surface treatment. These sensors can detect Avidin concentration in biological mediums by measuring the red emission decreasing rate.

**SWC5 • 14:45**

High Refractive-index-contrast Polymer Waveguide Platform for Excitation and Sensing in Aqueous Environments, Bjørn Agnarsson1, Hamid Keshmiri1, Jennifer Haldorsen1, Kristjan Leosson1; 1Department of Physics, Science Institute, Iceland. A polymer waveguide platform, applicable to a wide range of biophotonic applications, which rely on evanescent-wave sensing or excitation in aqueous solutions, is presented. The platform offers a high level of integration and functionality.

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13:30–15:15

**SOWC • Poled and Polarizing Fibers**

John Marcianite, Univ. of Rochester, USA, Presider

**SOWC1 • 13:30**

Highly Polarizing Single-Mode Optical Fiber for Sensing Applications, Bill Jacobsen1, Abdal Soufiane2; 1Verrillon Inc, USA. We demonstrate a high performance, highly manufacturable Single-Polarization Fiber (PZF), which offers a wide polarization bandwidth, very high polarization extinction ratio, and consistent performance within lot and from-lot-to-lot. We will also discuss on-going R&D projects involving PZF.

**SOWC2 • 14:00**

Relating DC-Field to Induced Nonlinear Susceptibility in Periodically Poled Silica Fiber, Christopher A. Sapiano1, Stewart Atchison1, Li Qian1; 1Electrical and Computer Engineering, University of Toronto, Canada. The relationship between DC-fields and effective second order nonlinearity is studied. DC-induced processes are modeled and fitted against equivalent natural second order processes. Insight is provided into the disparity between bulk glass and fiber.

**SOWC3 • 14:15**

Observation of Background Fluorescence in a Poled Fiber, Eric Y. Zhu1, Zhiyuan Tang1,2, Edward A. Lee1, Kim Kwon1, Li Qian1, Lukas G. Holt1, Marco Lucisano1; 1School of Physics, University of Sydney, Australia; 2Institute of Electro-Optical Science and Engineering, National Cheng Kung University, Taiwan. We observe broadband fluorescence (1260-1610 nm) in a periodically-poled silica fiber pumped at 775 nm; it is a noise contribution to correlated photon pair generation. The fluorescence is significantly lower in an identical, but unpoled, fiber.

**SOWC4 • 14:30**

Tapered Fiber Devices with Azopolymer Coating, Amado Manuel Valdez-Sanitzi1, Juan Hernandez-Cardenas1,2; 1Instituto de Investigaciones en Materiales, UN, Mexico. Azopolymer coated fiber devices are demonstrated for in-fiber polarization control using an external laser beam. When placed in a fiber cavity, photo-induced birefringence on these devices modifies the spectral and polarization of fiber lasers.

**SOWC5 • 14:45**

Optically Tunable Bandpass Filter Using Series-connected Photonic Liquid Crystal Fibers, Jia-Hong Liu1, Ta Lin1, Yan-Jhen Huang2, Chia-Rong Lee2, Chin-Ping Yu1; 1Department of Photonics, NSYSU, Taiwan; 2Institute of Electro-Optical Science and Engineering, National Cheng Kung University, Taiwan. We demonstrate an optically tunable bandpass filter based on two series-connected photonic liquid crystal fibers filled with different LCs. By using photoreactive LCs, 115-nm bandwidth tunability can be achieved by 5-second blue-laser irradiation.

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Sessions continue on page XX.
A Novel Dispersion and D Tolerant Clock Phase Detector

SPWC5 • 15:15

A novel clock phase detector is presented and shown to be tolerant to chromatic dispersion and D. The phase detector can be used in a clock recovery circuit for demodulation of 100Gb coherent transmission system.

IWF6 • 15:15

Noise Reduction Effect of Semiconductor Optical Amplifier Using Fiber Bragg Grating. Yoshinobu Maeda1; ‘School of Science and Engineering, Kinki Univ., Japan. A negative feedback semiconductor optical amplifier was realized in an InGaAsP-InP amplifier using a fiber Bragg grating. The negative feedback optical amplification effect can be utilized to recover signal loss with a lower error probability.

IWF • Devices and Components III—Continued

IWF5 • 15:00

Ultrafast Pulse Compression in Integrated Two-Photon Amplifiers, Amir Nevet1, Alex Hayat1, Meir Orenstein1; ‘Technion, Israel. We demonstrate experimentally compression of femtosecond-scale pulses by two-photon gain in an electrically-driven AlGaAs waveguide. Dynamic control of pulse width from 240 to 140 fs is achieved by varying the current injection levels.

IWE6 • 15:15

Stripe-based Collimating Silica Planar Waveguide for a Free-space Wavelength Selective Cross Connect, Nazirul Afham Idris1, Amir Nevet1, Alex Hayat1, Meir Orenstein1; ‘Technion, Israel. We propose an integrated beam collimating silica waveguide with stripe-based structure for the use in wavelength selective cross connect (WSXC). The coupling loss of the device is below 0.15 dB within the ideal propagation distance.

IWE5 • 15:00

Integration of a Tunable, Optical Delay Generator in a Silicon Photonics Platform, Kambez Jamshidi1, Stefan Meister1, Aww Alsaadi1, Hans Joachim Eichler1, Thomas Schneider1; ‘High Frequency Technology, Deutsche Telekom Univ. of Applied Sciences, Germany; ‘Inst. für Optik und Atomare Physik, Technical Univ. of Berlin, Germany. We propose an integrated optical delay generator based on Frequency-to-Time conversion. The required dispersions are produced by micro ring resonators based on SOI nano wires. Our design can provide delays up to 500 nanoseconds.

IWE • Photonic Integration III—Continued

IWE5 • 15:00

Integration of a Tunable, Optical Delay Generator in a Silicon Photonics Platform, Kambez Jamshidi1, Stefan Meister1, Aww Alsaadi1, Hans Joachim Eichler1, Thomas Schneider1; ‘High Frequency Technology, Deutsche Telekom Univ. of Applied Sciences, Germany; ‘Inst. für Optik und Atomare Physik, Technical Univ. of Berlin, Germany. We propose an integrated optical delay generator based on Frequency-to-Time conversion. The required dispersions are produced by micro ring resonators based on SOI nano wires. Our design can provide delays up to 500 nanoseconds.

IWF • Devices and Components III—Continued

IWF5 • 15:00

Ultrafast Pulse Compression in Integrated Two-Photon Amplifiers, Amir Nevet1, Alex Hayat1, Meir Orenstein1; ‘Technion, Israel. We demonstrate experimentally compression of femtosecond-scale pulses by two-photon gain in an electrically-driven AlGaAs waveguide. Dynamic control of pulse width from 240 to 140 fs is achieved by varying the current injection levels.

IWE6 • 15:15

Stripe-based Collimating Silica Planar Waveguide for a Free-space Wavelength Selective Cross Connect, Nazirul Afham Idris1, Amir Nevet1, Alex Hayat1, Meir Orenstein1; ‘Technion, Israel. We propose an integrated beam collimating silica waveguide with stripe-based structure for the use in wavelength selective cross connect (WSXC). The coupling loss of the device is below 0.15 dB within the ideal propagation distance.
**SWC • Photonic Crystal Sensors—Continued**

**SWC6 • 15:00**
Guided Mode Resonance Sensors for the Monitoring of Film Growth in Atomic Layer Deposition, Adriana Szeghalmi1,2, Mato Knez2, Ernst Bernhard Kley1; 1Institute of Applied Physics, Friedrich Schiller University Jena, Germany; 2Max-Planck Institute of Microstructure Physics, Germany. Guided mode resonance optics consisting of linear gratings are highly sensitive optical sensors. Their use for monitoring the film growth during atomic layer deposition will be discussed based on rigorous coupled wave approach calculations.

**SWC7 • 15:15**
Large Blueshift of Resonance Wavelength Simulated With a Small Refractive-index Change of a Nanoporous Waveguide, Zhi-mei Qi1; 1State Key Laboratory of Transducer Technology, Institute of Electronics, CAS, China. Simulation of refractive-index sensitivity of nanoporous waveguide resonance sensors reveals an extraordinary feature, that is, a large blueshift of the resonance wavelength induced by a small change in refractive index of the surrounding liquid.

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**15.30–16.00 Coffee Break, Harbour Ballroom Foyer**

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**NOTES**
SPWD • Optical Techniques II
Ivan Djordjevic, Univ. of Arizona, USA, Presider

16:00 • 18:00
Photonic Temporal Integration of Broadband Microwave Waveforms over Nanosecond Time Windows, Mohammad H. Aghbari1, Yongwoo Park1, José Azahar1; ‘Energie, Matériaux et Télécommunications, Institut National de la Recherche Scientifique (INRS), Canada. By cascading an ultrafast time-limited intensity integrator with a discrete-time integrator, a new method for integration of microwave/optical intensity signals is experimentally demonstrated with unprecedented processing time-bandwidth product >140.

SPWD • 16:15
Amplitude and Timing Jitter Performance of Spectrally Periodic Phase Filters for Optical Pulse Rate Multiplication, Antonio Malacarne1, Mohammad H. Asghari1, Antonio Malacarne1; 1Chair for High Frequency Information Science, Albert Einstein Institute for Quantum Information Science, Berlin, Germany. We investigate the performance of optical equalization of distortions induced by polarization mode dispersion (PMD) in 112 Gbit/s metro networks using FIR filters. The D-induced mean OSNR penalties are reduced to < 0.1 dB.

IPW • 16:30
New Photonic components for Quantum Information Science, Alberto Polit1, Jonathan C. Matthews1, Anthony Laing1, Alberto Peruzzo1, Konstantinos Poulios1, Jaemin Meinecke1, Damien Boumeza1, Pete Shadbolt1, Preet Kalawan1, Xing-Qi Zhao1, Maria Rosas-Verde1, Mirko Lobino1, Terry Rudolph1, John G. Rarity1; 1School of Mathematics, University of Bristol, UK; 2Physics, University of Ottawa, Canada. By introducing weak values in quantum information science, we demonstrate the potential of quantum systems to perform complex tasks that are not possible with classical systems. We present a new technique for measuring weak values in quantum systems, which allows for the quantification of quantum properties in a way that is not possible with classical systems.

IPW • 16:45
Infrared Colloidal Quantum Dot Chalcogenide Films for Integrated Light Sources, Ofer Levi, Univ. of Toronto, Canada, Presider

16:00–17:30
IPW • Devices and Components IV

16:00 • 18:00
Quantum Information Processing on Photonic Chips, Dirk Englund1; 1Department of Electrical Engineering and Computer Sciences, University of California, Berkeley, USA. We propose and demonstrate a new method for integrating microwave/optical components using ultrafast optical pulse shaping techniques. This method allows for the integration of microwave and optical components in a single photonic chip, enabling new possibilities for quantum information processing.

SPWD • 16:00
Temporal and Spectrally Periodic Contrast in Optical Coherence Tomography (OCT) — Imaging Tissue Structure and Function, Alex Vitkin1, Membran Un, Canada. In this talk, I will discuss speckle as another source of contrast in OCT imaging. Specifically, I will analyze how temporal and spatial behaviour will be described.

SPWD • 16:15
Ultrafast Optical Pulse Shaping Technique Using Multi-Arm Time Differentiators with Programmable Optimization, M. A. Pinto1, Mohammad H. Asghari1, Antonio Malacarne1; 1Chair for High Frequency Information Science, Berlin, Germany. We propose and numerically evaluate a simple, reconfigurable ultrafast optical pulse shaping technique using multi-arm time differentiators with programmable weights that can be implemented using available integrated-waveguide/in-fiber technologies.

IPW • 16:30
Wonderful World of Weak Values, John Howell1, David Starling1, Ben Dixon1; 1Optical Science Program, University of Dayton, USA. An introduction to weak values will be given along with experimental results in precision beam deflection, signal-to-noise ratio, phase amplification and precision frequency measurements.

IPW • 16:45
Impact of Draw Inhomogeneities on the Loss and Mode Content of Large-Mode-Area Fibers, John Marciante1, Andrew Sarangan1; 1Institute of Optics, University of Rochester, USA. Inhomogeneities in the draw process cause variations in fiber diameter, leading to optical scattering. Beam-propagation simulations reveal that loss is acceptable for 1% RMS variations, but that good beam quality requires RMS variations below 0.1%.
Coherent SPE-OCDMA Sequences for Impairment Mitigation in SPWD6 • 17:15

Johns Hopkins University, USA; 2Radiance Technologies, Inc., USA; 3Lawrence Livermore National Laboratory, USA. When an optical parametric amplifier (OPA) operated as a phase-sensitive amplifier (PSA) is used for point source imaging, the angular resolution improvement can defeat the classical Rayleigh limit, and approach the de Broglie resolution.

Quantum Ghost Imaging Through Turbulence

Ben Dixon1; 1Physics, University of Rochester, USA. We investigate the effect of turbulence on quantum ghost imaging. We use entangled photons in several experimental configurations and demonstrate that for a novel configuration, the effect of turbulence can be greatly diminished.

We propose a novel design for arbitrary-order optical differentiation based on a especially-apodized long period fiber grating operated in transmission to fully optimize the energetic efficiency and processing speed of the device.

Sequences for Impairment Mitigation in Coherent SPE-OCDMA

Yi Yang1, A. Brinton5, 1ECE, The Johns Hopkins University, USA. Robust performance of spectrally phase encoded OCDMA with key impairments depends on the encoding sequences, according to correlation properties and pulse shapes.

Compact FIR Filter Architecture for Tunable Optical Dispersion Compensation in Silicon Photonics

Abdul Rahim1, Stefan Schwarz2, Jürgen Azaña1; 1Institut National de la Recherche Scientifique - Energie, Matériaux et Télécommunications (INRS-EMT), Canada. We present a novel design of the device.

Robust performance of spectrally phase encoded OCDMA with key impairments depends on the encoding sequences, according to correlation properties and pulse shapes.

Femtosecond Three-Photon Counting in a Photomultiplier Tube

Alex Hayut1, Meir Orenstein1, John Sheppard1, Heath Berry2; 1Louisiana Tech University, USA; 2Radiance Technologies, Inc., USA. We demonstrate experimentally ultrafast three-photon counting by three-photon absorption in a photomultiplier tube, which may serve as a unique tool for ultrafast quantum state characterization as well as for ultrasensitive temporal measurements.
Key to Authors and Presiders
(Bold denotes Presider or Presenting Author)

A
Abdelrahman, Ahmed Ibrahim-AWA5
Abivin, Patrice-STuB5
Abolghasem, Payam-IMC4
Abouraddy, Ayman-SOMD2
Absil, Philippe-IWC2
Adam, Jean-Luc-SOTuB2
Adams, Charles S-SLMB3
Adibi, Ali-IMD3, ITuD7
Agarwal, Anu-IMB1, ITuA5, ITuC6, IW4A, IWG3, SM5D
Agashe, Shaankh-STuC1
Aggarwal, Ishwar-SOMC, SOTuA4
Agnarsson, Bjorn-SWC5
Ahamad, Nur-SWC2
Ahmad, Raja-SOTuB4
Ahmed, Osman Sayed-MOHM-IMA3, IWD4
Ahn, Tae-Jung-SCM6
Aitchison, Stewart-ITuB4, ITuB5, SMB5, SOWC2
Akhanv, Hooman-SWB2
Al-saadi, Aws-IWE5
Akhavan, Hooman-SWB2
, SMB3,
Aitchison, Stewart-ITuB4,
Ahn, Tae-Jung-SCM6
Aitchison, Stewart-ITuB4, ITuB5, SMB5, SOWC2
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Aitchison, Stewart-ITuB4,
Ahn, Tae-Jung-SCM6
Aitchison, Stewart-ITuB4, ITuB5, SMB5, SOWC2
Al-saadi, Aws-IWE5
Akhavan, Hooman-SWB2
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Aitchison, Stewart-ITuB4,
Ahn, Tae-Jung-SCM6
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Al-saadi, Aws-IWE5
Akhavan, Hooman-SWB2
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Akhavan, Hooman-SWB2
, SMB3,
Aitchison, Stewart-ITuB4,
Sensors Keynote Speaker
SMA1 • 8:45-9:45
Optical Biomedical Sensors: What Can Nanophotonics Bring? Dan-Xia Xu, Inst. for Microstructural Sciences, National Research Council Canada, Canada. We discuss how nanophotonics is influencing the field of optical biomedical sensors. View points are exemplified in the context of developing integrated silicon photonic wire molecular sensor systems.

Dan-Xia Xu is a Senior Research Officer with National Research Council Canada, and an adjunct professor with arleto University. She received her B.S. degree from the University of Science and Technology of China in 1985, and her Ph.D. degree from Linköping University in Sweden in 1991 working on silicon-germanium HBTs and multi-quantum-well tunneling diodes. Since joining NRC, she has developed high speed SiGe HBTs, silicides for sub-micron VLSI, SiGe and silicon photodetectors, and later switched her research field to integrated optics. In 2001-2002 she was part of the research team at Optenia Inc. that successfully developed the first commercial glass waveguide echelle grating demultiplexer. In 2003, she pioneered the study of cladding stress induced birefringence in SOI waveguides and its application for polarization independent operation in photonic components. This technique is easy to implement and gives unprecedented control and design freedom in devices such as AWGs, ring resonators and Mach-Zehnder delay interferometers. Since 2005, she has been working on SOI photonic wire biosensors which are shown to be the most sensitive evanescent field sensor platform known to date. The NRC biosensor team has developed compact and high channel count sensors arrays and a reader system which does not require temperature control, and is capable of detecting protein and DNA adsorption of less than a femto-gram. Her current research interest is high index contrast silicon photonics, including biosensors, ring resonators, and optical modulation for biological sensing and optical communications. She has co-authored over 200 publications in technical journals and international conferences, seven research teams, and holds 6 patents.

Presentation Schedule Updates
IME4, Silicon Photonics Devices for Optical Interconnection, Takahiro Nakamura1,2, Junichi Fujikata1,2, Masashige Ishizaka1,2, and Keishi Ohashi1,2, : Photonics Electronics Technology Research Association , Japan 2: Green Innovation Research Laboratories, NEC Corporation , Japan, For optical interconnection, we demonstrated high-speed and high-efficiency optical modulator and photodetector by introducing nanostructure. Also, compact WDM optical source was developed using hybrid integrated SOA and silicon waveguide resonators. This paper will be presented in the IME4 time slot on Monday, 13 June at 17:00.

SOMB2, High Power Thulium Fiber Lasers, Martin Richardson, Univ. of Central Florida, will be presented in the SOWD1 time slot on Monday, 13 June at 16:00.

SOWD1, Fiber-based Synchronized Programmable Laser system for Biomedical, industrial and defense applications, Alain Villeneuve, Genia Photonics, Canada will be presented in the SOMB2 time slot on Monday, 13 June at 11:00.

SOWA4, Reliability of Double-Clad Fiber Coatings for Fiber Lasers, K. Tanka, J. Ambramczyk, D. Guertin, N. Jacobson and K. Farley, Nufern, USA. In this paper we describe work on the improved reliability of low index polymer coatings used in high power double-clad fiber lasers and amplifiers. This paper will be presented in the SOW4 on Wednesday, 15 June at 8:30.

Withdrawn Presentations
IMF7
STuC4
SOTuC1
SOWB2
SPWB4
**Program Updates**

Please note the title and abstract update for presentation SMC3, Performance Gains in an Interferometric Fiber optic Gyroscope Operated with a Single-Frequency Laser, Seth W. Lloyd, Michel J. F. Digonnet, and Shanhui Fan, Stanford University, Stanford, CA, USA. We present theoretical and experimental results demonstrating significant performance gains in interferometric fiber optic gyroscopes when the traditional gyroscope broadband source is replaced with a single-frequency laser.

Please note the abstract update for presentation SOM2, Multi-Material Optical Fiber Fabrication and Applications, Ayman Abouraddy; Univ. of Central Florida, USA. I review our progress in the emerging area of multi-material fibers. Applications range from mid-infrared linear and nonlinear chalcogenide glass fibers and fiber tapers, to the scalable and scale-invariant fabrication of micro- and nano-scale structures.

Please note the title and author block update for presentation ATuA3, Overlapped Subcarrier Multiplexed WDM PONs Enabled by Burst-Mode Receivers, David V. Plant1, Ziad A. El-San1, Jonathan M. Buset1, Bhavin J. Shastri1, 1McGill Univ., Canada.

Please note the title update for presentation ATuB1 Radio-over-Fiber Techniques and Applications for Multi-Gb/s In-Building Wireless Communication, Anthony Ngoma, Corning Inc., USA.

Please note the correct author name for presentation STuA1, Filamentation THz generation in air, S.L. Chin, Univ. Laval, Canada

Please note the update of following poster presentations:

**JTuB26**, Self-Assembled Monolayers (SAMs) of Porphyrin Deposited inside Solid-core Photonic Crystal Fibre (SCPCF), A. Veselov1, A. Efimov1, A. Chamorovskiy2, O. Otkhatnikov3, A. Kosolapov3, A. Levchenko3, H. Lemmetyinen1, N. Tkachenko1; 1Department of Chemistry and Bioengineering, Tampere Univ. of Technology, Finland; 2Optoelectronics Research Centre, Tampere Univ. of Technology, Finland; 3Fiber Optics Research Center of Russian Academy of Sciences, Russia.

**JTuB27**, A Bragg Microcavity Filter for Optical Sensing, Aju. S. Jugessur, Mariya Yagnyukova, James Dou, J. Stewart Aitchison; Electrical and Computer Engineering/ECTI, Univ. of Toronto, Canada. A Bragg microcavity optical sensor is fabricated using Electron-Beam Lithography and Reactive Ion Etching techniques. An index change of 0.03 corresponds to a peak resonance wavelength shift of approximately 1 nm.

**JTuB28**, Fiber-Optic Probe with Subwavelength Metallic Nanostructures for Sensing in Infrared Region, Seokyoung Roh, Taerin Chung, Byoungho Lee; Seoul National Univ., Korea. We investigate fiber-optic probe with subwavelength metallic nanostructures on the fiber-end facet for sensing. Nanostructures such as 1D/2D gratings in metallic layer are analyzed and utilized for inducing the plasmonic resonance in infrared region.

Presentation SOMC3, Laser Sintering of c-YAG Fiber, Jonathan Goldstein1, Geoff Fair1, David Zelmon1, Heedong Lee2; 1Air Force Research Lab, USA; 2IES, USA, will now be presented as poster JTuB29.

Please note the abstract update for presentation IWE5, Integration of a Tunable, Optical Delay Generator in a Silicon Photonics Platform, Kambiz Jamshidi , Stefan Meister , Aws Al-Saadi , Hans Joachim Eichler , Thomas Schneider, Deutsche Telekom Hochschule für Telekommunikation Leipzig, Germany. We propose an integrated optical delay generator based on Frequency-To-Time conversion. The required dispersions are produced by micro ring resonators based on SOI nano wires. Our design can provide high delays in relatively small footprints.

Please note the title update for presentation SOWB5, Hollow-core Photonic Crystal Fibre based Raman Lasers, Fatih Benabid, Univ. of Bath, UK

**Program Corrections**

Please note the correct author block IMC4, Tailoring the Far Field of Bragg Reflection Waveguides, Nima Zareian, Payam Abolghasem, Amr S. Helmy, Univ. of Toronto, Canada.

Please note the correct affiliation of SMB1, Subwavelength Hot Spot Generation for Sensor Applications, Byoungho Lee, Republic of Korea.

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**Presider Updates**

- Francesco Poletti; Univ. of Southampton, UK will preside over SMD, Spectral and Biomedical Imaging.

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