

Signal Processing in Photonic Communications (SPPCom)

19 June - 21 June 2012, Cheyenne Mountain Resort, Colorado Springs, Colorado, United States

SPPCom is your home to learn about the photonic transmission technology required in communication networks of all kind - from access to long haul and submarine.

Photonic transmission technology is required in communication networks of all kind - from access to long haul and submarine. Moreover, optical multimode, free-space, polymer and on-chip communication channels are becoming ever - more important in other types of applications, including sensor networks, free space communications, and feeding radio over fiber. For many advanced applications, simple data communications approaches, such as intensity modulation with direct detection, are no longer adequate given data impairments, increased system capacity, and required spectral efficiency. As an example, more advanced equalizer and forward error correction (FEC) technologies are now penetrating into high-end metro and core networks as well as into lower-end short MMF link equipment. The system gain has been quite dramatic, adding several dBs of performance.

Papers are being considered in the following topic categories:

- Clock and carrier recovery in coherent systems
- Full field detection in direct receivers
- Equalization in direct and coherent (Tx and/or Rx side)
- Advanced modulation formats
- Orthogonal frequency division multiplexing (OFDM)
- Error correction and detection
- Line coding
- Polarization demultiplexing and control
- High speed electronic components (i.e., FPGA, D/A- and A/D-Converters)
- Cost efficiency, power consumption, and complexity
- Channel estimation, distortion identification, performance monitoring

Chairs

Fred Buchali, *Alcatel-Lucent, Bell-Labs, Germany*
Robert Killey, *Univ. College, UK*
David Plant, *McGill Univ., Canada*

Program Chairs

Chao Lu, *Hong Kong Polytechnic Univ., Hong Kong*
William Shieh, *Univ. of Melbourne, Australia*
Xiang Liu, *Alcatel-Lucent, USA*
Seb Savory, *University College, London, UK*

This event is part of the Advanced Photonics Congress, allowing attendees to access to all meetings within the Congress for the price of one and to collaborate on topics of mutual interest.

[Advanced Photonics Congress](#)

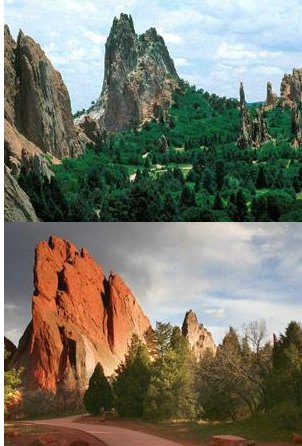
- [Access Networks and In-house Communications \(ANIC\)](#)
- [Bragg Gratings, Photosensitivity and Poling in Glass Waveguides \(BGPP\)](#)
- [Integrated Photonics Research, Silicon, and Nano-Photonics \(IPR\)](#)
- [Nonlinear Photonics \(NP\)](#)
- [Specialty Optical Fibers \(SOF\)](#)
- [Signal Processing in Photonic Communications \(SPPCom\)](#)

Sponsor:



Advanced Photonics Congress

17 June - 21 June 2012, Cheyenne Mountain Resort, Colorado Springs, Colorado, USA



Seven Collocated Meetings Covering All Aspects of Advanced Photonics

- [Access Networks and In-house Communications \(ANIC\)](#)
- [Bragg Gratings, Photosensitivity and Poling in Glass Waveguides \(BGPP\)](#)
- [Integrated Photonics Research, Silicon, and Nano-Photonics \(IPR\)](#)
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- [Specialty Optical Fibers & Applications \(SOF\)](#)
- [Signal Processing in Photonic Communications \(SPPCom\)](#)

[OIDA Workshop](#)

[Photonic Integration for Advanced Modulation Format Transmission at 100Gb/s and Beyond - Status of the Industry and Challenges Ahead Workshop](#)

Thursday, 21 June

08:30 - 17:00

Complimentary to all Advanced Photonics Registrants!

Special Items for Purchase:

OIDA Luncheon and Session

21 June 2012, 13:45 - 14:15

USD \$35



Advanced Photonics Congress attendees are invited to join the OIDA Workshop on Photonic Integration for Advanced Modulation Format Transmission at 100Gb/s and Beyond-Status of the Industry and Challenges Ahead for a luncheon and a session presented by David Welch.

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.

Corporate Sponsor:



Sponsor:



Signal Processing in Photonic Communications (SPPCom)

19 June - 21 June 2012, Cheyenne Mountain Resort, Colorado Springs, Colorado, United States

Program

SPPCOM is your home to learn about the photonic transmission technology required in communication networks of all kind - from access to long haul and submarine.

A number of distinguished [invited speakers](#) have been invited to present at the meeting.

Plenary

JW1A
Wednesday, 20 June
8:30 - 10:00
Platte



[Henning Buelow](#), Alcatel-Lucent, Bell Labs, Germany

Quo vadis, spatial multiplexing?

Abstract: Application areas and motivation of high bit-rate transport over fiber bundle, multi-core fiber, and multimode fiber are revisited. With a focus on mode multiplexing, recent research is reviewed and direction of future research is discussed.



[Yun Chung](#), Korea Advanced Inst. of Science and Technology, South Korea

Future Optical Access Networks

Abstract: This paper discusses the most competitive technical solutions for future optical access networks capable of providing >10-Gb/s service to each subscriber.

SPPCom Workshop:

Trends in Linear and Non-linear Digital Signal Processing for Communication Over all Degrees of Freedom of Light

Wednesday, 20 June
16:00-18:00, *Platte*

This workshop will consist of one hour of invited talks, followed by an open-forum discussion. Attendees are invited to converse with the speakers, make comments or ask questions. Speakers will include the following individuals:

- **Opening Remarks**, Moshe Nazarathy, *Technion Univ., Israel*
- **Trends in High-speed Optical Transport**, Roberts Kim, *Ciena, Canada*
- **Trends in High Spectral Efficiency Transmission**, Gabriella Bosco, *Politecnico di Torino, Italy*
- **Trends in Photonic Integrated Circuits for Coherent Optical Communications**, Jeff Rahn, *Infinera, Canada*
- **Trends in Hardware-efficient DSP Algorithms for Optical Communications**, Fabio Pittalà, *Huawei European Research Center, Germany*
- **Trends in High-speed Digital Signal Processing for Optical Communications**, Maxim Kuschnerov, *Nokia Seimens Networks, Germany*
- **Trends in All-optical Processing**, Juerg Leuthold, *KIT Univ., Germany*
- **Trends in Subband Multiplexing**, Moshe Nazarathy, *Technion Univ., Israel*

Other subjects may also be discussed.

Special Events

The congress has a variety of special events throughout the meeting including the OIDA Workshop, Congress Reception and special presentations. For more detailed information, view our [Special Events](#) page

Signal Processing in Photonic Communications (SPPCom)

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Invited Speakers

Spectrally Efficient Transmission: A Comparison Between Nyquist-WDM and CO-OFDM approaches, Gabriella Bosco, *Politecnico di Torino, Italy*

DSP-enabled OFDM superchannel transmission, S. Chandrasekhar, *Bell Labs, Alcatel-Lucent, USA*

Dynamic Optical Arbitrary Waveform Generation and Measurement for Telecommunications, Nicolas Fontaine, *Bell Labs, Alcatel-Lucent, USA*,

Real-time Coherent Optical OFDM, Noriaki Kaneda, *Bell Labs, Alcatel-Lucent, USA*

1-Tb/s coherent transceiver, Roberts Kim, *Ciena, Canada*

Recent Advances in Signal Processing for Real-time Implementation - 40Gb/s, 100Gb/s and Beyond, Maxim Kuschnerov, *Nokia Siemens Networks, Germany*

Performance Monitoring Through Signal Processing in Current and Future Optical Communication Systems, Alan P. T. Lau, *The Hong Kong Polytechnic University, China*

Real-time OFDM and Nyquist Transmitters, Juerg Leuthold, *KIT University, Germany*

Single-carrier Frequency-domain Equalization, Tadao Nakagawa, *NTT Labs, Japan*

Sub-banding - a Signal Processing Architecture Improving Real-time Realization of Coherent Optical Receivers, Moshe Nazarathy, *Technion University, Israel*

Efficient Training-Based Channel Estimation in Coherent Optical Communication Systems, Fabio Pittalà, *Huawei European Research Center, Germany*

500Gb/s PIC Based Coherent Optical Modem, Jeff Rahn, *Infinera, Canada*

MIMO Processing for Space-division Multiplexed Transmission, Sebastian Randel, *Bell Labs, Alcatel-Lucent, USA*

Decision-aided Carrier Phase Estimation for Coherent Optical Communication Systems, Changyuan Yu, *National University of Singapore, Singapore*

Hardware-efficient Carrier Recovery Algorithms for Single-carrier Systems, Xiang Zhou, *ATT, USA*

High Performance, Low Overhead CO-OFDM for Next Generation Fiber Transmission Systems, Qunbi Zhuge, *McGill University, Canada*

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Future Optical Access Networks

Abstract: This paper discusses the most competitive technical solutions for future optical access networks capable of providing >10-Gb/s service to each subscriber.

Poster Sessions



JM5A - Joint Poster Session I

Monday, 18 June
18:00 - 19:30
Centennial Room and Terrace

JTu5A - Joint Poster Session II

Tuesday, 19 June
18:00 - 19:30
Centennial Room and Terrace

The Joint 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. During both poster sessions light refreshments will be offered plus an opportunity to meet with exhibitors.

Conference Receptions

Poster Reception & Exhibits

Monday, 18 June
18:00 - 19:30



Centennial Room and Terrace

This Poster Reception is an opportunity to review the poster presentations and grab light refreshments and snacks. Don't miss this opportunity to network with your colleagues and walk through the Exhibit floor.

Congress Reception & Exhibits

Tuesday, 19 June
18:00 - 19:30
Centennial Room and Terrace

This Reception brings together all of the meetings within the congress IPR, NP BGPP, SOF, SPPCom, and ANIC for a fun evening of networking with light appetizers and drinks. This event features another Joint Poster Session and is a great another great opportunity to learn about the latest products and innovations. Complimentary to full Technical attendees!

New! Networking Cookout

Wednesday, 20 June
18:30 - 20:30
The Courtyard
*Ticketed event - This event is **not** included in the Congress registration fees.*

Join us at this great event! Come meet with leaders of the optics and photonics community in a great informal and fun setting. Enjoy the sunset as you grab dinner, drinks and lively conversation! For \$20 USD for full technical registrants, \$10 USD for students.

Optoelectronics Industry Development Association (OIDA) Workshop

[Photonic Integration for Advanced Modulation Format Transmission at 100Gb/s and Beyond - Status of the Industry and Challenges Ahead Workshop](#)

Thursday, 21 June
08:30 - 18:00
Complimentary to all Advanced Photonics Registrants!

Program Topic: Ever growing internet traffic calls for more bandwidth at higher interface density and the telecom industry responded by migrating from a simple OOK to advanced modulation format transmission. Commercial systems e.g., coherent DP-QPSK modulation systems operating at 100Gb/s per wavelength have been deployed while many new developments are underway. They target different applications and vary by technology platform but all have one feature in common: **optical components based on photonic integration.**

It is becoming increasingly evident that the photonic integration, in some shape or form is the key to further advancement of such systems. The objective of this workshop is to provide a snapshot of the photonic integration techniques and platforms used for advanced modulation format transmission today and discuss challenges going forward. This workshop is sponsored by OIDA member company Infinera, Inc.

OIDA Luncheon Workshop Program

[Photonic Integration](#)
Thursday, 21 June
12:30 - 14:00

Tickets to lunch can be purchased for \$35 USD when you register.



All Advanced Photonics Congress registrants are invited to join the OIDA [Photonic Integration](#) Workshop featuring guest speaker David Welch, Co-Founder and Executive Vice President of Infinera Corporation.

SPPCom Workshop:

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Wednesday, 20 June
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Other subjects may also be discussed.

ADVANCED PHOTONICS CONGRESS 2012

- Access Networks and In-house Communications (ANIC)
- Bragg Gratings, Photosensitivity and Poling in Glass Waveguides (BGPP)
- Integrated Photonics Research, Silicon, and Nano-Photonics (IPR)
- Nonlinear Photonics (NP)
- Specialty Optical Fibers & Applications (SOF)
- Signal Processing in Photonic Communications (SPPCom)



17-21 June 2012 ✦ **Cheyenne Mountain Resort, 3225 Broadmoor Valley Road, Colorado Springs, CO, 80906 USA**

We're glad you'll be joining us in Colorado Springs this summer! This packet should include what you need to prepare for the meeting. If you have any questions or need more information, please contact Meetings & Exhibits Coordinator Sam Nystrom at topicalexhibits@osa.org or +1.202.416.1995.

EXHIBITOR SERVICE MANUAL

Please provide this information to anyone who will be attending the meeting and staffing your company's table.

Exhibit space will be assigned on-site based on the order of receipt of space contracts.

IMPORTANT DEADLINES

17 May 2012	Housing reservations deadline.
21 May 2012	Registration forms due (fax to +1 202.416.6100 or email topicalexhibits@osa.org).
21 May 2012	50-75 word description due for exhibitor listings. Exhibitor Listing Form included at end of this kit.
21 May 2012	Exhibitor Response Form due; form included at end of this kit.
4 June 2012	Final day to order electrical power, internet, or other services from hotel. On-site orders will be charged a 25% additional fee and service may be delayed. Exhibit Order Form included at end of this kit.
14 June 2012	The Cheyenne Mountain Resort begins accepting shipments from exhibitors; shipments received earlier may be declined.

EXHIBIT SCHEDULE

Click [HERE](#) for a complete schedule of the meeting.

17 June 2012	15.00-18.00	Registration Open
18 June 2012	7.00-18.00	Registration Open
18 June 2012	7.00-10.00	Exhibit Set-Up
18 June 2012	10.00-10.30 15.30-16.00	Exhibit Hours / Coffee Break
18 June 2012	18.00-19.30	Joint Poster Session / Exhibitor Reception
19 June 2012	7.30-18.00	Registration Open
19 June 2012	10.00-10.30 15.30-16.00	Exhibit Hours / Coffee Break
19 June 2012	18.00-19.30	Joint Poster Session/Exhibits/Conference Reception
20 June 2012	7.30-11.00	Exhibit Tear-Down

*Exhibitors may set their own hours each day. We do not require that you remain at your display for the entire time, however, **displays should be staffed during scheduled Coffee Breaks, Poster Sessions, and Receptions.** Attendee traffic patterns vary daily. Most attendees will leave the technical sessions for the coffee breaks that are located in the exhibit area but will then return to the sessions. Exhibit traffic is limited during other times to the poster sessions and receptions that are located in the exhibit area.*

EXHIBIT DETAILS

The exhibit, poster sessions, conference reception, and stand alone coffee breaks will be held in the Centennial Room of the Cheyenne Mountain Resort.

Exhibitors (tabletops and booths) will be provided with one 6' x 30" (1.8288m x .762m) draped or skirted table, two chairs, and one wastebasket.

Tabletop: Your display must fit completely on the surface of the table for a total display space no larger than 6'w x 2'd x 8'h (approx. 1.829m x .61m x 2.438m). Decorations and signage may not be attached to or hung from any permanent structure. The total height all materials, including the table, must be no higher than 8 feet (approx. 2.438m).

Booth: Your display must fit completely within a 10' x 10' (3.048m x 3.048m) area which will be marked. Decorations and signage may not be attached to or hung from any permanent structure. In the front half of the booth (from aisle), the total height of all materials must not exceed 4 feet (1.219m). In the back half, the total height must be no higher than 8 feet (2.438m).

Please see the Exhibit Order Form at end of this kit for more information and pricing on electrical, internet, and audiovisual services. Contact Andre D'Amour, Assistant Director, Conference Services, at +1.719.538.4009 or adamour@benchmarkmanagement.com for further details. Exhibitors can order the following items directly from the hotel:

ELECTRICAL SERVICE - **Deadline: Monday, 4 June 2012**

Cost: US \$25.00 for a dedicated 20 Amp 110V outlet with power strip.

This is an estimate of an order placed by 4 June. Orders placed later than this date may be charged a higher rate.

NOTE: It is highly recommended that power be ordered in advance. On-site orders will be charged a 25% additional fee and service may be delayed. Exhibitors can bring their own converters, extension cords, power strips and surge protectors, but these items may also be available through the hotel for a charge. International exhibitors should bring power converters with them, as they may not be available. Electrical circuits may be non-exclusive and may be shared with other exhibitors.

INTERNET SERVICE - **Deadline: Monday, 4 June 2012**

Wireless internet is complimentary in all public spaces and guest rooms. It is not available in the meeting rooms, including the Centennial Room, where the exhibits will take place.

Wired Internet service is available upon request. Cost: US \$100.00 for wired high speed internet access.

Note that the exhibit hours are flexible, and there will be time during the day to leave the exhibit area to utilize the wireless service in a guest room or public space.

AUDIOVISUAL SERVICE - **Deadline: Monday, 4 June 2012**

Computers, telecommunications, and projections equipment are all available for rental from the Cheyenne Mountain Resort. Please keep in mind that exhibits displays must stay within the 10' x 10' (3.048m x 3.048m) booth dimensions and 6'w x 2'd x 8'h (approx. 1.829m x .61m x 2.438m) tabletop dimensions.

EXHIBITOR REGISTRATION

Exhibitors may pick up their badges at the meeting's registration desk during the following hours.

17 June 2012	13.00–18.00
18 June 2012	7.00–18.00
19 June 2012	7.30-17.00

EXHIBITOR BADGES – DEADLINE: MONDAY, 21 MAY 2012

Exhibitors – Do not use online registration. Fax the completed [REGISTRATION FORM](#) to +1.202.416.6100 ATTN: Cathryn Wanders by Monday, 21 May 2012.

Each person attending the meeting must have a badge. Each exhibiting company will receive three complimentary badges. Please complete the provided registration form (one per person).

- (1) Exhibitor Technical Badge – includes access to all technical sessions and conference reception; one copy of technical digest on CD-ROM; one copy of conference program
- (2) Exhibitor Personnel Badges – access to the exhibit hall only

If an additional registration is needed, that person must purchase a technical registration. The registration form is included with this packet. Please note, **by signing up to exhibit, you are NOT automatically registered for the conference**. A form must be submitted.

EXHIBITOR LISTING – **Deadline: Monday, 21 May 2012**

If you have not already done so, please email a 50-75 word description of your company (including complete contact information) to Sam Nystrom at topicalexhibits@osa.org. To have your description included in the Exhibitor Listings, it must be received no later than 21 May 2012. This listing will be distributed to each registrant at the meeting. The Exhibitor Listing Form is included at the end of this kit.

SECURITY

The hotel has security on the property; however security will not be specifically designated to monitor the meeting rooms. It is strongly recommended that you take any valuable equipment (i.e. laptops, small components, other materials) with you or secure them each night. It is also recommended that you bring a drape or cloth to cover your table each night. Each exhibitor is required to have adequate insurance levels, and basic precautions should be taken. Reference your exhibit space contract for required insurance levels.

Please do not store valuables under your table or leave objects such as phones, cameras, etc. on your table unless the booth is staffed.

TRANSPORTATION

For more information about transportation to the hotel, including airline and rental car discounts and links to public transportation, please visit our [Travel Information Website](#).

AREA AIRPORTS

Colorado Springs is served by the [Colorado Springs Airport \(COS\)](#). It is approximately 20 minutes from the Cheyenne Mountain Resort. COS is served by [10 commercial airlines](#) and affiliates, offering 120 daily flights. Another option is the [Denver International Airport \(DEN\)](#), located approximately an hour from the Cheyenne Mountain Resort. DEN is served by [15 commercial airlines](#) and their affiliates.

Airline Discount

For your convenience, OSA management has arranged discounted air travel with American Airlines. You may visit the American Airlines website at www.aa.com to search for available flights and use the authorization code **8762EJ** to receive your discount. You may also call the American Airlines Meeting Services Desk directly at +1.800.433.1790 for assistance with reservations and ticket purchases.

SHUTTLE SERVICES

A shuttle service provide by the resort is available from COS for approximately US \$30 per person roundtrip or US \$18 per person one-way. Call +1.719.538.4000 to set up a pickup and have your flight dates, times, and numbers ready.

Super Shuttle

SuperShuttle is the nation's leading shared-ride airport shuttle, providing door-to-door ground transportation and provides service to and from 28 major airports in 23 cities. **Service is available at Denver International Airport (DEN), but not at Colorado Springs Airport (COS)**. Super Shuttle is pleased to offer a discount to participants attending the Advanced Photonics Congress. Please refer to code **CQAFI**. Discounted reservations may be made on the [Super Shuttle website](#) or by phone at +1.800.BLUE VAN (258.3826).

TAXIS

A one-way taxi from COS to the Cheyenne Mountain Resort is approximately US \$25.

[Yellow Cab](#): +1.719.634.5000

[Spring Cab](#): +1.719.444.8989

RENTAL CARS

A selection of rental cars is available from [Colorado Springs Airport](#) and [Denver International Airport](#).

Rental Discount

Avis Rent-a-Car is pleased to offer low rates with unlimited mileage to participants attending OSA Optics and Photonics Congresses. For reservations call +1.800.331.1600 or consult the [worldwide telephone directory](#) and refer to Avis Worldwide Discount #D004076. Reservations may also be made on the Avis [website](#).

DRIVING DIRECTIONS TO CHEYENNE MOUNTAIN RESORT

FROM COLORADO SPRINGS AIRPORT (COS)

1. Go west on Mark Proby Pkwy approximately 3 miles to Academy Blvd.
2. Turn left on Academy and stay in the left-hand lane.
3. Follow Academy approximately 4 miles to Highway 115.
4. Exit north at Highway 115.
5. Proceed approximately one mile to Cheyenne Mountain Blvd.
6. Turn left on Cheyenne Mountain Blvd. and go one block to Broadmoor Valley Rd.
7. Turn left and go three blocks to Cheyenne Mountain Resort.

FROM DENVER INTERNATIONAL AIRPORT (DEN) VIA I-25

1. Head south.
2. Take the ramp onto Peña Blvd.
3. Take Exit 285 to merge onto I-225 S towards Colorado Springs/Aurora.
4. Take 1A on the left to merge onto I-25 S towards Colorado Springs.
5. Exit 138 - Circle Drive.
6. Turn West (toward the mountains).
7. Two miles to Highway 115 South - Canon City.
8. Continue under the overpass and LEFT turn onto ramp.
9. First traffic light, Cheyenne Mountain Boulevard, turn RIGHT.
10. Take the first LEFT, Broadmoor Valley Road - (Resort's sign on the corner).
11. One half mile to Cheyenne Mountain Resort - Main Entrance on the LEFT.

PARKING AT RESORT

Complimentary self-parking and valet-parking is available in a secure outdoor lot at the resort.

HOUSING

A block of sleeping rooms has been reserved for the convenience of Advanced Photonics meeting attendees at the Cheyenne Mountain Resort. **In order to secure the group rate, you must reserve your room by Thursday, 17 May 2012.**

The daily meeting rates are:

Single/Double Room	US \$169.00
Extra Person Charge	US \$10.00
Resort Fee	US \$8.00

Rates will be honored 3 days prior and post conference dates. State and local taxes are 9.4%. Check-in time is 13.00 and check-out time is 15.00. If you book within the block, the following services are complimentary to make your stay more enjoyable:

- Fitness classes
- Outdoor tennis
- Boating and fishing (seasonal)
- Bell and Room Attendant gratuities
- 800 and Local call access
- Newspaper and in-room coffee and tea
- Fitness Center and Aquatics access and parking

Some of the amenities available at the Cheyenne Mountain Resort include delicious [Hotel Dining](#), an 18-hole [Golf Course](#), various [Recreational Activities](#), and nearby [Area Attractions](#).

Book your Hotel Reservation:

- [ONLINE](#)
- Call: +1.719.538.4000 and request 2012 OSA Advanced Photonics Congress Rate

SHIPPING & MATERIAL HANDLING

MATERIAL HANDLING / DELIVERY & STORAGE

Delivery, load-in and load-out must occur at the hotel loading dock. There are no exceptions. Exhibitor vehicles may park in the driveway to the loading dock for the amount of time required to perform their task. If this time is expected to exceed 30 minutes, the exhibitor must obtain special written authorization. In addition, exhibitors must supply their own equipment to transport supplies into the Hotel. During move-in, any damage incurred to the walls, carpet, doors, door frames and elevators will be billed. Should the exhibitor leave without cleaning up properly, they will be responsible for any additional labor charges to restore the room to its prior condition. A pre- and post-conference walk-through inspection of the space to be used may also be required.

If needed, please notify topical Exhibits@osa.org in advance and we will work with you to have your shipment delivered.

SHIPPING INSTRUCTIONS

Due to limited space, the Cheyenne Mountain Resort cannot accept packages more than 2 weeks prior to the start of the meeting. Incoming shipments will not be assessed an incoming shipping fee. Please label your incoming boxes as follows:

**Cheyenne Mountain Resort
Advanced Photonics Optical
Attn: Vendor Name
3225 Broadmoor Valley Road
Colorado Springs, CO 80906**

RETURN SHIPMENTS

All packages must be shipped off property within 24 hours of completion of meeting. All exhibitors are responsible for packing and labeling their own materials (boxes, crates, display cases). The Cheyenne Mountain Resort will not be liable for any items left in the room after the conference. All outgoing materials (boxes, crates, display cases) must be properly labeled with a shipping label and form, provided by the hotel. Outgoing boxes are \$7.50 a piece.

After completing the above, the hotel will transport all boxes and display cases to the Shipping/Receiving area at the end of the conference. Please retain a copy of your shipping form for tracking purposes.

FREIGHT FORWARDING SHIPMENTS / CUSTOMS BROKERS

Vendors using freight forwarding companies or customs brokers are responsible for making their own pick-up and ship-out arrangements. Please inform Andre D'Amour, Assistant Director, Conference Services, at +1.719.538.4009 or adamour@benchmarkmanagement.com of any freight forwarding shipments that you may have in the event that you are not present when the pick-up is made. Please make sure that all necessary documents are included with your shipment.

AIR FREIGHT / CARGO – DOMESTIC SHIPMENTS

STS Air Cargo is available to assist those companies who need to ship exhibit materials to and from Colorado Springs. For more information, please contact:

STS Air Cargo
PO Box 998
Millbrae, CA 94030
Phone: +1.800.692.6116
Fax: +1.650.692.6175
stsair@stsair.com

CUSTOMS & INTERNATIONAL SHIPMENTS

All shipments which will be traveling internationally **MUST** use a customs broker. Management is not responsible for any shipments that may be stopped at customs or for any additional charges that may be incurred for international shipments. Below is a suggested customs broker. TWI Global will assist those companies which need to ship exhibit materials to Colorado Springs. For more information, please contact:

Alison Minichiello
TWI Group, Inc.
230-59 International Airport Center Blvd.
North Lobby, Suite #250
Jamaica, New York 11413
Tel: +1.718.995.0500
aminichiello@twiglobal.com

PROMOTIONAL OPPORTUNITIES

Take advantage of the opportunity to maximize your company's meeting presence through the unique sponsorships available at Advanced Photonics 2012. Increase your company's visibility among qualified attendees while utilizing a cost-effective way to gain a competitive advantage. Don't miss your chance to reach hundreds of attendees!

To take advantage of a sponsorship opportunity, please call +1.202.416.1474 or email Regan Pickett at rpickett@osa.org.

Advanced Photonics: Topical Meeting Exhibit 2012

Buyers' Guide Submission Instructions

- Fax: +1 202.558.3995, Attn: Sam Nystrom – topicalexhibits@osa.org**
- Please provide the following information for inclusion in the Buyers' Guide, which will be provided to all attendees. One listing per company is provided. Should a company miss this deadline, you will not be listed in the Guide.
- SUBMIT BY 21 MAY 2012**
- Provide all information as it is to be published. Please write **legibly** in dark ink and fax to +1 202.558.3995 or email to topicalexhibits@osa.org.*
- Company Name _____
- Address 1 _____
- Address 2 _____
- City _____ State/Province _____
- ZIP/Postal Code _____ Country _____
- Phone _____ Fax _____
- Web site _____
- Email _____
- 50-75 word description** (*any descriptions over 75 words may be edited*):

Exhibitor Response Form

Advanced Photonics Congress 2012

- *Access Networks and In-house Communications (ANIC)*
- *Bradd Gratings, Photosensitivity and Poling in Glass Waveguides (BGPP)*
- *Integrated Photonics Research, Silicon, and Nano-Photonics (IPR)*
- *Nonlinear Photonics (NP)*
- *Specialty Optical Fibers & Applications (SOF)*
- *Signal Processing in Photonic Communications (SPPCom)*

Email Response Form to topicalexhibits@osa.org, or fax to +1 202.558.3995, ATTN: Sam Nystrom

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Telecommunications	Dates Needed	Cost per Day	# of Days	Quantity	TOTAL
Long distance access phone		50			
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Wired High Speed Internet Access		100			
Wi-Fi access per computer*		75			
*requires IT assistance to set up					
Other:					
Computer		Cost per Day	# of Days	Quantity	TOTAL
PC Laptop w/ Windows XP Pro		150			
20" LCD Panel		100			
24" LCD Panel		200			
Other:					
Projection A/V		Cost per Day	# of Days	Quantity	TOTAL
Flipchart		45			
Easel		10			
DVD Deck		45			
13" CRT Preview Monitor		45			
32" CRT TV		75			
40" LCD Monitor		350			
50" Plasma Screen w/ Floor Stand		550			
Other:					
Electrical		Cost per Day	# of Days	Quantity	TOTAL
5 Amp 110V w/ power strip		15			
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Additional Power Strips		5			
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Other:					
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Access Networks and In-house Communications (ANIC)
Bragg Gratings, Photosensitivity and Poling in Glass Waveguides (BGPP)
Integrated Photonics Research, Silicon, and Nano-Photonics (IPR)
Nonlinear Photonics (NP)
Specialty Optical Fibers & Applications (SOF)
Signal Processing in Photonic Communications (SPPCom)

17–21 June, 2012
Colorado Springs, CO, USA

Welcome to the 2012 Advanced Photonics Congress! We hope you enjoy all that Colorado Springs offers, and take full advantage of the scientific sessions before you. The Congress has co-located six stimulating veteran topical meetings (listed above) to allow attendees exposure to a wide variety of topics.

This year's Congress will offer 8 plenary speakers, ample opportunities for networking, and multiple events to motivate discussions on the latest research and exhibits featuring companies which will help enhance your organization. There will be two joint poster sessions, the first will have served refreshments on Monday, 18 June from 18:00–19:30. The second poster session with the conference reception will be on Tuesday, 19 June from 18:00–19:30. A special feature of this year's Congress is the OIDA Workshop, "Photonic Integration for Advanced Modulation Format Transmission at 100Gb/s and Beyond - Status of the Industry and Challenges Ahead" with an optional Luncheon program with guest speaker David Welch, Co-Founder and Executive Vice President of Infinera Corporation on Thursday, 21 June. We hope that bringing together leaders and experts among the different communities to share information and discuss topics across the disciplines of optical science and engineering will provide you with a rich experience in Colorado Springs.

The Access Networks and In-house Communications (ANIC) topical meeting is designed to present many of the latest advances in the development of FTTx technologies ranging from significant advancements in device development to the development of sophisticated algorithms to transmit data, control and monitor the network, and efficiently distribute the signals. This year's meeting will have a plenary speaker, 7 invited speakers, 10 oral presentations and 4 poster presentations.

The Bragg Gratings, Photosensitivity, and Poling (BGPP) topical meeting gives you the opportunity to discover the impact on telecommunications and sensing and witness first-hand the latest advances and breakthroughs in the field of fiber gratings. BGPP continues to be a popular meeting for covering the state-of-the-art advances in fiber gratings in a relaxed and non-pressured atmosphere. The program is tailored for informal exchanges, forming new partnerships, and reconnecting with colleagues. This year's meeting will feature a plenary speaker, 13 invited speakers, 51 oral presentations and 11 poster presentations.

The Integrated Photonics Research, Silicon, and Nano-Photonics (IPR) is a long standing meeting with a great tradition of excellence in innovative science, advanced engineering and cutting edge technology that covers all aspects of research in a burgeoning area of integrated photonics. This year's meeting will include traditional areas such as photonic integrated circuit design, technology and applications; physics and technology of on-chip active and passive photonic devices; planar waveguide technology, lightwave circuits and systems-on-the chip; theory, modeling and numerical simulation of waveguide and integrated photonic devices and circuits; integrated diffractive optics and micro-photonics. Also, IPR 2012 will continue to cover hot topics in nano-photonics, including generation, detection, transport and utilization of optical fields on the "nanoscale." A new feature of IPR 2012 is an emerging area of research that relates to various aspects of slow light, including basic physics, implementation and potential use in integrated photonics. This year's meeting will include 2 plenary speakers, 28 invited speakers, 70 oral presentations and 8 poster presentations.

The Nonlinear Photonics (NP) topical meeting is a venue for researchers interested in nonlinear optical processes in structures, devices and systems. The meeting covers all aspects of nonlinear photonics and is devoted to both temporal and spatial nonlinear effects. It covers computational as well as experimental aspects and discusses nonlinear material aspects as well as nonlinear systems. The meeting will also feature 2 plenary speakers, 8 invited speakers, 68 oral presentations and 76 poster presentations.

The Speciality Optical Fibers and Applications (SOF) meeting will discuss synthesis, processing, characterization, modeling, physical properties and applications of specialty and novel optical fibers with high technological impact potential. The purpose of this conference is to bring together global leaders from academia, industry, and the public/government sector to survey the present state of the art and project future trends in specialty optical fiber materials, designs, and applications. Particular attention will be paid to high energy fiber lasers, novel optical amplifiers and lasers, infrared and nonlinear fibers, micro-structured and photonic crystal fibers, active and passive polymer optical fibers, fiber-based sensors, crystalline and ceramic optical fibers, and fibers for biomedical and bioscience uses. We have scheduled a plenary speaker, 20 invited speakers, 3 tutorial speakers, 38 oral presentations, and 11 poster presentations.

The Signal Processing in Photonic Communications (SPPCom) meeting will discuss photonic transmission technology required in communication networks of all kind, from access to long haul and submarine, focusing on advanced signal processing techniques to overcome signal impairments, and to achieve increased system capacities and spectral efficiencies. The topical meeting with feature 16 invited speakers, 26 oral presentations, and 1 poster presentation.

We all are very pleased to have you join us and we look forward to a great meeting!

ANIC

Pandelis Kourtessis, *London Herts Univ., UK*
Thomas Pfeiffer, *Alcatel-Lucent, Germany*
Antonio Teixeira, *Universidade de Aveiro, Portugal*

BGPP

Morten Ibsen, *Univ. of Southampton, UK*
Paul Westbrook, *OFS Laboratories, USA*

IPR

Dan-Xia Xu, *National Research Council Canada*
Anatoly Zayats, *King's College London, UK*

NP

Wieslaw Krolikowski, *Australian Natl. Univ., Australia*
Frank Wise, *Cornell Univ., USA*

SOF

Ishwar Aggarwal, *Univ. of North Carolina at Charlotte, USA*
John Ballato, *Clemson Univ., USA*

SPPCom

Fred Buchali, *Alcatel-Lucent, Bell-Labs, Germany*
Robert Killely, *Univ. College of London, UK*
David Plant, *McGill Univ., Canada*

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Congress Highlights

BGPP Welcome Reception (Invitation Only)

Sponsored by Fianium
Sunday, 17 June, 18:00–19:30
Grand River Terrace

BGPP attendees are invited to kick-off the conference with this networking event. Join your colleagues for an intimate reception with drinks and light appetizers.

Joint Poster Sessions

JM5A – Monday, 18 June, 18:00–19:30
JTU5A – Tuesday, 19 June, 18:00–19:30
Centennial Room and Terrace

The Joint 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. During both poster sessions, refreshments will be offered plus attendees have an opportunity to meet with exhibitors.

Conference Receptions

Poster Reception & Exhibits

Monday, 18 June, 18:00–19:30
Centennial Room and Terrace

This Poster Reception is an opportunity to review the poster presentations and grab light refreshments and snacks. Don't miss this opportunity to network with your colleagues and walk through the Exhibit floor.

Congress Reception & Exhibits

Tuesday, 19 June, 18:00–19:30
Centennial Room and Terrace

This Reception brings together all of the meetings within the congress IPR, NP BGPP, SOF, SPPCom, and ANIC for a fun evening of networking with light appetizers and drinks. This event features another Joint Poster Session and is a great chance to learn about the latest products and innovations. Complimentary to full Technical attendees!

Optoelectronics Industry Development Association (OIDA) Workshop

Photonic Integration for Advanced Modulation Format Transmission at 100Gb/s and Beyond – Status of the Industry and Challenges Ahead Workshop

Thursday, 21 June, 08:30–18:00
White River

Complimentary to all Advanced Photonics Congress Registrants!

Program Topic: Ever growing internet traffic calls for more bandwidth at higher interface density and the telecom industry responded by migrating from a simple OOK to advanced modulation format transmission. Commercial systems e.g., coherent DP-QPSK modulation systems operating at 100Gb/s per wavelength have been deployed while many new develop-

ments are underway. They target different applications and vary by technology platform but all have one feature in common: **optical components based on photonic integration.**

It is becoming increasingly evident that the photonic integration, in some shape or form is the key to further advancement of such systems. The objective of this workshop is to provide a snapshot of the photonic integration techniques and platforms used for advanced modulation format transmission today and discuss challenges going forward. This workshop is sponsored by OIDA member company Infinera, Inc.

OIDA Luncheon Workshop Program

Photonic Integration
Thursday, 21 June, 12:30–14:00
Colorado II & III

Tickets to lunch can be purchased for \$35 USD when you register.



All Advanced Photonics Congress registrants are invited to join the OIDA Photonic Integration Workshop featuring guest speaker David Welch, Co-Founder and Executive Vice President of Infinera Corporation.

Plenary and Keynote Speakers



Fire and Ice: 25 Years of Fiber Grating Sensor Technology

Monday, 18 June
JM1B.1 • 08:30, *White River*

Eric Udd, Columbia Gorge Research, USA

President of Columbia Gorge Research has been deeply involved with fiber optic sensors since 1977 and helped pioneer early work on fiber optic gyros, fiber optic smart structures for health monitoring, high temperature and high speed fiber optic sensors systems, multi-axis strain sensors and fiber optic pressure sensors. He worked for McDonnell Douglas from 1977 to 1993, where he managed over 25 DoD, NASA and internally funded fiber optic sensor programs. Mr. Udd has held a series of positions moving from Engineer/Scientist, to Manager-Fiber Optics, and in 1989 was appointed as one of 40 McDonnell Douglas Fellows. In 1993, he started Blue Road Research and directed the growth of the company through its acquisition by Standard MEMS in January 2000. In January 2006, Mr. Udd left Blue Road Research to found Columbia Gorge Research. Columbia Gorge Research is strongly focused on the objective of moving fiber optic sensor technology to the field quickly and efficiently supporting both end users and developers of the fiber optic sensor technology by forming synergistic relationships with

other companies and organizations. Mr. Udd has 45 issued US Patents and several more pending on fiber optic technology, has written and or presented over 150 papers and has chaired approximately 30 international conferences on fiber optic sensor technology. He has edited the books *Fiber Optic Sensors: An Introduction for Engineers and Scientists*, Wiley, 1991 (2nd edition 2011) and *Fiber Optic Smart Structures*, Wiley, 1995. Mr. Udd is a Fellow of SPIE and OSA and a member of IEEE and the LEOS. Mr. Udd has been awarded the Richardson Medal for 2009 by the Optical Society of America for his work on fiber optic sensors and the field of fiber optic smart structures.



Negative Refraction and Light Bending with Plasmonic Nanoantennas

Monday 18 June
JM1A.1 • 08:30, Colorado I

Vlad Shalaev, *Purdue Univ., USA*

Vladimir (Vlad) M. Shalaev, Scientific Director for Nanophotonics in Birck Nanotechnology Center and Distinguished

Professor of Electrical and Computer Engineering at Purdue University, specializes in nanophotonics, plasmonics, and optical metamaterials. Vlad Shalaev received several awards for his research in the field of nanophotonics and metamaterials, including the Max Born Award of the Optical Society of America for his pioneering contributions to the field of optical metamaterials and the Willis E. Lamb Award for Laser Science and Quantum Optics. He is a Fellow of the IEEE, APS, SPIE, and OSA. Prof. Shalaev authored three books, twenty one book chapters and over 300 research publications.



Nanoscale Glass Blowing

Monday, 18 June
JM1B.2 • 09:15, White River

Philip Russell, *Max Planck Institute for the Science of Light, Germany*

Philip Russell is a Director at the Max-Planck Institute for the Science of Light in Erlangen, Germany and holds the Krupp

Chair in Experimental Physics at the University of Erlangen-Nuremberg. He obtained his doctorate in 1979 at the University of Oxford. His research interests currently focus on scientific applications of photonic crystal fibers and related structures. He is a Fellow of the Royal Society and the Optical Society of America (OSA) and has won several international awards for his research including the 2005 Körber Prize for European Science, the 2005 Thomas Young Prize of the Institute for Physics (UK) and the 2000 OSA Joseph Fraunhofer Award/Robert M. Burley Prize - for the invention of photonic crystal fiber.



The Roles of Optics in Information Processing

Monday, 18 June
JM1A.2 • 09:15, Colorado I

David A.B. Miller, *Stanford Univ., USA*

David A. B. Miller received his Ph.D. from Heriot-Watt University in Physics in 1979. He was with Bell Laboratories from 1981

to 1996, as a department head from 1987. He is currently the W. M. Keck Professor of Electrical Engineering, and a Co-Director of the Stanford Photonics Research Center at Stanford

University. He has been active in professional societies and was President of the IEEE Lasers and Electro-Optics Society in 1995. His research interests include physics and devices in nanophotonics, nanometallics, and quantum-well optoelectronics, and fundamentals and applications of optics in information sensing, switching, and processing. He has published more than 240 scientific papers and the text "Quantum Mechanics for Scientists and Engineers", holds 69 patents, has received numerous awards, is a Fellow of OSA, IEEE, APS, and the Royal Societies of Edinburgh and London, holds two honorary degrees, and is a Member of the National Academy of Sciences and the National Academy of Engineering.



Technology Platforms for Photonic Integrated Circuits

Tuesday, 19 June
JT1B.1 • 08:30, Colorado I

Michael Wale, *Oclaro, UK*

Michael Wale is Director Active Product Research at Oclaro, based at Caswell, UK, in which role he is responsible for strate-

gic programs in photonic integration technologies and their applications. Mike received his BA, MA and D. Phil. degrees in physics from the University of Oxford, UK. He has been active in photonics research, development and manufacturing since the early 1980s, with particular emphasis on photonic integrated circuit technology. Alongside his role at Oclaro, Mike is a part-time Professor at Eindhoven University of Technology in The Netherlands and an Honorary Professor at Nottingham University in the UK. Prof. Wale is a member of the Executive Board of the European Technology Platform, Photonics21, and chairman of its Working Group on Design and Manufacturing of Optical Components and Systems.



Complex Nonlinear Opto-Fluidics

Tuesday, 19 June
JT1B.2 • 09:15, Colorado I

Mordechai (Moti) Segev, *Technion - Israel Institute of Technology, Israel*

Mordechai (Moti) Segev is a Distinguished Professor of Physics, at the Technion, Israel. He received his B.Sc. and D.Sc. from the

Technion in 1985 and 1990, respectively. After spending three years at Caltech as a post-doc, he joined Princeton in 1994 as an Assistant Professor, becoming an Associate Professor in 1997, and a Professor in 1999. In the summer of 1998, he went back to Israel, eventually resigning from Princeton in 2000. Moti Segev's research interests are mainly in Nonlinear Optics, Solitons, Sub-Wavelength Imaging, Lasers and Quantum Electronics, although he finds much entertainment in more demanding fields such as basketball and hiking. He has more than 280 publications in refereed journals, many book chapters, and has given more than 100 Plenary, Keynote and Invited presentations at conferences. Among his most significant contributions are the discoveries of photorefractive solitons, of incoherent (white light) solitons and of accelerating wavepackets of Maxwell's equations, first observation of 2D lattice solitons, first experimental demonstration of Anderson localization in a disordered periodic system, and the invention of sparsity-based subwavelength imaging technique. Moti Segev is a Fellow of the OSA and of the APS. He has won numerous awards, among them the 2007 Quantum Electronics Prize of the EPS, the 2009 Max Born

Award of the OSA, and the 2008 Landau Prize (Israel). In 2011, he was elected to the Israel Academy of Sciences and Humanities. However, above all his personal achievements, Moti Segev takes pride in the success of the graduate students and post-doctoral fellows that have worked with him over the years. Among those are currently 16 university professors in the United States, Germany, Taiwan, Croatia, Italy, India and Israel.



Future Optical Access Networks

Wednesday, 20 June
JW1A.1 • 08:30, *Platte*

Yun Chung, *Korea Advanced Inst. of Science and Technology, Republic of Korea*

Y. C. Chung is a professor of electrical engineering at the Korea Advanced Institute of Science and Technology (KAIST), which he joined in 1994. From 1987 to 1994, he was with the Lightwave Systems Research Department at AT&T Bell Laboratories. From 1985 to 1987, he was with Los Alamos National Laboratory under AWU-DOE Graduate Fellowship Program. His current activities include high-capacity WDM transmission systems, all-optical WDM networks, optical performance monitoring techniques, WDM passive optical networks, and fiber-optic networks for wireless communications, etc. He has published over 500 journal and conference papers in these areas and holds over 80 patents. Prof. Chung is a Fellow of IEEE and OSA, and a Member of Korean Academy of Science and Technology.



Quo Vadis, Spatial Multiplexing?

Wednesday, 20 June
JW1A.2 • 09:15, *Platte*

Henning Buelow, *Universitaet Erlangen, Germany*

Henning Buelow is Distinguished Member of Technical Staff in the Department of Optical Technologies at Bell Labs Alcatel-Lucent in Stuttgart, Germany. He received his Dipl.-Ing. degree in electrical engineering from the University of Dortmund, Germany, and a Ph.D. from the University of Berlin for work on integrated optical switching matrices. He joined Bell Labs (former Alcatel-Lucent Research-and-Innovation) in Stuttgart, Germany, in 1990. Since then he worked on optical amplifiers, on polarization mode dispersion, and on dynamic distortion mitigation in high bit-rate transmission systems by electronic and optical signal processing. His current research interests are mode multiplexed systems and coded modulation for coherent systems. Between 2008 and 2011 he has been Guest-Professor with the University of Erlangen, Germany.

Tutorial Speakers



Nonlinear Fibers for Parametric Signal Generation Amplification and Processing

Monday, 20 June
SM4E.4 • 17:15, *Rio Grande/Gunnison*

Stojan Radic, *Univ. of California San Diego, USA*

Stojan Radic joined the UCSD faculty in November 2003. He received his Ph.D. in optics from The Institute of Optics (Rochester) in 1995. Radic gained a worldwide reputation while working in industry, first

at Corning in the Photonics Technology division, and later at Bell Laboratories in Lightwave Systems Research (1998-03). Immediately prior to coming to the Jacobs School, Radic held a chaired position at Duke University. Radic has published 40 articles in refereed journals, and serves on committees for Optical Fiber Communication (OFC), Conference on Lasers and Electro-Optics (CLEO) and Optical Amplifiers and their Applications (OAA) conferences.

Recent Developments in Fiber Lasers, Mode Stability Issues in LMA Fibers

Tuesday, 19 June
STu4F.5 • 17:15, *Rio Grande/Gunnison*

Jens Limpert and **César Jauregui Misas**, *Friedrich-Schiller-Universität Jena*



Prof. Jens Limpert was born in Jena, Germany, in 1975. He received his M.S in 1999 and Ph.D. in Physics from the Friedrich Schiller University of Jena in 2003. His research interests include high power fiber lasers in the pulsed and continuous-wave regime, in the near-infrared and visible spectral range. After a one-year postdoc position at the University of Bordeaux, France, where he extended his

research interests to high intensity lasers and nonlinear optics, he returned to Jena and is currently leading the Laser Development Group (including fiber- and waveguide lasers) at the Institute of Applied Physics. He is author or co-author of more than 150 peer-reviewed journal papers in the field of laser physics. His research activities have been awarded with the WLT-Award in 2006 and with an ERC Starting Grant in 2009. Jens Limpert is member of the German Physical Society and the Optical Society of America.



Dr. César Jauregui Misas was born in Santander, Spain, in 1975. He received both his Telecommunication Technical Engineering degree and his Telecommunication Engineering degree at the University of Cantabria. In 2003, he got his Ph.D. degree at that same University. In 2005 he began a two-year post-doc stay at the Optoelectronics Research centre, where he investigated the phenomenon of slow-light in optical

fibers. Since 2007 he is working at the Institute of Applied Physics in Jena. His primary research concerns are high-power fiber lasers, non-linear effects in optical fibers and Fiber Optic sensors. César Jáuregui has co-authored more than 120 papers presented in conferences and scientific journals. He has been awarded with several academic prizes. Among them, in 2004, he was awarded with a prize for the best Thesis at the University of Cantabria.

Proudly committed to innovation since 2000



With its advanced fiber Bragg gratings designs and assemblies, TeraXion is proud to work you on complex designs and prototype challenges. Our custom offering aims to transform ideas in cutting-edge solutions that fit the very specific needs of universities and research centers.

12 years after its creation, TeraXion is more committed than ever to innovate and is well positioned for future growth by leveraging its fiber Bragg grating, specialized lasers and silicon photonics platforms for your benefits.

Sustained innovation is made possible thanks to our talented people and to our valuable partners.

About TeraXion:

- 200 employees
- 125 publications
- 32 granted patents
- Privately owned
- 120,000 devices sold
- 500 customers

Thank you partners, we are delighted to innovate with you.

TeraXion's contribution at BGPP 2012

- **Bragg grating notch filters in silicon-on-insulator waveguides (BW2E.3)**

Y. Painchaud, M. Poulin, C. Latrasse, N. Ayotte, M.-J. Picard and M. Morin

Session: Applications of Gratings and Poled Glass: Novel Bragg Grating Filters

Time: Wednesday June 20, 11:00 AM

- **100 nm Wide Fiber Bragg Grating Dispersion Compensator Around Zero Dispersion Wavelength (BW4E.1)**

F. Trépanier, M. Morin, G. Brochu, Y. Painchaud, D. C. Adler, W. Wieser and R. Huber

Session: Applications of Gratings and Poled Glass: FBG Applications to Optical Signal Processing

Time: Wednesday June 20, 4:00 PM

- **Characterization of Integrated Bragg Grating Profiles (BM3D.7)**

Alexandre D. Simard; Yves Painchaud; Sophie LaRochelle

Session: Grating Properties and Fabrication: Novel Fibers and Grating Design

Time: Monday June 18, 3:15 PM

TeraXion

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J. Nathan Kutz, *Univ. of Washington, USA*

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Modelling, Analysis and Computational Techniques in Nonlinear Photonics

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Alejandro Aceves, *Southern Methodist Univ., USA*

Sonia Boscolo, *Aston Univ., UK*

Claudio Conti, *Sapienza Univ. of Rome, Italy*

Ulf Peschel, *Univ. of Erlangen, Germany*

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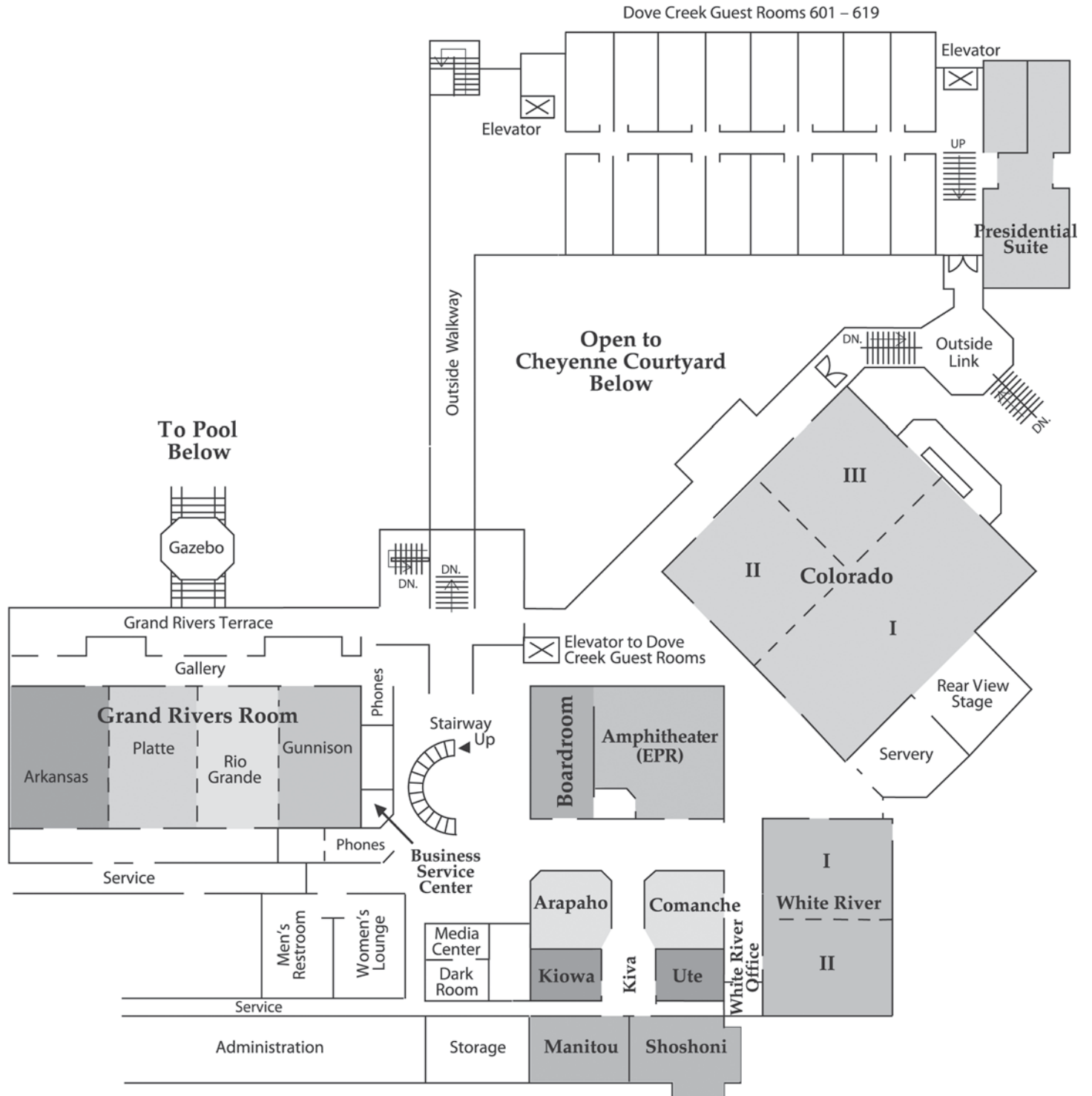
Committee Members

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Xingwen Yi, *Univ. of Electronics and Science of China, China*
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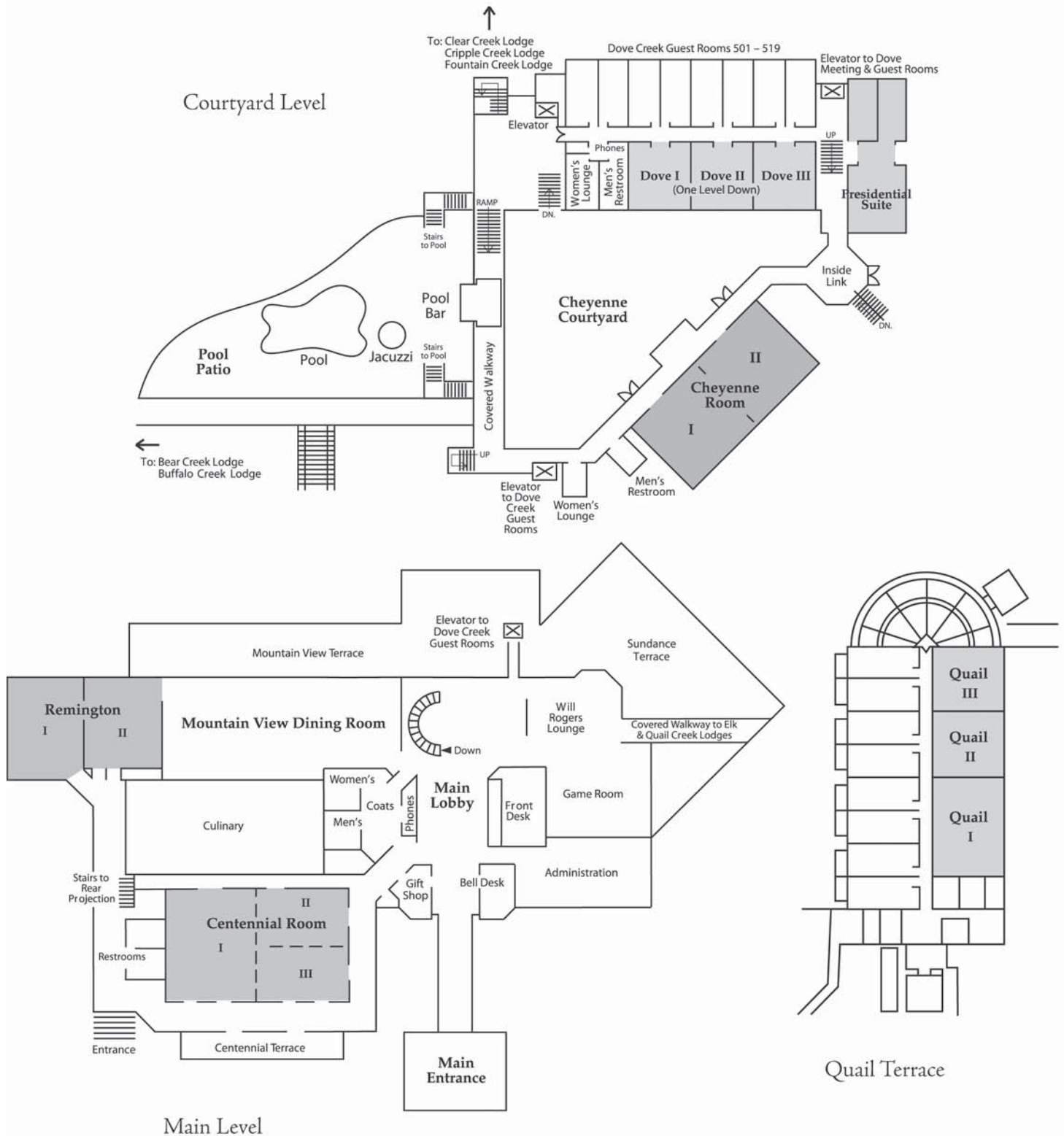


CHEYENNE MOUNTAIN RESORT
colorado springs

Conference Level



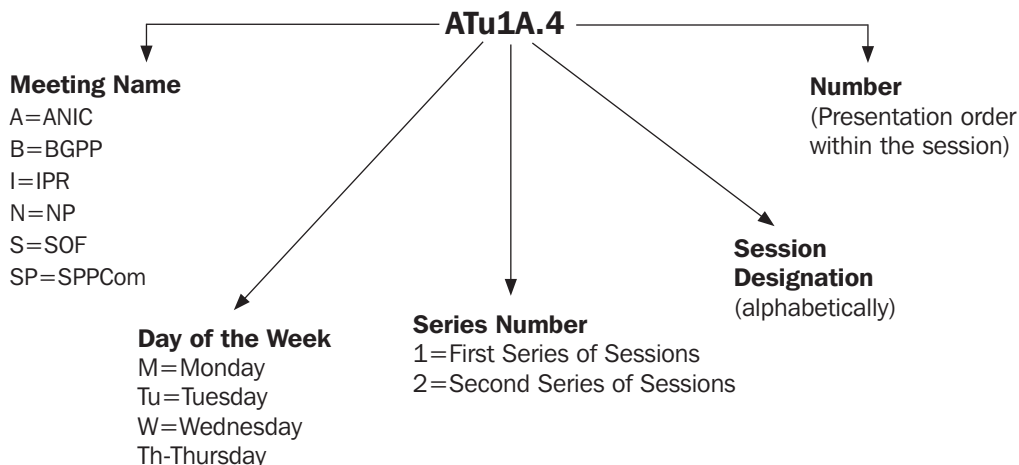
Main Level, Courtyard Level, and Quail Terrace Maps



▶ Captured Session Content

We are delighted to announce that your 2012 Advanced Photonics technical registration includes a valuable new enhancement! A portion of the sessions at this year's congress are being digitally captured for on-demand viewing. All captured content from listed sessions will be live for viewing within twenty-four hours of being recorded. Just look for the symbol ▶ in the Agenda of Sessions and abstracts to easily identify the presentations being captured. Content will be available for 60 days following the Congress.

Explanation of Session Codes



The first letter of the code designates the meeting (For instance, A=Access Networks and In-house Communications, B=Bragg Gratings, Photosensitivity and Poling in Glass Waveguides, I=Integrated Photonics Research, Silicon and Nano-Photonics, N=Nonlinear Photonics, S=Specialty Optical Fibers & Applications, SP=Signal Processing in Photonic Communications, J=Joint). The second element denotes the day of the week (Monday=M, Tuesday=Tu, Wednesday=W). The third element indicates the session series in that day (for instance, 1 would denote the first parallel sessions in that day). Each day begins with the letter A in the fourth element and continues alphabetically through a series of parallel sessions. The lettering then restarts with each new series. The number on the end of the code (separated from the session code with a period) signals the position of the talk within the session (first, second, third, etc.). For example, a presentation coded AW1A.4 indicates that this paper is part of the Access Networks and In-house Communications meeting (A) and is being presented on Wednesday (W) in the first series of sessions (1), and is the first parallel session (A) in that series and the fourth paper (4) presented in that session.

Invited papers are noted with **Invited**

Tutorials are noted with **Tutorial**

Plenaries are noted with **Plenary**

Captured Content Sessions are noted with ▶

Exhibit Hours

18 June 2012	10:00–10:30 15:30–16:00	Exhibit Hours / Coffee Break	<i>Centennial Room</i>
	18:00–19:30	Joint Poster Session / Exhibits / Reception	<i>Centennial Room & Terrace</i>
19 June 2012	10:00–10:30 15:30–16:00	Exhibit Hours / Coffee Break	<i>Centennial Room</i>
	18:00–19:30	Joint Poster Session / Exhibits / Conference Reception	<i>Centennial Room & Terrace</i>

Agenda of Sessions — Sunday, 17 June

15:00–18:00	Registration, Lower Lobby, Conference Level
18:00–19:30	BGPP Welcome Reception (Invite Only), Grand Riverview Terrace

— Monday, 18 June

	Colorado II	Colorado III	Colorado I	White River	Rio Grande/Gunnison
	IPR	IPR	NP	BGPP	SOF
07:00–18:00	Registration, Lower Lobby, Conference Level				
07:50–08:00				Opening Comments	
08:00–10:00				JM1B • Joint BGPP and SOF Plenary Session - Eric Udd and Philip Russell, <i>White River</i>	
08:20–08:30	Opening Comments				
08:30–10:00	JM1A • Joint IPR & NP Plenary Session I - Vladimir Shalaev and David Miller, Colorado I ▶				
10:00–10:30	Coffee Break and Exhibits, Centennial Room				
10:30–12:30	IM2A • Highly Integrated Optical III-V Circuits	IM2B • Theory, Modeling & Simulations I: Numerical Methods	NM2C • Soliton and Localization Effects in Nonlinear Dynamics ▶	BM2D • Grating Properties and Fabrication: Femtosecond Inscription (ends at 12:15)	SM2E • Joint SOF, BGPP & NP Session I
12:30–13:30	Lunch Break, On Your Own				
13:30–15:30	IM3A • Lasers and Integration	IM3B • Theory, Modeling & Simulations II: Plasmonics and Nano-optics	NM3C • Advances in Nonlinear Signal Processing and Applications ▶	BM3D • Grating Properties and Fabrication: Novel Fibers and Grating Design	SM3E • PBG & PCF Fibers
15:30–16:00	Coffee Break and Exhibits, Centennial Room				
16:00–18:00	IM4A • Electro-Optic Modulators and Switches ▶	IM4B • Theory, Modeling & Simulations III: Active Photonics	NM4C • Nonlinearities in Lasers and Dissipative Systems	BM4D • Fundamentals of Photosensitivity and Poling: Photo-induced Processes and Gratings	SM4E • Joint SOF & NP Session
18:00–19:30	JM5A • Joint Poster Session & Reception/ Exhibit, Centennial Room & Terrace				

Key to Conference Abbreviations

ANIC	Access Networks and In-house Communications
BGPP	Bragg Gratings, Photosensitivity, and Poling in Glass Waveguides
IPR	Integrated Photonics Research, Silicon and Nano Photonics
NP	Nonlinear Photonics
SPPcom	Signal Processing in Photonics Communications
SOF	Specialty Optical Fibers

Agenda of Sessions — Tuesday, 19 June

	Platte	Colorado II	Colorado III	Colorado I	White River	Rio Grande/ Gunnison
	SPPCom	IPR	IPR	NP	BGPP	SOF
07:30–18:00	Registration, Lower Lobby, Conference Level					
08:20–08:30	Opening Comments					
08:30–10:00	SpTu1A • OFDM I	JTu1B • Joint IPR & NP Plenary Session II – Michael Wale and Moti Segev, Colorado I ▶			BTu1C • Grating Properties and Fabrication: Long Period Gratings	STu1D • Fiber & Fabrication
10:00–10:30	Coffee Break and Exhibits, Centennial Room					
10:30–12:30	SpTu2A • OFDM II	ITu2B • Waveguides, Polarizers and Dispersion ▶	ITu2C • Slow Light in Photonic Crystals	NTu2D • Nonlinear systems and Nonlinear Dynamics	BTu2E • Applications of Gratings and Poled Glass: FBG Sensors and Interrogation Systems	STu2F • Fiber Based Devices
12:30–13:30	Lunch Break, On Your Own					
13:30–15:30	SpTu3A • DSP Algorithm I	ITu3B • Microphotonic Filters ▶	ITu3C • Tunable Delay	NTu3D • Nonlinearities in Novel Propagation Environments	BTu3E • Sensor Symposium I	STu3F • Mid IR
15:30–16:00	Coffee Break and Exhibits, Centennial Room					
16:00–18:00	SpTu4A • Subsystems	ITu4B • Integration of Silicon Photonics with Other Technologies ▶	ITu4C • Metamaterials, Sensors and Optical Properties of Nanoparticles	NTu4D • Spatial Effects and Periodic Structures	BTu4E • Sensor Symposium II (ends at 17:15)	STu4F • Fiber Lasers I
18:00–19:30	JTu5A • Joint Poster Session & Reception/ Exhibit, Centennial Room & Terrace					

Key to Conference Abbreviations

ANIC	Access Networks and In-house Communications
BGPP	Bragg Gratings, Photosensitivity, and Poling in Glass Waveguides
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Agenda of Sessions — Wednesday, 20 June

	Arkansas	Platte	Colorado II	Colorado I	White River	Rio Grande/ Gunnison
	ANIC	SPPCom	IPR	NP	BGPP	SOF
07:30–18:00	Registration, Lower Lobby, Conference Level					
08:20–08:30	Opening Comments					
08:30–10:00	JW1A • Joint SppCom & ANIC Plenary Session - Yun Chung and Henning Buelow, Platte		IW1B • Plasmonics and Applications	NW1C • Novel Nonlinear Effects	BW1D • Fundamentals of Photosensitivity and Poling: Direct Laser Writing and Thermal Poling 	SW1E • Fiber Based Sensors
10:00–10:30	Coffee Break and Exhibits, Colorado Gallery and Grand Rivers Gallery					
10:30–12:30	AW2A • PON Technology Trends	SpW2B • Coherent System Implementation	IW2C • Nanophotonics for Energy Conversion and Applications	NW2D • Theory of Novel Nonlinear Processes	BW2E • Applications of Gratings and Poled Glass: Novel Bragg Gratings Filters (ends at 12:15) 	SW2F • Fiber Lasers II
12:30–13:30	Lunch Break, On Your Own					
13:30–15:30	AW3A • Indoor Networks	SpW3B • High Capacity System	IW3C • Photonic Crystals	NW3D • Rogue Waves and Novel Propagation Effects	BW3E • Applications of Gratings and Poled Glass: Applications of Gratings and Poled Glass: Lasers Grating Structures and Reflectors 	SW3F • Applications of Fiber Lasers/ Devices
15:30–16:00	Coffee Break and Exhibits, Colorado Gallery and Grand Rivers Gallery					
16:00–18:00	AW4A • OFDM- and WDM-PON Technologies	SPPCom Postdeadline Paper Session and Rump Session	IW4C • Bionanophotonics and Si Nanophotonics 	NP Postdeadline Paper Session	BW4E • Applications of Gratings and Poled Glass: FBG Applications to Optical Signal Processing (ends at 17:15) BGPP Postdeadline Paper Session (17:15–18:00)	SW4F • Lasers, Components and Fiber Characterization
18:30–21:30	Networking Dinner (Tentative), Cheyenne Courtyard/Backup: Centennial Room					

Key to Conference Abbreviations

ANIC	Access Networks and In-house Communications
BGPP	Bragg Gratings, Photosensitivity, and Poling in Glass Waveguides
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SOF	Specialty Optical Fibers

Agenda of Sessions — Thursday, 21 June

	Colorado I	Platte	White River
	NP	SPPCom	OIDA Workshop
07:30–12:30	Registration , <i>Lower Lobby, Conference Level</i>		
08:30–10:00	NTh1A • Novel Nonlinear Materials 🎯	SpTh1B • DSP Algorithm II	Integration for Advanced Modulation Format Transmission at 100Gb/S and Beyond – Status of the Industry and Challenges Ahead Workshop
10:00–10:30	Coffee Break , <i>Colorado Gallery and Grand Rivers Gallery</i>		
10:30–12:30	NTh2A • Nonlinear Effects in Optical Waveguides 🎯	SpTh2B • Monitoring (10:30–12:00)	Continued from Above
12:30–14:00			OIDA Lunch – Ticketed , <i>Colorado II & III</i>
14:00–18:00			OIDA Workshop (continued)

Key to Conference Abbreviations

ANIC	Access Networks and In-house Communications
BGPP	Bragg Gratings, Photosensitivity, and Poling in Glass Waveguides
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NP	Nonlinear Photonics
SPPcom	Signal Processing in Photonics Communications
SOF	Specialty Optical Fibers

Colorado I

Joint Integrated Photonics Research, Silicon and Nano Photonics/
Nonlinear Photonics

White River

Joint Bragg Gratings, Photosensitivity, and Poling in Glass Waveguides/
Specialty Optical Fibers

07:00–18:00 Registration, Lower Lobby, Conference Level

08:20–08:30

Opening Comments

08:30–10:00

JM1A • Joint IPR & NP Plenary Session I

Frank Wise; Cornell Univ., USA; Anatoly Zayats; Univ. of London King's College, UK, Presider

JM1A.1 • 08:30 **Plenary**

Negative Refraction and Light Bending with Plasmonic Nanoantennas, Vladimir M. Shalaev¹; ¹*Purdue Univ., USA*. We review the exciting field of optical metamaterials and outline the recent progress in developing tunable and active MMs, semiconductor-based and loss-free negative-index MMs. We also discuss a new approach for broadband light bending.

JM1A.2 • 09:15 **Plenary**

The Roles of Optics in Information Processing, David A. B. Miller¹; ¹*Stanford Univ., USA*. Optics has many potential roles it could play in information processing. History, prospects and technology for interconnects and other applications are summarized, including key requirements for potentially viable technological approaches.

08:20–08:30

Opening Comments

08:30–10:00

JM1B • Joint BGPP and SOF Plenary Session

John Ballato; Clemson Univ., USA; Morten Ibsen; Univ. of Southampton, UK, Presider

JM1B.1 • 08:30 **Plenary**

Fire and Ice: 25 Years of fiber grating sensor technology, Eric Udd¹; ¹*Columbia Gorge Research, LLC, USA*. Over the past 25 years fiber grating sensor technology has been applied in extreme environments where conventional sensor technology has limited or in some cases non-existent measurement capabilities enabling widespread application potential.

JM1B.2 • 09:15 **Plenary**

Nanoscale Glass Blowing, Philip Russell¹; ¹*Max Planck Institute for the Science of Light, Germany*. The past 15 years has seen the emergence of glass fibers with intricate transverse microstructures, often with nanoscale features. Their ability to guide and manipulate light in unexpected ways has led to many novel applications.

10:00–10:30 Coffee Break, Centennial Room

NOTES

Horizontal lines for taking notes.

Monday, 18 June

Colorado II

Integrated Photonics Research, Silicon and Nano Photonics

Colorado III

Integrated Photonics Research, Silicon and Nano Photonics

Colorado I

Nonlinear Photonics

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

10:30–12:30

IM2A • Highly Integrated Optical III-V CircuitsMilan Mashanovitch; Univ. of California Santa Barbara, USA, *Presider*IM2A.1 • 10:30 **Invited**

Generic InP-based integration technology, today and tomorrow, Meint K. Smit¹; ¹Electrical Engineering, Technische Universiteit Eindhoven, Netherlands. Generic Photonic Integration Processes will cause a revolution in micro and nanophotonics. Generic InP-based technology provides a broad photonic functionality, both active and passive. It also has a good potential for future integration with electronics.

IM2A.2 • 11:00

Modified Uni-Traveling Carrier Photodiodes Heterogeneously Integrated on Silicon-on-Insulator (SOI), Andreas Beling¹, Yang Fu¹, Zhi Li¹, Huapu Pan¹, Qiugui Zhou¹, Allen Cross¹, Molly Piels², Jon Peters², John E. Bowers², Joe C. Campbell¹; ¹ECE Department, Univ. of Virginia, USA; ²ECE Department, Univ. of California Santa Barbara, USA. We propose and demonstrate a novel InP-based evanescently-coupled modified uni-traveling carrier photodiode (MUTC PD) on SOI waveguide. A 100- μm long waveguide MUTC PD reaches a third-order local intercept point (IP3) of 20 dBm at 7 GHz and 10 mA.

IM2A.3 • 11:15 **Invited**

Selective-area-growth technology for flexible active building blocks, Helene Debregeas¹, Jean Decobert¹, Nadine Lagay¹, Ronan Guillamet¹, David Carrara¹, Olivier Patarid¹, Christophe Kazmierski¹, Romain Brenot¹; ¹III-V Lab, France. Selective area growth enables to locally tune the epitaxial material thickness and composition on a single InP substrate. This paper presents this technology and its application to photonic integrated circuits, illustrated by two realisations.

IM2A.4 • 11:45 **Invited**

Large-scale Monolithic Integration Enabling Terabit Transmitters and Coherent Super-channel Architecture, Masaki Kato¹, Damien Lambert¹, Vikrant Lal¹, Matthias Kuntz¹, Joseph Summers¹, Peter Evans¹, Scott Corzine¹, Matthe Fisher¹, Roman Malendevich¹, Jefferey Rahn¹, Amod Damle¹, Andrew Dentai¹, Ranjani Muthiah¹, Randal Salvatore¹, Adam James¹, Pavel Studenkov¹, Eva Strzelecka¹, Thomas Vallaitis¹, Forrest Sedgwick¹, Omer Khayam¹, Radhakrishnan Nagarajan¹, Jie Tang¹, Jiaming Zhang¹, Huan-Shang Tsai¹, Tim Butrie¹, Mark Missey¹, David Krause¹, John McNicol¹, Kuang-Tsan Wu¹, Han Sun¹, Mike Reffle¹, Fred Kish¹, David Welch¹; ¹Infinera Corporation, USA. In this talk, we review InP-based, 10 wavelength, polarization-multiplexed quadrature phase-shift keying (PM-QPSK) transmitter and receiver photonic integrated circuits (PICs) that enable terabit coherent super-channel architecture.

10:30–12:30

IM2B • Theory, Modeling & Simulations I: Numerical MethodsKurt Busch; Humboldt Universitat zu Berlin, Germany, *Presider*IM2B.1 • 10:30 **Invited**

Future Requirements of Modeling Software for Integrated Optical Communication Systems, Michael Hochberg¹, Thierry J. Pinguet^{2,3}, Tom Baehr-Jones¹; ¹Electrical and Computer Engineering, Univ. of Delaware, USA; ²Electrical Engineering, Univ. of Washington, USA; ³Luxtera, Inc., USA. As silicon photonics processes mature, the infrastructure needed to support large scale design needs to follow suit. We discuss here future requirements for modeling of integrated optical communication systems.

IM2B.2 • 11:00 **Invited**

Simulation and Optimization of Photonic Integrated Circuits, Jackson Klein¹, James Pond¹; ¹Lumerical Solutions, Inc., Canada. We will demonstrate the simulation of photonic integrated circuits, initially using analytical models for each element of the circuit. The results of physical electromagnetic and electrical solvers will then be incorporated to simulate realistic photonic integrated circuits.

IM2B.3 • 11:30

CAPHE: Time-domain and Frequency-domain Modeling of Nonlinear Optical Components, Martin Fiers^{1,2}, Thomas Van Vaerenbergh², Joni Dambre¹, Peter Bienstman^{1,2}; ¹Department of Information Technology, Ghent Univ., Belgium; ²Center for Nano- and Biophotonics, Ghent Univ., Belgium; ³Department of Electronics and Information Systems, Ghent Univ., Belgium. We present CAPHE, a tool for modeling optical circuits in time and frequency domain. Some applications are optical filter design, variational studies and dynamical modeling of strongly nonlinear components (microrings, microdisks, SOAs).

IM2B.4 • 11:45

Topology optimization of nano-photon systems, Yuriy Elesin¹, Fengwen Wang¹, Jacob Andkjær¹, Jakob S. Jensen¹, Ole Sigmund¹; ¹Technical Univ. of Denmark, Denmark. We describe recent developments within nano-photon systems design based on topology optimization. Applications include linear and non-linear optical waveguides, slow-light waveguides, as well as all-dielectric cloaks that minimize scattering or back-scattering from hard obstacles.

10:30–12:30

NM2C • Soliton and Localization Effects in Nonlinear DynamicsF. Oemer Ilday; Bilkent Universitesi, Turkey, *Presider*NM2C.1 • 10:30 **Invited**

Tiny Waves we Should Never Ignore, Shalva Amiranashvili¹, Carsten Bree¹, Fedor Mitschke¹, Ayhan Demircan²; ¹Weierstrass Institute for Applied Analysis and Stochastics, Germany; ²Univ. of Rostock, Germany; ³no Affiliation, Germany. Tiny dispersive waves are naturally generated by non-resonant wave interactions and Cherenkov radiation of solitons. We have found that these waves may in turn feed the solitons and spontaneously switch them to a large-amplitude state.

NM2C.2 • 11:00

Do solitons arise from modulational instability?, Christoph Mahnke¹, Fedor Mitschke¹; ¹Institut fuer Physik, Universitaet Rostock, Germany. The notion that a train of solitons arises from cw by modulational instability is rejected by using discrete scattering transform, adopted to infinite domain. Inclusion of the Raman effect, however, can induce soliton formation.

NM2C.3 • 11:15

Modulation Instability in Xenon-Filled Hollow-Core Photonic Crystal Fiber Francesco Tani¹, John C. Travers¹, Ka Fai Mak¹, Wonkeun Chang¹, Philip Russell^{1,2}; ¹Max Planck Institute for the Science of Light, Germany; ²Department of Physics, Univ. of Erlangen-Nuremberg, Germany. Abstract: We experimentally access the modulation instability regime in xenon-filled kagomé PCF. Soliton orders ~100 are obtained with few- μJ , 490 fs pulses at 800 nm. Numerical simulations confirm pulse breakup into ultrashort solitons.

NM2C.4 • 11:30

Stimulated Modulation Instability in Silicon for Energy Efficient Supercontinuum Generation, Peter DeVore^{1,2}, Daniel R. Solli^{1,3}, Claus Ropers^{1,3}, Prakash Koonath¹, Bahram Jalali^{1,2}; ¹Department of Electrical Engineering, Univ. of California, Los Angeles, USA; ²California NanoSystems Institute, Univ. of California, Los Angeles, USA; ³Courant Research Center Nano-Spectroscopy and X-Ray Imaging, Univ. of Göttingen, Germany. Nonlinear losses limit supercontinuum efficiency in silicon. This fundamental limitation can be relaxed and higher energy efficiency and a more stable output can be obtained by stimulating modulation instability with an off-resonant weak seed.

NM2C.5 • 11:45

Spontaneous Generation of Spectral Incoherent Solitons through Supercontinuum Generation Bertrand Kibler¹, Claire Michel¹, Alexandre Kudlinski², Benoit Barvau^{1,2}, Guy Millot¹, Antonio Picozzi¹; ¹Laboratoire Interdisciplinaire Carnot de Bourgogne, France; ²Laboratoire PhLAM, France. We study experimentally the highly nonlinear regime of supercontinuum generation in photonic crystal fibers. We report a transition from continuous to discrete spectral incoherent solitons in the low-frequency edge of the supercontinuum spectrum.

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

10:30–12:15

BM2D • Grating Properties and Fabrication: Femtosecond Inscription

Manfred Rothhardt, IPHT, Germany, Presider

BM2D.1 • 10:30 **Invited**

Monolithic Fiber Lasers for the Mid-Infrared, Real Vallee¹; ¹*Centre d'optique photonique et laser, Université Laval, Canada*. The recent development of rare-earth doped as well as Raman gain fluoride all-fiber laser operating beyond 2.2 μm is reviewed.

BM2D.2 • 11:00

Fiber Bragg grating operating in the visible range written with 400 nm femtosecond pulses and a phase-mask, Julien Carrier¹, Martin Bernier¹, Real Vallee¹; ¹*Université Laval (COPL), Canada*. A Bragg grating with reflectivity of 99.9% at 542.2 nm was written in silica fiber using 400 nm femtosecond pulses and a phase-mask. This is the first step towards the development of all-fiber visible lasers.

BM2D.3 • 11:15

Discrete non-planar reflections of a fs laser pulse written volume Bragg grating (VBG), Daniel Richter¹, Christian Voigtländer¹, Jens U. Thomas¹, Andreas Tünnermann¹, Stefan Nolte^{1,2}; ¹*Friedrich-Schiller-Univ. Jena, Abbe Center of Photonics, Institute of Applied Physics, Germany*. We present a VBG inscribed in fused silica by three beam interference of fs pulses. The generated twodimensional grating structure exhibits a discrete diffraction pattern which can be described based on the Ewald sphere.

BM2D.4 • 11:30

Orientation dependence of higher order mode reflections in femtosecond pulse written fiber Bragg gratings, Jens U. Thomas¹, Markus Mundus¹, Christian Voigtländer¹, Ria G. Becker¹, Andreas Tünnermann^{1,2}, Stefan Nolte^{1,2}; ¹*Institute of Applied Physics, Abbe Center of Photonics, Friedrich-Schiller-Universität, Germany*; ²*Fraunhofer Institute for Applied Optics and Precision Engineering, Germany*. Ultrashort pulse lasers allow for the inscription of fiber Bragg gratings largely independent of the fiber geometry. Here, we investigate how the orientation of a reflected higher order mode depends on the FBG's cross-section.

BM2D.5 • 11:45

Reflection Characteristics of Type II FBG Made With Femtosecond Radiation, Dan Grobnić¹, Stephen J. Mihailov¹, Robert B. Walker¹, Christopher W. Smelser¹; ¹*Communications Research Centre, Canada*. We have designed an experiment to show that in spite of the broadband loss along the grating, type II gratings manifest low loss in a reflective configuration

10:30–12:30

SM2E • Joint SOF, BGPP & NP Session I

John Ballato, Clemson Univ., USA, Presider

SM2E.1 • 10:30 **Invited**

Ultrafast Laser Processing of Glass: From New Phenomena to Applications, Peter G. Kazansky¹, M. Beresna¹, M. Gecevicius¹; ¹*Univ. of Southampton, UK*. Ultrafast laser processing of glass reveals new phenomena. Reviewed, are recent demonstrations of 5D optical memory, vortex polarization converters employing self-assembled nanostructuring, ultrafast laser calligraphy and polarization writing control using pulses with tilted front.

SM2E.2 • 11:00 **Invited**

High Power Passive Components for kW Lasers, Bertrand Gauvreau¹, Mathieu Faucher¹, Nigel Holehouse¹; ¹*ITF Laboratories Inc., Canada*. Accelerating deployment of industrial kilowatt fiber lasers caused a rapidly increasing demand for high performance passive components. We present a leading manufacturer point of view on the trends and future limitations of the technology.

SM2E.3 • 11:30

AgBr-TiI, AgBr-KRS-5 photonic crystals and fibers based on them for Middle and Far infrared, Andrey I. Chazov¹, Alexandr S. Korsakov¹, Dmitry S. Vrublevsky¹, Viktor S. Korsakov¹, Vladislav V. Zhukov¹, Liya V. Zhukova¹, Nadezhda Terlyga¹; ¹*Ural Federal Univ. named after the first President of Russia B.N.Eltsin, Russian Federation*. Crystals of new composition for manufacturing of photonic fibers for middle and far infrared range are described. Doping of AgCl-AgBr solid solutions with TiI resulted in higher photostability and wider transmission range of grown crystals and extruded fibers.

SM2E.4 • 11:45

Direct UV Written Waveguide's Dispersion in Flexible Silica Flat Fibre Chip, Desmond M. Chow¹, Din Chai Tee¹, Seyed Reza Sandoghchi¹, Faisal Rafiq Mahamd Adikan¹; ¹*Electrical Engineering, Univ. of Malaya, Malaysia*. Dispersion of Direct UV Written channel waveguides in novel flexible silica Flat Fibre chip was numerically simulated via Finite Element Method. Result shows nearly zero chromatic dispersion at communication band with application in Integrated Optics.

Colorado II

Integrated Photonics Research, Silicon and Nano Photonics

Colorado III

Integrated Photonics Research, Silicon and Nano Photonics

Colorado I

Nonlinear Photonics

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

IM2A • Highly Integrated Optical III-V Circuits—Continued
IM2A.5 • 12:15

Cryogenic Operation of Silicon Photonic Modulators, Jeremy Wright¹, Doug C. Trotter¹, William Zortman¹, Anthony L. Lentine¹, Eric Shaner¹, Michael R. Watts², Akin Akturk³, Marty Peckerar³, ¹Sandia National Laboratories, USA; ²Massachusetts Institute of Technology, USA; ³Univ. of Maryland, USA. For the first time simulation and operation of a silicon photonic modulator is demonstrated at cryogenic temperatures. The device operated at 5Gbps and 10Gbps at a temperature of 115K opening application areas in harsh environments.

IM2B • Theory, Modeling & Simulations I: Numerical Methods—Continued
IM2B.5 • 12:00

Perfectly Matched Layers Conforming to Triangular Lattices for Numerical Simulations of Photonic Crystal Devices, Shichang She¹, Ya Yan Lu¹; ¹City Univ. of Hong Kong, Hong Kong. For simulating photonic crystal devices with a triangular lattice structure, it is advantageous to use hexagon unit cells and truncate the domain along the edges of these unit cells. A perfectly matched layer (PML) technique that conforms to triangular lattices is developed in this paper.

IM2B.6 • 12:15

Three-dimensional periodic LOD-FDTD method with a fundamental scheme, Yuu Wakabayashi¹, Junji Yamauchi¹, Hisamatsu Nakano¹; ¹Hosei Univ., Japan. We develop a three-dimensional implicit FDTD method based on the locally one-dimensional scheme to analyze periodic structures. Computational time is reduced to 29% of that for the explicit FDTD method with acceptable results being maintained.

NM2C • Soliton and Localization Effects in Nonlinear Dynamics—Continued
NM2C.6 • 12:00

Partition of the instantaneous and delayed nonlinear responses in optical fibers, Olivier Vanvincq¹, Abdelkrim Bendahmane¹, arnaud musso¹, Alexandre Kudlinski¹; ¹Universite de Lille 1, France. We provide a semi-analytical model for partitioning the nonlinear response of silica glass into electronic and nuclear contributions to describe the propagation of ultrashort solitons with a duration comparable to the Raman response time scale.

NM2C.7 • 12:15

Highly Localized Plasma Formation in Air Using Space-time Focusing of mJ Ultrafast Pulses, Michael Greco¹, Charles G. Durfee¹; ¹Colorado School of Mines, USA. Space-time focusing of spatially-chirped Ti:Sapphire laser pulses is used to generate a plasma in air axially localized to 28x less than the confocal parameter, suppressing filamentation on the way to the focus.

12:30–13:30 Lunch Break, On Your Own

13:30–15:30
IM3A • Lasers and Integration

Joris Van Campenhout; *InterUniv. Microelectronics Center, Belgium, Presider*

IM3A.1 • 13:30 **Invited**

Recent Advances in Germanium Based Devices, Kazumi Wada¹; ¹Materials Engineering, Univ. of Tokyo, Japan. The present paper has reviewed recent advances in Ge growth and devices in Si microphotronics. We have shown a high quality Ge growth without a post-growth annealing. Strain-engineered Ge will be an important material platform for not only photodetectors but modulators and light emitters.

IM3A.2 • 14:00 **Invited**

Low Power Computer Interconnect with 1060nm VCSEL, Jean Benoit Héroux¹, Shigeru Nakagawa¹; ¹IBM Research - Tokyo, Japan. Results on an optical link using a high efficiency 1060 nm VCSEL are presented. Clear eye patterns are obtained at 25 Gbps. A Tx module with a 1.7 pJ/bit energy consumption at 10 Gbps is demonstrated.

13:30–15:30
IM3B • Theory, Modeling & Simulations II: Plasmonics and Nano-optics

Jackson Klein; *Lumerical Solutions, Inc., Canada, Presider*

IM3B.1 • 13:30 **Invited**

Discontinuous Galerkin Methods in Nanophotonic, Kurt Busch^{1,2}; ¹Institut für Physik, AG Theoretische Optik & Photonik, Humboldt Universität zu Berlin, Germany; ²Max-Born-Institut, Germany. Nanophotonic devices typically feature complex geometries and materials with nonlinear optical properties. This poses serious challenges to computational approaches. The Discontinuous Galerkin Time-Domain method provides a rather flexible approach to accurate computations of such systems.

IM3B.2 • 14:00 **Invited**

Non-asymptotic Effective Medium Theory, Igor Tsukerman¹; ¹Electrical & Computer Eng. The Univ. of Akron, USA. In the proposed non-asymptotic homogenization theory the coarse-grained fields are defined to satisfy Maxwell's equations and boundary conditions exactly. The end result is an extended material tensor with 36 local and additional nonlocal parameters.

13:30–15:30
NM3C • Advances in Nonlinear Signal Processing and Applications

John Dudley; *Universite de Franche-Comte, France, Presider*

NM3C.1 • 13:30 **Invited**

Advances in Optical Signal Processing Based on Phase Sensitive Parametric Mixing, David J. Richardson¹, Joseph Kakande¹, Radan Slavik¹, Francesca Parmigiani¹, Periklis Petropoulos¹; ¹Optoelectronics Research Centre, Univ. of Southampton, UK. We review our recent work in the area of optical processing of phase encoded signals, focusing in particular on optical phase quantization - a key functionality for regeneration and test and measurement applications.

NM3C.2 • 14:00

High resolution time-to-space conversion of sub-picosecond pulses at 1.55µm by non-degenerate SFG in PPLN crystal, Dror Shayovitz¹, Christine Silberhorn², Dan M. Marom¹, Harald Herrmann², Wolfgang Sohler², Raimund Ricken²; ¹Applied Physics, Hebrew Univ. of Jerusalem, Israel; ²Applied Physics, Univ. of Paderborn, Germany. We demonstrate time-to-space conversion of ultrashort optical pulses using sum-frequency generation in PPLN. An order of magnitude increase in conversion efficiency over our previous work was achieved, whilst maintaining a resolution factor of 90.

NM3C.3 • 14:15

All-optical nonlinear simultaneous polarization and intensity regeneration of a 40-Gb/s telecommunication signal, Philippe Morin¹, Julien Fatome¹, Christophe Finot¹, Stéphane Pitois¹, Guy Millot¹; ¹ICB, Université de Bourgogne, France. We experimentally report the simultaneous all-optical regeneration of the polarization state and the intensity profile of a 40 Gb/s Return-to-Zero telecommunication signal by means of Kerr effect occurring in a single segment of fiber.

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

BM2D • Grating Properties and Fabrication: Femtosecond Inscription—Continued

BM2D.6 • 12:00

Femtosecond Laser-induced, Electro-optically Tunable Waveguide Bragg Gratings in Lithium Niobate, Sebastian Kroesen^{1,2}, Wolfgang Horn^{1,2}, Cornelia Denz^{1,2}; ¹Westfälische Wilhelms-Universität, Institute for Applied Physics, Germany; ²Westfälische Wilhelms-Universität, Center for Nonlinear Science (CeNoS), Germany. We demonstrate the fabrication of electro-optically tunable, type-II Bragg gratings in lithium niobate. The waveguide is structured periodically to achieve narrowband reflections in the c-band. An electric field is used to achieve electro-optic tuning of the reflection maximum by $\Delta\lambda = 625$ pm.

SM2E • Joint SOF, BGPP & NP Session I—Continued

SM2E.5 • 12:00

Spectral Broadening of mid-IR Femtosecond Pulses in Highly Germanium Doped Fiber, Nikolai Tolstik¹, Dmitry S. Klimentov¹, Vladislav Dvoyrin¹, Irina Sorokina¹, Evgeni Sorokin², Vladimir Kalashnikov²; ¹Department of physics, NTNU, Norway; ²Institut für Photonik, TU Wien, Austria. We demonstrate spectral broadening of femtosecond mid-IR pulses in a single-mode highly germanium-doped fiber.

SM2E.6 • 12:15

Study of the linewidth dependence of the double peaked Brillouin spectrum on temperature and strain in an aluminosilicate fiber, Francesca H. Mountfort¹, Mohammad Belal¹, Jayanta K. Sahu¹; ¹Optoelectronics Research Centre, Univ. of Southampton, UK. The spontaneous Brillouin spectrum of an aluminosilicate fiber shows two distinct peaks. Respective linewidths exhibit strain coefficients of -0.0204 ± 0.0043 MHz/ $\mu\epsilon$ and 0.02374 ± 0.0053 MHz/ $\mu\epsilon$ and temperature coefficients of -0.66 ± 0.2447 MHz/ $^{\circ}\text{C}$ and 0.50 ± 0.1459 MHz/ $^{\circ}\text{C}$.

12:30–13:30 Lunch Break, On Your Own

13:30–15:30

BM3D • Grating Properties and Fabrication: Novel Fibers and Grating Design

Paul Westbrook; OFS Laboratories, USA, Presider

BM3D.1 • 13:30 **Invited**

Waveguide Bragg Gratings for the Realization of High-Quality Monolithic Cavities, Edward H. Bernhardt¹, Henk van Wolferen², Kerstin Wörhoff¹, René de Ridder¹, Markus Pollnau¹; ¹Integrated Optical Microsystems Group, Univ. of Twente, Netherlands; ²Transducers Science and Technology Group, Univ. of Twente, Netherlands. The fabrication and characterization of waveguide Bragg gratings integrated with aluminum oxide channel waveguides are reported. Passive and lasing Bragg-grating-based cavities with Q-factors exceeding 1.5×10^6 and 1.1×10^{11} , respectively, are demonstrated.

BM3D.2 • 14:00

Relief Bragg grating reflectors inscribed into solid core photonic crystal fibres, Maria Konstantaki¹, Paul Childs¹, Michele Sozzi¹, Stavros Pissadakis¹; ¹FORTH-IESL, Greece. Relief Bragg gratings are inscribed inside the capillaries of solid core photonic crystal fibres using 248nm laser radiation and toluene vapors. These gratings exhibit reflection extinction ratios greater than 20dB, while surviving up to 1200°C.

BM3D.3 • 14:15

Direct-write depressed cladding waveguide Bragg-gratings in ZBLAN glass, Simon Gross¹, David G. Lancaster², Heike Ebdendorff-Heidepriem², Tanya M. Monro², Alexander Fuerbach¹, Michael J. Withford¹; ¹Macquarie Univ., Australia; ²Univ. of Adelaide, Australia. Strong waveguide Bragg-gratings (10 dB reflectivity) were fabricated by the direct-write technique in ZBLAN glass. Based on a depressed cladding, an array of 169 periodic and in phase modifications was placed inside the core.

13:30–15:30

SM3E • PBG & PCF Fibers

Stojan Radic; Univ. of California San Diego, USA, Presider

SM3E.1 • 13:30 **Invited**

Large-core Single-mode Solid Photonic Bandgap Fibers, Liang Dong¹, Kunimasa Saitoh², Fanting Kong¹, Paul Foy¹, Thomas Hawkins¹, Devon McClane¹; ¹Clemson Univ., USA; ²Hokkaido Univ., Japan. Mode-area scaling of single-mode fibers is critical to power scaling of fiber lasers. Significantly different guidance principle of solid photonic bandgap fibers provides new design opportunities. Recent progress in this area will be reported.

SM3E.2 • 14:00

Low Loss (34 dB/km) Silica Hollow Core Fiber for the 3 μm Spectral Region, Fei Yu¹, William J. Wadsworth¹, Jonathan C. Knight¹; ¹Physics, Univ. of Bath, UK. We describe the characteristics of a silica hollow-core fiber for transmission around 3 μm wavelength, with minimum attenuation of 34 dB/km. The design is based on the use of a negative curvature core wall.

SM3E.3 • 14:15

Photonic bandgap confinement in an all-solid tellurite glass photonic crystal fiber, Joris Lousteau¹, Gerardo Scarpignato¹, George Athanasiou², Nadia G. Boetti¹, Emanuele Mura¹, Massimo Olivero³, Trevor Benson², Daniel Milanese¹; ¹DISAT, Politecnico di Torino, Italy; ²GGIEMR, Univ. of Nottingham, UK; ³DELEN, Politecnico di Torino, Italy. The manufacturing process and the fiber characterization procedures of an all-solid tellurite glass photonic bandgap fiber are described and discussed. Results of experimental loss measurements are compared with modeling predictions to discuss the fiber quality

Colorado II

Integrated Photonics Research, Silicon and Nano Photonics

Colorado III

Integrated Photonics Research, Silicon and Nano Photonics

Colorado I

Nonlinear Photonics

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

IM3A • Lasers and Integration—Continued

IM3A.3 • 14:30

Silicon-Organic Hybrid (SOH) Lasers at Telecommunication Wavelengths, Matthias Lauerma¹, Dietmar Korn¹, Patrick Appel¹, Luca Alloatti¹, Wolfgang Freude¹, Juerg Leuthold¹, Christian Koos¹, ¹*Institute of Photonics and Quantum Electronics (IPQ) and Institute of Microstructure Technology (IMT), Karlsruhe Institute of Technology, Germany*. We demonstrate for the first time lasing in silicon-organic hybrid (SOH) strip waveguides. Optical gain is provided by a dye-doped polymer cladding enabling room-temperature lasing at telecommunication wavelengths.

IM3A.4 • 14:45

Electrically Pumped Germanium-on-Silicon Laser, Rodolfo E. Camacho-Aguilera¹, Yan Cai¹, Neil Patel¹, Jonathan T. Bessette¹, Marco Romagnoli², Lionel C. Kimerling¹, Jurgen Michel¹, ¹*Massachusetts Institute of Technology, USA*; ²*APIC Corporation, USA*. Germanium lasing from Ge-on-Si pnn heterojunction diode structures is demonstrated. Selective growth of highly phosphorus doped Ge in oxide trenches shows a design for CMOS compatible laser integration.

IM3A.5 • 15:00

High n-type doped germanium for electrically pumped Ge laser, Yan Cai¹, Rodolfo E. Camacho-Aguilera¹, Jonathan T. Bessette¹, Lionel C. Kimerling¹, Jurgen Michel¹, ¹*Massachusetts Institute of Technology, USA*. We demonstrate an active phosphorous concentration of $4 \times 10^{19} \text{ cm}^{-3}$ in Ge by delta doping. Dopant enhanced diffusion is observed and modeled. Photoluminescence (PL) and electroluminescence (EL) confirm the high doping level with stronger emission.

IM3A.6 • 15:15

Deep submicron etched-slot coupled semiconductor lasers fabricated by standard UV-lithography, Tingting Yu¹, lei Wang¹, Li Zou¹, Jianjun He¹, ¹*Zhejiang Univ., China*. A single mode deep submicron etched-slot coupled laser is fabricated using standard UV-lithography. A threshold current of 22mA and SMSR near 40dB is achieved and the slope efficiency is 0.178W/A.

IM3B • Theory, Modeling & Simulations II: Plasmonics and Nano-optics—Continued

IM3B.3 • 14:30

Optimal On/Off Scheme for All-Optical Switching, Philip T. Kristensen¹, Mikkel Heuck¹, Jesper Mork¹, ¹*DTU Fotonik, Technical Univ. of Denmark, Denmark*. We present a two-pulsed on/off scheme based on coherent control for fast switching of the optical energy in a micro cavity and use calculus of variations to optimize the switching in terms of energy.

IM3B.4 • 14:45

Control of dispersion in photonic crystal waveguides using group symmetry theory, Pierre Colman^{1,2}, Sylvain Combrié¹, Gaëlle Lehoucq¹, Alfredo De Rossi¹, ¹*Thales Research and Technology, France*; ²*Danmarks Tekniske Universitet, Denmark*. We demonstrate dispersion tailoring by coupling modes in a photonic crystal waveguide. Different dispersion features are generated and controlled by a single geometrical parameter. This concept is demonstrated experimentally with very good agreement with theory.

IM3B.5 • 15:00

Scattering of Evanescent Wave by Nanowires, David A. Shapiro¹, Leonid L. Frumin¹, Oleg V. Belai¹, Serge V. Perminov², ¹*Institute of Automation and Electrometry, Russian Federation*; ²*A.V. Rzhanov Institute of Semiconductor Physics, Russian Federation*. The scattering of evanescent wave, one of the main processes of nanophotonics, is studied in 2D geometry using boundary integral equations and special two-domain Green function. The problem is studied for a single, a pair, and a series of nanowires.

IM3B.6 • 15:15

Polarization converters using optical nano-waveguides, Junji Yamauchi¹, Takashi Hashimoto¹, Yuu Wakabayashi¹, Hisamatsu Nakano¹, ¹*Hosei Univ., Japan*. Polarization converters using optical nano-waveguides are proposed and investigated numerically. An extinction ratio of more than 15 dB is obtained over a wavelength range of 1.3 μm to 1.7 μm for an embedded air-core waveguide.

NM3C • Advances in Nonlinear Signal Processing and Applications—Continued

NM3C.4 • 14:30

Observation of Low-Contrast All-Optical Switching in Silicon Nitride Microdisks Based on the Zeno Effect, Scott Hendrickson¹, Chad Weiler¹, Ryan M. Camacho², Peter Rakich³, Ian Young², Mike Shaw², Todd Pittman³, Jim Franson³, Bryan C. Jacobs¹, ¹*Johns Hopkins Univ. Applied Physics Lab, USA*; ²*Sandia National Laboratories, USA*; ³*Univ. of Maryland, Baltimore County, USA*. Low-contrast all-optical Zeno switching has been demonstrated in a Silicon Nitride microdisk resonator surrounded by hot Rubidium vapor. The device is based on the suppression of the cavity field buildup due to non-degenerate two-photon absorption.

NM3C.5 • 14:45

Low-Power All-Optical Switching Using EIT and the Zeno Effect, David Clader¹, Scott M. Hendrickson¹, Ryan M. Camacho², Bryan C. Jacobs¹, ¹*The Johns Hopkins Univ. Applied Physics Laboratory, USA*; ²*Sandia National Laboratories, USA*. We present theoretical results for an all-optical switch based on electromagnetically induced transparency and the Zeno effect in a microdisk resonator. We predict 20 dB of switching contrast with only 100 nW of control-beam power.

NM3C.6 • 15:00

Dual-channel, single-photon upconversion detector at 1300 nm, Paulina S. Kuo^{1,2}, Jason S. Pelc³, Oliver Slattery², Lijun Ma², Martin M. Fejer³, Xiao Tang², ¹*Joint Quantum Institute, NIST-Univ. of Maryland, USA*; ²*Information Technology Laboratory, National Inst of Standards & Technology, USA*; ³*E. L. Ginzton Laboratory, Stanford Univ., USA*. We show a dual-channel, upconversion detector at 1.3- μm -wavelength based on phase-modulated periodically poled LiNbO₃, and use it for wavelength- to time-division multiplexing to achieve high data rates, useful for quantum key distribution.

NM3C.7 • 15:15

Silicon-Chip Femtosecond Source, Kasturi Saha¹, Yoshitomo Okawachi¹, Bonggu Shim¹, Jacob S. Levy², Mark A. Foster¹, Michal Lipson^{2,3}, Alexander L. Gaeta^{1,2}, ¹*School of Applied & Engineering Physics, Cornell Univ., USA*; ²*School of Electrical and Computer Engineering, Cornell Univ., USA*; ³*Kavli Institute at Cornell for Nanoscale Science, Cornell Univ., USA*. We demonstrate an on-chip, high-repetition-rate femtosecond pulse source using a high-Q silicon-nitride-based parametric frequency comb. Sub-200-fs pulses at a 99-GHz repetition rate are generated.

15:30–16:00 Coffee Break, Centennial Room

16:00–18:00

IM4A • Electro-Optic Modulators and Switches

Michael Watts; Massachusetts Institute of Technology, USA, Presider

IM4A.1 • 16:00 **Invited**

High-Speed Silicon Photonic Transceivers, Mehdi Asghari¹, Dazeng Feng¹, Jonathan Luff¹, ¹*Kotura, Inc., USA*. This talk will review the key components needed for high speed, low power, Silicon Photonics transceivers. Particular attention will be paid to the use of WDM to enhance aggregate bandwidth density and power consumption tradeoffs within the overall solution.

16:00–18:00

IM4B • Theory, Modeling & Simulations III: Active photonics

Michael Hochberg; Univ. of Washington, USA, Presider

IM4B.1 • 16:00 **Invited**

Nanowire Arrays for Photovoltaics and Lighting: Electronic and Optical Properties, Bernd Witzigmann², Marcus Deppner², Shuqing Yu², Jan Kupec¹, Friedhard Roemer², ¹*ETH Zurich, Switzerland*; ²*Univ. of Kassel, Germany*. Semiconductor nanowire arrays possess both subwavelength electromagnetic as well as quantum electronic features. In this paper, the properties of nanowire arrays are discussed for their use as light emitting diodes and photovoltaic devices.

16:00–18:00

NM4C • Nonlinearities in Lasers and Dissipative Systems

Philippe Grelu; Universite de Bourgogne, France, Presider

NM4C.1 • 16:00 **Invited**

Nonlinear Engineering: from the Soliton-Similariton Laser to Nonlinear Laser Lithography, F. Oemer O. Ilday¹, ¹*Bilkent Universitesi, Turkey*. We demonstrate a novel nanolithography method, tightly governed by positive and negative feedback, resulting in extremely uniform nanostructures. The underlying mechanism is inspired by and bears much similarity to mode-locked lasers.

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

BM3D • Grating Properties and Fabrication: Novel Fibers and Grating Design—Continued

BM3D.4 • 14:30

Integrated Holographic Polymer-Dispersed Liquid Crystal Bragg Reflector into Photonic Crystal Fibre, Gianluigi Zito¹, Stavros Pissadakis¹, *Foundation for Research and Technology-Hellas (FORTH), Institute of Electronic Structure and Laser (IESL), P.O. Box 1385, 71 110, Greece*. The fabrication of a Bragg phase grating by photo-induced modulation of a liquid crystal/polymer composite material integrated into a photonic crystal fibre is demonstrated.

BM3D.5 • 14:45

Dynamic Frequency Tuning in a Fiber Grating Cavity, Zhangwei Yu^{1,2}, Irina V. Kabakova³, Pierre-Yves Fonjallaz², Oleksandr Tarasenko², Walter Margulis^{1,2}, Martijn de C. Sterke³, *¹Applied Physics, Royal Institute of Technology, Sweden; ²Acreo AB, Sweden; ³CUDOS and IPOS, Univ. of Sydney, Australia*. Dynamic frequency tuning of trapped light in a phase-shifted fiber grating cavity is demonstrated by high-voltage electrical pulses. Y-polarization light is found to be sensitive to refractive index changes caused by a transverse pressure-wave.

BM3D.6 • 15:00

Physical Insight into Dispersionless FBG Designs, Michalis N. Zervas^{1,2}, Michael K. Durkin², *¹Univ. of Southampton, UK; ²SPI Lasers, UK*. We provide physical insight into the role different sections play in inverse-scattering-designed dispersionless FBGs. Using this knowledge we design and fabricate strong (>30dB) bidirectional dispersionless filters.

BM3D.7 • 15:15

Characterization of Integrated Bragg Grating Profiles, Alexandre D. Simard¹, Yves Painchaud², Sophie LaRoche¹, *¹Universite Laval, Canada; ²TeraXion, Canada*. Spectral responses of gratings in SOI are extracted using time windowing to eliminate parasitic reflections. Filtering high spatial frequencies of the phase profile, obtained by layer peeling, allows examination of the wafer thickness uniformity.

SM3E • PBG & PCF Fibers—Continued

SM3E.4 • 14:30 **Invited**

Hybrid photonic crystal fiber components and amplifiers, Thomas T. Alkeskjold¹, Marko Laurila², Kristian R. Hansen², Mette Jørgensen², Sidsel Petersen², Jesper Lægsgaard², Christina Olausson¹, Jes Broeng¹, *¹NKT Photonics, Denmark; ²DTU Fotonik, Department of Photonics Engineering, Denmark*. We present recent development of hybrid photonic crystal fiber amplifiers and components providing enhanced spectral and modal filtering.

SM3E.5 • 15:00

Pixelated Bragg fibers, Assaad Baz¹, Geraud Bouwmans¹, Laurent Bigot¹, Yves Quiquempois¹, *¹Physics of Lasers, Atoms and Molecules Laboratory, Univ. of Lille, France*. We report on a new Bragg Fiber design for which the high index rings are replaced by discontinuous rings made of circular high index rods. Advantages of this new kind of fibers are presented

SM3E.6 • 15:15

All-Glass AgPO₃/Silica Photonic Band-Gap Fibre, Gianluigi Zito¹, Ioannis Konidakis¹, Stavros Pissadakis¹, *¹IESL, FORTH, Greece*. Photonic band-gap guidance is demonstrated in an all-solid microstructured optical fibre consisting of a silver-metaphosphate cladding structure embedded in silica. Tuning of that all-solid fibre transmission spectrum was achieved by UV laser irradiation.

15:30–16:00 Coffee Break, Centennial Room

16:00–18:00

BM4D • Fundamentals of Photosensitivity and Poling: Photo-induced Processes and Gratings

John Canning; *Univ. of Sydney, Australia, Presider*

BM4D.1 • 16:00 **Invited**

Femtosecond direct laser writing of linear and nonlinear optical properties in photosensitive glass, Lionel Canioni¹, Gautier Papon¹, Arnaud Royon¹, Nicolas Marquestaut¹, Yannick Petit^{1,2}, Kevin Bourhis³, Marc Dussauze², Thierry Cardinal¹, *¹LOMA, Univ. Bordeaux, France; ²ISM, Univ. Bordeaux, France; ³IC-MCB, CNRS, France*. Glasses specifically tailored with photosensitive agents such as silver are efficient material for direct laser writing localized linear and non linear optical properties. The relation between the photo-induced structures and the modifications of the linear and optical properties are discussed.

16:00–18:00

SM4E • Joint SOF & NP Session

Liang Dong; *Clemson Univ., USA, Presider*

SM4E.1 • 16:00 **Invited**

Nonlinear Frequency Generation in Poled Fibers: From Sum-Frequency to Polarization-Entangled Photon Pairs, Li Qian¹, Eric Y. Zhu¹, Zhiyuan Tang¹, *¹Electrical and Computer Engineering, Univ. of Toronto, Canada*. We review progress in periodically-poled silica fibers (PPSFs). Using a birefringent PPSF, we enable spectrally-separate QPM and demonstrate polarization-dependent sum-frequency generation and direct polarization-entangled photon pair generation.

Colorado II

Integrated Photonics Research, Silicon and Nano Photonics

Colorado III

Integrated Photonics Research, Silicon and Nano Photonics

Colorado I

Nonlinear Photonics

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IM4A • Electro-Optic Modulators and Switches—Continued

IM4A.2 • 16:30

Photonic Integration in State-of-the-Art Silicon Electronics Processes, Jason Orcutt¹, ¹Research Laboratory of Electronics, Massachusetts Institute of Technology, USA. Photonic integration within state-of-the-art CMOS and DRAM processes leverages the existing electronic manufacturing infrastructure to minimize cost. Suitable design techniques combined with in-foundry optimization or post-processing have enabled integration within several advanced technologies.

IM4A.3 • 17:00

Low Power SiGe Electroabsorption Modulators for Optical Interconnects, Edward Fei¹, Elizabeth Edwards¹, Yijie Huo¹, Xiaochi Chen¹, Stephanie Claussen¹, Xi Liu¹, Yiwen Rong^{1,2}, Theodore Kamins¹, David Miller¹, James Harris¹, ¹Electrical Engineering, Stanford Univ., USA; ²Phillips Lumileds, USA. We demonstrate low voltage quantum-confined Stark effect electroabsorption in a Ge/SiGe quantum well diode with a new thin intrinsic layer design, showing the potential for absorptive modulators with low photocurrent dissipation power.

IM4A.4 • 17:15

Integrated Electro-optical Switching with Phase-Modified Liquid Crystal Blends, Florenta Costache¹, Martin Blas¹, Kirstin Bornhorst¹, Andreas Rieck¹, Haldor Hartwig¹, ¹Fraunhofer Institute for Photonic Microsystems, Germany. Liquid crystal-oil-blends with modified nematic-isotropic transition temperatures were developed for electro-optical waveguides. Microsecond, low loss switching is demonstrated on devices designed to include such waveguides. These devices are operable at room temperature.

IM4A.5 • 17:30

Ultra-Wide Bandwidth Design for Very-Low Voltage Substrate-Removed Electro-optic Intensity Modulators, Selim Dogru¹, Nadir Dagli¹, ¹Department of Electrical and Computer Engineering, Univ. of California, Santa Barbara, USA. Ultra-wide bandwidth, very-low drive voltage modulator design is presented. Design combines buried electrodes made of doped semiconductors and dielectrics with very large dielectric constant dispersion. 0.4 V π device with bandwidth exceeding 100 GHz is possible.

IM4A.6 • 17:45

Thin Film Electro-Optic Devices for 50 GHz Applications, Jianheng Li¹, Zhifu Liu¹, Bruce W. Wessels¹, ¹Department of Materials Science and Engineering and Materials Research Center, Northwestern Univ., USA. We have demonstrated mm scale, thin film electro-optic modulator utilizing a photonic crystal structure. By decreasing device length the EO response was greater than 50 GHz. The microwave response of the modulator was measured and simulated.

IM4B • Theory, Modeling & Simulations III: Active photonics—Continued

IM4B.2 • 16:30

Suppressing Mode Competition in Terahertz Quantum Cascade Lasers, Huda M. Tanvir¹, B.M.Azizur Rahman¹, Kenneth Gratton¹, ¹School of Engineering and Mathematical Sciences, City Univ. London, UK. Terahertz QCLs based on metal-metal waveguides are often susceptible to lase with higher order modes. This paper aims to introduce a waveguide structure that is able to suppress the generation of higher order modes.

IM4B.3 • 16:45

Quasi-Phase-Matching for Broadband Discrete Mid-IR FWM in Width-Modulated Si Photonic Waveguides, Jeffrey B. Driscoll¹, Richard R. Grote¹, Jerry I. Dadap¹, Nicolae C. Panou², Richard M. Osgood¹, ¹Department of Electrical Engineering, Columbia Univ., USA; ²Electronic and Electrical Engineering, Univ. College London, UK. We investigate quasi-phase-matching via silicon waveguide width-modulation as an effective means to achieve four-wave-mixing between the telecommunications bands and mid-IR.

IM4B.4 • 17:00

Intersubband optical properties of GaAs/InGaAs nanopore superlattices, Yinying Xiao-Li¹, John O'Brien¹, ¹Electrical Engineering, Univ. of Southern California, USA. GaAs/InGaAs nanopore superlattices are analyzed. Subband gaps are observed from 1-20 meV. Optical absorption due to intersubband transitions is studied and strong absorption peaks covering terahertz and far-infrared ranges are observed at various temperatures.

IM4B.5 • 17:15

Multiple versus Single Quantum Well Transistor Laser Performances, Iman Taghavi^{1,2}, Hassan Kaatuzian¹, Jean Pierre Leburton^{2,3}, ¹Photonics Research Laboratory, Electrical engineering, AmirKabir Univ. of Technology, Islamic Republic of Iran; ²Beckman Institute for advanced science and technology, Univ. of Illinois at Urbana-Champaign, USA; ³Electrical engineering, Univ. of Illinois at Urbana-Champaign, USA. We present a transport-based model that can be used to investigate the optoelectronic operations of transistor lasers with multiple quantum well. Significant enhancement in device performances is anticipated when the MQW structure is properly designed.

IM4B.6 • 17:30

Buried metal grating for vertical fiber-waveguide coupling with high directionality, Pin-Tso Lin¹, Che-Yao Wu¹, Po-Tsung Lee¹, ¹Photonics, National Chiao Tung Univ., Taiwan. We numerically propose a buried metal grating coupler which can forbid diffractions toward substrate by itself. When the grating is higher than 600 nm, it can reach 90% coupling directionality without using substrate mirror.

IM4B.7 • 17:45

Time-Domain Analysis of High-Order Laterally-Coupled DFB Lasers, akram akrou¹, Kais Dridi¹, Trevor Hall¹, ¹Photonic technology laboratory, Ottawa Univ., Canada. A time-domain traveling wave algorithm is extended to investigate high-order laterally-coupled distributed feedback semiconductor laser. The effect of longitudinal spatial hole-burning is mitigated by means of fine tuning of the grating duty cycle.

NM4C • Nonlinearities in Lasers and Dissipative Systems—Continued

NM4C.2 • 16:30

Environmentally stable, passively modelocked, all-normal dispersion fibre similariton laser, Neil Broderick¹, Claude Aguerarary¹, Jocelyn S. Chen², Vladimir Kruglov¹, ¹Physics, Univ. of Auckland, New Zealand; ²Southern Photonics Ltd., New Zealand. We report on a new similariton fibre laser system based on a nonlinear amplifying loop mirror. The laser is robust and produces linearly chirped pulses that can be recompressed to 350fs.

NM4C.3 • 16:45

Effect of Slow Gain Dynamics in Mode-Locked Fiber Lasers: Chirped Soliton Molecules, Alexandr Zaviyalov¹, Philippe Grelu², Falk Lederer¹, ¹Institute of Condensed Matter Theory and Solid State Optics, Abbe Center of Photonics, Friedrich-Schiller-Universität Jena, Germany; ²Laboratoire Interdisciplinaire Carnot de Bourgogne, UMR 6303 CNRS, Université de Bourgogne, France. We theoretically and experimentally demonstrate the pivotal role of the gain dynamics in the formation of chirped soliton molecules in mode-locked lasers. Such molecules are characterized by an increasing separation from leading to trailing pulses.

NM4C.4 • 17:00

Ultrabroadband Mode-Locked Laser Based on Self-Similar Amplification, Andy Chong^{1,2}, Hui Liu³, Bai Nie⁴, Brandon G. Bale⁵, Stefan Wabnitz⁶, Marcos Dantus⁷, William Renninger⁸, Frank W. Wise⁹, ¹Electro-Optic program, Univ. of Dayton, USA; ²Department of Physics, Univ. of Dayton, USA; ³Department of Applied Physics, Cornell Univ., USA; ⁴Department of Chemistry, Michigan State Univ., USA; ⁵Photonic Research Group, Aston Univ., UK; ⁶Department of Information Engineering, Universit  di Brescia, Italy. We demonstrate an ultrabroadband mode-locked spectrum beyond the gain bandwidth from a fiber laser based on self-similar amplification. 21-fs pulses (the shortest from a fiber laser) are generated after phase correction.

NM4C.5 • 17:15

Dissipative rogue waves out of fiber lasers, Nail N. Akhmediev¹, Philippe Grelu², Jose-Maria Soto-Crespo³, ¹Optical Sciences Group, Australian National Univ., Australia; ²Instituto de Optica, CSIC, Spain; ³Laboratoire Interdisciplinaire Carnot de Bourgogne, Universit  de Bourgogne, France. We study rogue waves in dissipative systems such as unidirectional fiber laser. We have found that the probability of producing extreme pulses in this setup is higher than in any other system considered so far

NM4C.6 • 17:30

1.8 GHz Harmonically Mode-Locked Fiber Laser Employing Raman-Like Optoacoustic Interactions in PCF, Myeongsoo Kang¹, Philip Russell¹, ¹MPI for the Science of Light, Germany. By making use of 1.8 GHz acoustic resonances in a 1.8 μ m photonic crystal fiber core we generate a high-repetition-rate optical pulse train at the 317th harmonic of an Er-doped fiber ring laser.

NM4C.7 • 17:45

Crescent Waves in Optical Cavities, YuanYao Lin¹, JIsha P. Chandroth¹, Tsin-Dong Lee¹, Ray-Kuang Lee¹, ¹National Tsing Hua Univ., Taiwan. We theoretically and experimentally generate stationary crescent surface solitons pinged to the boundary of a micro-structured vertical cavity surface emission laser by triggering the intrinsic cavity mode as a background potential.

18:00–19:30 Joint Poster Sessions & Reception/ Exhibit, Centennial Room & Terrace

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

BM4D • Fundamentals of Photosensitivity and Poling: Photo-induced Processes and Gratings—Continued

BM4D.2 • 16:30

Three Bragg Grating Types in Hydrogen-Loaded Heavily Germanium - Doped Fibers, Oleg Medvedkov¹, Sergei Vasiliev¹, Pavel Gnusin¹, Evgeny Dianov¹; ¹FORC RAS, Russian Federation. Competition of two photosensitivity mechanisms in H₂-loaded Ge-doped fibers (75 mol.% GeO₂) results in complicated dynamics of FBG writing with successive formation of three grating types. The induced refractive index annealing is also nonmonotonic.

BM4D.3 • 16:45

Temperature-Resolved Spectroscopy of UV-Induced Absorption in H₂-Loaded Germanosilicate Fiber, Pavel Gnusin¹, Sergei Vasiliev¹, Oleg Medvedkov¹, Evgeny Dianov¹; ¹FORC RAS, Russian Federation. Annealing of UV-induced absorption near 1.4- μ m in H₂-loaded germanosilicate fibers is investigated by means of temperature-resolved spectroscopy. As a result, the contribution of H-containing groups to the induced refractive index is estimated.

BM4D.4 • 17:00

Stress changes induced by cw-244-nm Ar⁺ irradiation in H₂-loaded SMF-28e optical fibers, Georgios Violakis¹, Nandita Aggarwal¹, Hans G. Limberger¹; ¹STI, EPFL, Switzerland. Fiber Bragg Gratings were fabricated in H₂-loaded SMF-28e fibers using a cw-244-nm Ar⁺ laser with varying total fluence. Stress measurements revealed initial expansion followed by compaction.

BM4D.5 • 17:15

Design of silver activated phosphate and borophosphate based glasses for multi-scale structured optical materials, Thierry Cardinal¹, Evelyn Fargin¹, Kevin Bourhis¹, Yannick Petit^{1,2}, Arnaud Royon², Gauthier Papon³, Marc Dussauze³, Lionel Canioni², Vincent Rodriguez², David Grojo⁴, Olivier Uteza⁴, Philippe Delaporte⁴, Laurent Binet⁵, Daniel Caurant⁶; ¹ICMCB, France; ²LOMA, France; ³ISM, France; ⁴LP3, France; ⁵LCMC, France. Silver activated exotic phosphate and borophosphate glass composition allows fabricating, after thermal poling and/or laser structuring, multi-scale structured optical materials. The spatial distribution and the identification of the silver species is of important for optical property tailoring.

BM4D.6 • 17:30

Thermal decay of UV Ar⁺ and ArF excimer laser fabricated Bragg gratings in SMF-28e and Bi-Al-doped optical fiber, Georgios Violakis¹, Pouneh Saffari¹, Hans G. Limberger¹, Valery M. Mashinsky², Evgeny Dianov²; ¹Ecole Polytechnique Federale de Lausanne, Switzerland; ²FORC, Russian Federation. Fiber Bragg Gratings fabricated in pristine Bi-Al-SiO₂ and SMF-28e fibers using pulsed ArF-excimer and cw-244-nm Ar⁺ laser were annealed. Gaussian decomposition of the master curves revealed energy distributions depending on fiber and laser used.

BM4D.7 • 17:45

Mid-Infrared Bragg grating in chalcogenide fiber, Martin Bernier¹, Mohammed El-Amraoui¹, Younes Messaddeq¹, Real Vallee¹; ¹COPL, Université Laval, Canada. We report the writing of high reflectivity fiber Bragg gratings operating in the Mid-Infrared at 3.44 microns in a low-loss single-mode As₂S₃ chalcogenide fiber using 800 nm femtosecond pulses and a phase-mask.

SM4E • Joint SOF & NP Session—Continued

SM4E.2 • 16:30

Highly nonlinear photonic crystal fiber with an unprecedented high figure of merit at 1 μ m, Alexandre Kudlinski¹, Damien Labat¹, Gilles Mélin², Arnaud Mussot¹; ¹PhLAM, Univ. Lille 1, France; ²PRYSMIAN Group, France. We report a highly-nonlinear germanium doped photonic crystal fiber with Kerr and Raman nonlinear coefficients of 69.3 W⁻¹.km⁻¹ and 94 W⁻¹.km⁻¹ respectively, with losses of 17.5 dB/km at 1 μ m, which leads to a record figure of merit at 1 μ m.

SM4E.3 • 16:45 **Invited**

Nonlinear properties of silicon optical fibers, Anna C. Peacock¹, Priyanth Mehta¹, Todd D. Day², Justin Sparks², Pier J. Sazio¹, John V. Badding², Noel Healy¹; ¹Optoelectronic Research Centre, Univ. of Southampton, UK; ²Department of Chemistry, Pennsylvania State Univ., USA. The nonlinear transmission properties of hydrogenated amorphous silicon core fibers are characterized for short pulse propagation. The influence of the material quality and core size will be discussed in relation to device performance.

SM4E.4 • 17:15 **Tutorial**

Tutorial: Nonlinear Fibers for Parametric Signal Generation, Amplification and Processing, Stojan Radic¹; ¹Univ. of California San Diego, USA. Abstract not provided.

18:00–19:30 Joint Poster Sessions & Reception/ Exhibit, Centennial Room & Terrace

18:00–19:30

JM5A • Joint Poster Session I

JM5A.1

Low confinement loss of the tellurite hybrid-guiding photonic bandgap fiber, Tonglei Cheng¹, Yasutake Ohishi¹; ¹Research Center for Advanced Photon Technology, Toyota Technological Institute, Japan. We present a numerical investigation on the low confinement loss properties of a tellurite hybrid-guiding photonic bandgap fiber with a solid core surrounding by high-index rods and air-holes.

JM5A.2

Coherent Multiple Pulses Generation in a Passively Mode-locked Fiber Laser Cavity with Normal Dispersion, Weiqing Gao¹, Meisong Liao¹, Hiroyasu Kawashima¹, Takenobu Suzuki¹, Yasutake Ohishi¹; ¹Research Center for Advanced Photon Technology, Toyota Technological Institute, Japan. The coherent multiple pulses with the number from 2 to 5 are observed in a 1.55 μm normal dispersion cavity. The spectra are highly modulated and the largest pulse separation of 31.9 ps is observed.

JM5A.3

Tungstate-tellurite glass fibers for spectral region up to 3 μm , Vitaly Dorofeev¹, Alexander Moiseev¹, Igor Kraev¹, Sergey Motorin¹, Mikhail Churbanov¹, Alexey F. Kosolapov², Evgeny Dianov²; ¹Institute of Chemistry of High-Purity Substances of RAS, Russian Federation; ²Fiber Optics Research Center RAS, Russian Federation. Optical fibers were produced from high-purity TeO₂-WO₃-La₂O₃-(Bi₂O₃) glasses. Total loss was less than 0.5 dB/m at 1.2–2.8 μm and about 2 dB/m at maximum of OH-groups absorption at 3 μm with further sharp increase.

JM5A.4

Raman Response and SSFS in Phospho - Tellurite Fiber, Yasutake Ohishi¹, Shohei Miyoshi¹, Xin Yan¹, Takenobu Suzuki¹; ¹Toyota Technological Institute, Japan. Phospho-tellurite fiber has high controllability of Raman gain properties. With this feature, wavelength shift and delayed propagation of optical pulse induced by SSFS can be effectively controlled.

JM5A.5

Demonstration of Large Mode Photonic Crystal Fibers in DWDM application, Pedro S. Meledina^{2,1}, Edward A. Whittaker¹; ¹Physics Dept, Stevens Institute of Technology, USA; ²AT&T Labs, USA. We report on the application of PCF-LMA-25 fiber in a ULH DWDM network, showing no transmission impairments at different Sonet rates or at a combined 0.5 Terabits with 43 wavelengths after 720 km

JM5A.6

Phosphate Double-Cladding Optical Fibre for High-Power Laser Applications, Emanuele Mura¹, Joris Lousteau¹, Nadia G. Boetti¹, Gerardo Scarpignato¹, Davide Negro¹, Silvio Abrate², Daniel Milanese¹; ¹DISAT - Department of Applied Science and Technology, Politecnico di Torino, Italy; ²PhotonLab, Istituto Superiore Mario Boella, Italy. Phosphate glasses were developed in order to fabricate a passive double-cladding optical fibre for high-power amplifier and lasers applications. The fibre preform was fabricated by rotational casting technique. The use of this technique is reported for the first time using phosphate glasses.

JM5A.7

RIN transfer in random distributed feedback fiber lasers, Javier Nuño del Campo¹, Mercedes Alcon-Camas², Juan D. Ania-Castanón¹; ¹Instituto de Óptica "Daza de Valdés", CSIC, Spain; ²Dpto. Tecnología Fotónica, ETSI Telecomunicación, UPM, Spain. A numerical analysis of the RIN transfer from the Raman pumps to the signal in random distributed feedback fiber lasers is presented. Results show RIN transfer levels comparable to those in distributed Raman amplification.

JM5A.8

Experimental Investigation of Fiber Optical Parametric Amplifier Pulse Generators, Armand A. Vedadi¹, Camille-Sophie Bres¹; ¹EPFL, Switzerland. In light of recent theoretical results, the possibility to generate optical Sinc pulses rather than wider Gaussian pulses using fiber optical parametric amplification is experimentally investigated. The impact of pump phase modulation is also discussed.

JM5A.9

Terahertz Field Detection Boost by Nonlinear Collapse of Normally Dispersed Optical Pulses, Marco Peccianti^{2,1}, Matteo Clerici², Mostafa Shalaby², Lucia Caspani², Antonio Lotti³, Arnaud Couairon⁴, David Cooke⁵, Tsuneyuki Ozaki², Daniele Faccio⁶, Roberto Morandotti²; ¹Institute for Complex Systems, National Research Council, Italy; ²Energie Matériaux Télécommunications, institut national de la recherche scientifique, Canada; ³Dipartimento di Scienza e Alta Tecnologia, Università dell'Insubria, Italy; ⁴Centre de Physique Théorique, CNRS, France; ⁵Dept. of Physics, McGill Univ., Canada; ⁶School of Engineering and Physical Sciences, Heriot-Watt Univ., UK. We demonstrated the Terahertz field signal enhancement in the Air Biased Coherent Detection scheme in the transition from below to above the critical power for self-focusing of positively chirped optical probe pulses.

JM5A.10

Dual mode mode-locked laser based on an integrated nonlinear microring resonator, Marco Peccianti^{1,2}, Alessia Pasquazi¹, Brent Little³, Sai T. Chu³, David J. Moss³, Roberto Morandotti¹; ¹INRS-Energie Mat & Tele Site Varennes, Canada; ²Institute for Complex Systems - CNR, Italy; ³Infirna Ltd, USA; ⁴CUDOS, School of Physics, Univ. of Sydney, Australia. We demonstrate a mode locked laser based on an integrated high-Q microring resonator that exhibits stable operation of two slightly shifted spectral optical comb replicas, generating a highly monochromatic radiofrequency modulation.

JM5A.11

All-Optical Phase Regeneration in a Highly Nonlinear Lead-Silicate Fiber, Mohamed A. Ettabib¹, Francesca Parmigiani¹, Xian Feng¹, Liam Jones¹, Joseph Kakande¹, Radan Slavik¹, Francesco Poletti¹, Giorgio M. Ponzio¹, Jindan Shi¹, Marco N. Petrovich¹, Periklis Petropoulos¹, Wei H. Loh¹, David J. Richardson¹; ¹Univ. of Southampton, UK. We demonstrate phase regeneration of a 40-Gb/s DPSK signal in a 1.7m-long lead-silicate fiber using a black-box phase-sensitive amplifier. Results show an improvement in the EVM values of the signal after regeneration for various noise levels.

JM5A.12

Coherent Superposition of 800 and 400-nm Spectral Components in Supercontinuum Pulse Generated in Ar-Gas-Filled Hollow Core Fiber, Fumihiko Kannari¹, Kenta Yoshikiyo¹, Shohei Kondo¹, Yu Oishi¹; ¹Keio Univ., Japan. 800 and 400 nm broadband components in a supercontinuum pulse generated by phase modulation based on copropagation of fundamental and second-harmonic femtosecond pulses in an Ar-gas-filled hollow core fiber were separately compressed and coherently superposed.

JM5A.13

Nonlinear Dynamics of Micro-Resonator Based Optical Parametric Oscillators, Andrey B. Matsko¹, Anatoliy Savchenkov¹, Lute Maleki¹; ¹OEwaves Inc, USA. We study the dynamics of hyperparametric oscillation in high-Q calcium fluoride and magnesium fluoride optical ring micro-resonators. Hard and soft excitation of oscillation, mode locking regimes, and super-mode competition are investigated.

JM5A.14

Stimulated Emission Pumping Enabling Sub-Diffraction-Limited Spatial Resolution in CARS Microscopy, Carsten Cleff¹, Petra Gross¹, Carsten Fallnich¹, Herman L. Offerhaus², Jennifer L. Herek², Kai Kruse³, Willem Beeker³, Chris J. Lee³, Klaus J. Boller³; ¹Westfälische Wilhelms-Universität Münster, Germany; ²Optical Sciences Group, MESA+ Research Institute for Nanotechnology, Univ. of Twente, Netherlands; ³Laser Physics & Nonlinear Optics Group, MESA+ Research Institute for Nanotechnology, Univ. of Twente, Netherlands. Suppression of CARS signal generation is demonstrated by equalization of the ground and Raman states via a control state in a theoretical investigation. Using donut-shaped control light fields for population transfer results in sub-diffraction-limited spatial resolution CARS microscopy.

JM5A.15

Demonstration of polarization pulling in a fiber-optical parametric amplifier, Birgit Stiller¹, Philippe Morin², Duc minh Nguyen¹, Julien Fatome², Herve Maillotte², Stéphane Pitois², Thibaut Sylvestre¹; ¹Optics/FEMTO-ST institute, Univ. of franche-comte, France; ²institut carnot de bourgogne, universite de bourgogne, France. We report the experimental demonstration of all-optical polarization pulling of an initially polarization-scrambled signal using a fiber-optical parametric amplifier. Nonlinear polarization pulling has been achieved for both the signal and idler with 25 dB gain.

JM5A.16

Optical Characterization of Nonlinear THz Emitters, Silvia Mariani¹, Filippo Ghiglieno¹, Alessio ANDRONICO¹, Ivan Favero¹, Sara Ducci¹, Yanko Todorov¹, Carlo Sirtori¹, Martin Kamp², Mathieu Munsch³, Julien Claudon³, Jean-Michel Gerard³, Giuseppe Leo¹; ¹Physics, Univ. Paris Diderot - Paris 7, France; ²Physics, Wuerzburg Univ., Germany; ³CEA, France. We report on the optical characterization of AlGaAs nonlinear THz emitters based on triply resonant microcylindrical cavities. Reflectivity spectra measured from 2D arrays of pillars showing the excitation of THz whispering gallery modes are presented.

JM5A.17

Engineering of apodized chirped gratings based on desired second-order nonlinearity function, Ameneh Bostani¹, Amirhossein Tehrani¹, Raman Kashyap¹; ¹Ecole Polytechnique de Montreal, Canada. A novel design for apodized aperiodically poled lithium niobate is proposed to generate smooth ultra-wide second-harmonic intensity response. To exactly realize a desired effective second-order nonlinearity function, poled regions should be located in specific places

JM5A.18

Twofold enhancement of the gain bandwidth in two pumps fiber optical parametric chirped pulse amplifiers, Arnaud Mussot¹, Alexandre Kudlinski¹, Emmanuel Hugonot²; ¹phlam, France; ²CEA, France. We demonstrate with realistic numerical simulations that the gain bandwidth of two pumps fiber optical parametric chirped amplifiers can be twice as large as the one of a single pump configuration.

JM5A.19

All-Optical broadband phase noise emulation, Liam Jones¹, Francesca Parmigiani¹, Joseph Kakande¹, Periklis Petropoulos¹, David J. Richardson¹; ¹Optoelectronics Research Centre, Univ. of Southampton, UK. We demonstrate and characterize a technique to emulate broadband phase noise. This is achieved by exploiting cross-phase modulation induced spectral broadening, in a highly nonlinear fiber, of a signal from an intense incoherent light source.

JM5A.20

All-Optical Time-Stretch Digitizer for Capturing Ultrafast Optical Time Series and Rogue Events, Ali Fard¹, Brandon Buckley¹, Sanja Zlatanovic¹, Camille-Sophie Bres¹, Stojan Radic², Bahram Jalali¹; ¹Univ. of California Los Angeles, USA; ²Univ. of California San Diego, USA; ³Ecole Polytechnique Fédérale de Lausanne, Switzerland. We propose an all-optical time-stretch oscilloscope, combining four-wave mixing and time-stretch technique for real-time capture of ultrafast optical time-series, beyond the bandwidths achievable by electronics. As a proof-of-concept, we demonstrate capture of 40-Gbits/s optical data.

JM5A.21

Measurement of phase noise in four-wave mixing and its effect on wavelength conversion, Aravind Anthur¹, Rubeena Shihab¹, Deepa Venkitesh¹; ¹IIT-Madras, India. Increase in phase noise due to Four-Wave Mixing (FWM) is analyzed and experimentally verified using delayed self-heterodyne and heterodyne scheme. The possible scheme is suggested to minimize the phase noise on FWM based wavelength conversion of phase modulated data.

JM5A • Joint Poster Session I—Continued

JM5A.22

Quantum Optics with Strongly Localized Polaritons in Polaritonic Crystals, Alexander P. Alodjants¹, Eugene S. Sedov¹, Sergei M. Arakelian¹, YuanYao Lin², Ray-Kuang Lee²; ¹Physics and Applied Mathematics, Vladimir State Univ. named after A.G. and N.G. Stoletov's, Russian Federation; ²Institute of Photonics Technologies, National Tsing-Hua Univ., Taiwan. We propose a new type of spatially periodic structure representing polaritons in 2D lattice. We examine ground state properties, dissipative dynamics of the system in the presence of two- and three body polariton scattering effects.

JM5A.23

High Power Dual-wavelength Self-similar Parabolic Pulse Yb3+-Doped Fiber Laser, Weici Liu¹, Stefan Skupin^{1,2}, Edward Arévalo¹; ¹Institute of Condensed Matter Theory and Optics, Friedrich Schiller Univ., Germany; ²Max-Planck-Institute for the Physics of Complex Systems, Max-Planck-Institute, Germany. A simple and switchable high power dual-wavelength self-similar parabolic pulse Yb3+-doped fiber laser scheme is proposed, which is based on normal dispersion single-mode fiber, Yb3+ doped gain fiber and multimode fiber Bragg grating.

JM5A.24

Airy Beam-induced Optical Routing, Cornelia Denz¹, Patrick Rose¹, Falko Diebel¹, Martin Boguslawski¹; ¹Institute of Applied Physics, Univ. of Muenster, Germany. We present a new all-optical routing scheme based on the Airy beam family. The demonstrated router has 16 individually addressable output channels and can be used as optically induced splitter with configurable outputs as well.

JM5A.25

Spectral width and pulse duration tuning in Yb+ mode-locked fiber laser with birefringent Lyot filter, Yuri Fedotov¹, Sergey M. Kobtsev¹, Aleksey Rozhin², Sergei K. Turitsyn², Chengbo Mou²; ¹Department of Laser Physics and Innovation Technologies, Novosibirsk State Univ., Russian Federation; ²Photonics Research Group, Aston Univ., UK. A method of pulse duration and spectral width control in all-fiber Ytterbium mode-locked laser with SWCNT is presented. It is shown that PM-fiber can also serve as a spectrally selective filter.

JM5A.26

Detuning in Mode Coupled Waveguides, Scott Shepard¹, Joshua Copeland²; ¹Louisiana Tech Univ., USA; ²CenturyLink, USA. The different propagation speeds in glass and silicon waveguides detunes their coupling. We demonstrate conditions under which maximal power transfer can still be achieved.

JM5A.27

Bidirectional Pumping for Entangled Photons, Abhishek Anchal¹, Pradeep Kumar Krishnamurthy²; ¹Laser Technology Program, Center for Laser Technology, Indian Institute of Technology, Kanpur, India; ²Department of Electrical Engineering and Laser Technology Program, Center for Laser Technology, Indian Institute of Technology, Kanpur, India. We study a bidirectional FWM scheme for entangled photon generation. Simulation shows 26% increase in signal power and a 33% decrease in pump power compared to unidirectional FWM.

JM5A.28

Key regimes of single-pulse generation of fiber lasers mode-locked due to non-linear polarization evolution, Sergey Smirnov¹, Sergey M. Kobtsev¹, Sergey V. Kukarin¹, Alexey V. Ivanenko¹; ¹Department of Laser Physics and Innovation Technologies, Novosibirsk State Univ., Russian Federation. Three key regimes of single-pulse generation of all-normal-dispersion lasers mode-locked due to non-linear polarization evolution are considered. The regimes differ from each other in short-term pulse stability, in shape of spectra and auto-correlation functions

JM5A.29

Čerenkov-type second-harmonic generation in a periodically poled ferroelectric crystal, Ksawery K. Kalinowski¹, Yan Sheng¹, Wieslaw Z. Krolikowski¹; ¹Australian National Univ., Australia. We study both theoretically and experimentally the Čerenkov second-harmonic generation in a periodically poled LiNbO3 crystal. In particular we demonstrate strong sensitivity of the Čerenkov signal to the wavelength and position of the fundamental beam.

JM5A.30

Cherenkov-type second- and third-harmonic generation in random quadratic media, Mousa Ayoub¹, Philip Roedig¹, Jörg Imbrock¹, Cornelia Denz¹; ¹Institute of Applied Physics, Germany. In this contribution, we analyze numerically and experimentally Cherenkov-type second- and third-harmonics in two dimensional random $\chi^{(2)}$ photonic crystals and the effect of the shape and size of individual ferroelectric domains on the spatial intensity distribution.

JM5A.31

Dynamic Weber Soliton, Cornelia Denz¹, Falko Diebel¹, Patrick Rose¹, Martin Boguslawski¹; ¹Institute of Applied Physics, Univ. of Muenster, Germany. We report on the first experimental observation of an oscillating spatial soliton in parabolic Weber photonic lattices imprinted in photorefractive nonlinear media. The existence and propagation of the soliton is shown numerically and experimentally.

JM5A.32

Complex Soliton Dynamics in Lattices with Longitudinal Modulation, Panagiotis Papagiannis¹, Yannis Kominis^{1,2}, Kyriakos Hizanidis¹, Sotiris Droulias¹; ¹School of Electrical and Computer Engineering, National Technical Univ. of Athens, Greece; ²Dept. of Mathematics, Univ. of Patras, Greece. Soliton dynamics in longitudinally modulated optical lattices depend on both their initial power and momentum. New features are revealed such as enhanced beam mobility, dynamical switching and routing, extended and quasiperiodic trapping.

JM5A.33

Withdrawn

JM5A.34

Disorder mapping in VCSELs using frequency-selective feedback, Yoann Noblet¹, Thorsten Ackemann¹, Neal Radwell^{1,2}, Roland Jäger²; ¹Physics, Univ. of Strathclyde, UK; ²Physics and Astronomy, Glasgow Univ., UK; ³ULM Photonics GmbH, Germany. We report on a simple method with a high spectral and spatial resolution for mapping variations in the cavity resonance of a plano-planar broad-area laser based on frequency-selective feedback.

JM5A.35

Optical Induction of Multiperiodic Photonic Ratchets, Cornelia Denz¹, Martin Boguslawski¹, Andreas Kelberer¹, Patrick Rose¹; ¹Institute of Applied Physics, Univ. of Muenster, Germany. We present a highly flexible multiplexing method to optically induce multiperiodic photonic lattices. We demonstrate its versatility by the induction of a photonic ratchet. The corresponding refractive index landscape is analyzed implementing digital holography techniques.

JM5A.36

Thermal nonlinearities in gold nanostructures, Oliver Kahl¹, Dmitry A. Fishman¹, Scott Webster¹, Fabian Niesler^{2,3}, Martin Wegener^{2,3}, David J. Hagan¹, Eric W. Van Stryland¹; ¹CREOL, The College of Optics and Photonics, Univ. of Central Florida, USA; ²Institut für Angewandte Physik, Karlsruhe Institute of Technology (KIT), Germany; ³Institut für Nanotechnologie, Karlsruhe Institute of Technology (KIT), Germany. The plasmon resonance is found to broaden and red-shift under strong femtosecond/picosecond irradiation. Using a standard two-temperature model we find a correlation mapping the electron gas and lattice temperatures to the Drude damping coefficient.

JM5A.37

Fast Effective Nonlinear-Optical Response in Anisotropic Glasses of Co-alkanoates, Svitlana Bugaychuk¹, Anatoliy Tolochko¹, Gerturda Klimusheva¹, Yuriy Garbovskiy^{1,3}, Daria Melnik¹, Inna Tokmenko², Tatiana Mirnaya²; ¹Institute of Physics NAS Ukraine, Ukraine; ²Institute of General and Inorganic Chemistry NAS Ukraine, Ukraine; ³Univ. of Colorado at Colorado Springs, USA. Anisotropic glasses of Co-alkanoates have layered structure. Fast nonlinear response due to changes of electronic polarizability in coordination complexes is investigated. Thermal nonlinear response in metal alkanooates matrices is negligible small.

JM5A.38

Rogue Wave Description: Rational Solitons and Wave Turbulence Theory, Bertrand Kibler¹, Kamal Hammani¹, Claire Michel², Christophe Finot¹, Antonio Picozzi¹; ¹Laboratoire Interdisciplinaire Carnot de Bourgogne, France; ²Laboratoire de Physique de la Matière Condensée, France. We show that rogue waves can emerge from optical turbulence and that their coherent deterministic description provided by the rational solutions is compatible with the statistical description provided by the wave turbulence theory.

JM5A.39

Four-wave mixing instabilities in telecom fibers, Julien Fatome¹, Christophe Finot¹, Guy Millot¹, Andrea Armaroli², Stefano Trillo²; ¹ICB, Université de Bourgogne, France; ²Dipartimento di Ingegneria, Università di Ferrara, Italy. Instabilities in fiber four-wave mixing are investigated, revealing the formation of colliding dispersive shock waves in the normal GVD regime and collective modulation instabilities in the anomalous GVD regime.

JM5A.40

Optical rogue waves in Raman fiber lasers, Stephane Randoux¹, Pierre Suret¹; ¹Université de Lille 1, France. We present an experimental measurement of probability density functions for the power of the intracavity Stokes field in a Raman fiber laser. Rare extreme events associated to a non-gaussian statistics are observed.

JM5A.41

Synchronization of Limit Cycles in Nonlinear Passive Fiber Ring Resonators by Cross-Phase Modulation, Michael Kues¹, Petra Gross¹, Carsten Fallnich¹; ¹Institute of Applied Physics, Germany. The synchronization of limit cycle states occurring in nonlinear fiber ring resonators by a weak coupling via seeding in different polarizations is shown by numerical simulations, leading to an optical control of the frequency comb.

JM5A.42

Analysis of the Multi-Pulsing Instability in Mode-Locked Lasers Using Dynamical Dimension Reduction, Eli Shlizerman¹, J. Nathan Kutz²; ¹Applied Mathematics, Univ. of Washington, USA. We introduce a dimension reduction method for determining the stability of mode-locked pulses and the onset of the multi-pulsing instability. Applying it to the master mode-locking model, operating regimes and high-energy pulses are demonstrated.

JM5A.43

Intermittent Self-Pulsing in a Fiber Raman Laser, Atalla El-Taher¹, Sergey Sergeyev¹, Elena G. Turitsyna¹, Sergei K. Turitsyn¹, Paul Harper¹; ¹Aston Univ., UK. We report on an experimental study of intermittent self-pulsing caused by the coupling of the first and second Stokes cascades in a fiber Raman laser.

JM5A.44

Formation and propagation of shock waves in nonlocal media, Neda Ghofraniha¹, Luigi Amato Santamaria², Viola Follì², Claudio Conti^{2,3}; ¹IPCF, CNR, Italy; ²ISC, CNR, Italy; ³Physics Department, La Sapienza Univ., Italy. We report on the observation of shock waves in nonlocal thermal nonlinear media, investigating the way nonlinearity and nonlocality affect the point of shock formation and its dynamic through the samples.

JM5A • Joint Poster Session I—Continued

JM5A.45

Suppression of the frequency drifts in polarization modulational instability spectra by means of a photon reservoir, Patrice T. Dinda¹, Zambo Abouou¹, Claude M. Ngabireng¹; ¹*Universite de Bourgogne, France*. By appropriately combining the effects of second- and fourth-order dispersion, and by carefully choosing the pump power, we create a photon reservoir which suppresses the drifts of sidebands in the spectra of polarization modulational instability

JM5A.46

Withdrawn

JM5A.47

Nonlinear switching in a purely plasmonic directional coupler, Ulf Peschel¹, Daniel Ploss², Jing Wen¹, Arian Kriesch¹; ¹*Institute of Optics, Information and Photonics: Nonlinear Optics and Nanophotonics, Univ. of Erlangen-Nuremberg, Cluster of Excellence Engineering of Advanced Materials and Erlangen Graduate School in Advanced Optical Technologies, Germany*. Plasmonic components allow for subwavelength integration while simultaneously generating extraordinary field enhancement thus amplifying nonlinear effects. Here we present first experimental results indicating nonlinear switching in a plasmonic directional coupler of a few micrometers length.

JM5A.48

Influence of Nonlinear Pulse Propagation on Squeezed Vacuum Pulse Generation in a Photonic Crystal Fiber, Fumihiko Kannari¹, Shota Sawai¹; ¹*Keio Univ., Japan*. During femtosecond laser pulse propagation through a photonic crystal fiber, copropagation of Stokes and anti-Stokes pulses influences quantum correlation in the broadened spectrum. A -4.0dB squeezed vacuum pulse is obtained with a fiber polarization interferometer.

JM5A.49

Cavity Polariton Breathers, Oleg Egorov¹, Falk Lederer¹; ¹*Institute of Condensed Matter Theory and Solid State Optics, Friedrich-Schiller-Universität Jena, Germany*. We predict the existence of breathing solitons in semiconductor microcavities. Parametric mixing of polaritons from the upper and lower branch of the dispersion relation gives rise to their formation requiring a nonzero excitonic dispersion.

JM5A.50

Power and spectral optimization of random distributed feedback fiber lasers, Dmitriy V. Churkin^{1,2}, Ilya Vatik³, Sergey Babin^{2,3}; ¹*Aston Univ., UK*; ²*Novosibirsk State Univ., Russian Federation*; ³*Institute of Automation and Electrometry SB RAS, Russian Federation*. We present the optimization of power and spectral performances of the random DFB fiber laser using the balance equation set. The numerical results are in good in agreement with experiments.

JM5A.51

Withdrawn

JM5A.52

Quantum-classical correspondence in multidimensional nonlinear systems: Anderson localization and “superdiffusive” solitons, Andrea Fratolocchi¹, Danilo Brambilla¹; ¹*KAUST Univ., Saudi Arabia*. We have theoretically studied Anderson localization in a 2D+1 nonlinear kicked rotor model. The system shows a very rich dynamical behavior, where the Anderson localization is suppressed and soliton wave-particles undergo a superdiffusive motion.

JM5A.53

Gain-controlled Soliton Routing in Dissipative Optical Lattices, Yannis Komninos^{1,2}, Sotiris Droulias¹, Panagiotis Papagiannis¹, Kyriakos Hizanidis¹; ¹*School of Electrical and Computer Engineering, National Technical Univ. of Athens, Greece*; ²*Dept. of Mathematics, Univ. of Patras, Greece*. We investigate dynamical soliton trapping in optical lattices under the presence of gain and loss mechanisms. It is shown that depending on soliton initial power and velocity dynamical gain-controlled routing can take place.

JM5A.54

Nonlinear refractive and absorptive response of a thin nonlocal media, Marcelo D. Iturbe-Castillo¹, Emma V. Ramirez Garcia², Maximino L. Arroyo Carrasco³, Marcela M. Mendez Otero³, Edmundo Reynoso Lara², Sabino Chavez Cerda¹; ¹*Inst Nat Astrofisica Optica Electronica, Mexico*; ²*Benemerita Universidad Autonoma de Puebla, Mexico*. A model to describe both nonlinear refractive and absorptive response of a thin nonlocal media is proposed. The model is used to obtain the far field intensity of the close or open aperture z-scan technique

JM5A.55

Asymmetric collision of two bright spatial solitons in a Kerr media, Marcelo D. Iturbe-Castillo¹, Daysi Ramirez Martinez², Marcela M. Mendez Otero³, Maximino L. Arroyo Carrasco³; ¹*Inst Nat Astrofisica Optica Electronica, Mexico*; ²*Benemerita Universidad Autonoma de Puebla, Mexico*. We study numerically the asymmetric collision of spatial solitons and their waveguide properties. We demonstrated that the amount of energy confined by each waveguide is function of the initial angle and separation between the solitons

JM5A.56

Hydrogen pressure sensor based on a tapered-FBG written by DUV femtosecond laser technique, Susana Silva^{1,2}, L. Coelho^{1,2}, F. X. Malcata^{3,4}, Martin Becker⁵, Manfred W. Rothhardt⁵, Hartmut Bartelt⁵, O. Frazão¹; ¹*INESC Porto, Portugal*; ²*Departamento de Física e Astronomia da Faculdade de Ciências, Universidade do Porto, Portugal*; ³*ISMAI - Instituto Superior da Maia, Portugal*; ⁴*Instituto de Tecnologia Química e Biológica, Portugal*; ⁵*Institute of Photonic Technology, Germany*. An optical fiber sensor based on a tapered-FBG coated with 150 nm-thick Pd film is proposed for hydrogen pressure detection. The FBG was written in a 50 m-diameter tapered fiber by DUV femtosecond laser technology.

JM5A.57

Direct writing of Bragg grating structures in waveguide bundles, Markus Thiel¹; ¹*Fiber Optical Sensor Systems, Fraunhofer HHL, Germany*. Femtosecond laser processing of waveguide bundles with Bragg structures in bulk glass offers the possibility of stronger Bragg reflection signals, due to the higher refractive index contrast. First results of this new design are presented and will be discussed.



PHD OPPORTUNITIES

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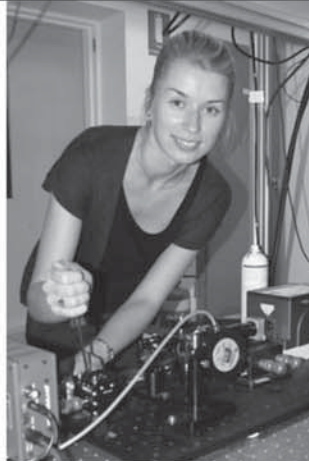
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After completing an internship with CUDOS Sydney in 2010, I saw the opportunity of being part of a world leading group in optics, based in a top-ten rated city.
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At the time I applied for a PhD, the CUDOS group was already well-known around the world as one of the leading photonics research centres. So, when I got a Postgraduate Scholarship I did not hesitate to accept it. I am glad I did it since CUDOS proved to be a strong team of first class optics scientists and very active in promoting professional growth.
IRINA KABAKOVA, RECENT CUDOS PHD GRADUATE, NOW POSTDOCTORAL FELLOW, THE UNIVERSITY OF SYDNEY



I co-founded Envato, which operates thriving internet based marketplaces where over 700,000 members buy and sell digital content, and employs a staff of over 60. Apart from the usual critical thinking abilities, a PhD at CUDOS has given me international experience representing a leading world class research institution and the mindset to build my own enterprise.
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Signal Processing in Photonics Communications

Joint Integrated Photonics Research, Silicon and Nano Photonics/
Nonlinear Photonics

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

07:30–18:00 Registration, Lower Lobby, Conference Level

08:30–10:00

SpTu1A • OFDM I

Xiang Zhou; AT&T Corp., USA, *Presider*

SpTu1A.1 • 08:30 


Real-time Coherent Optical OFDM Receiver for Intradynne Detection in High Data Rate Transmission, Noriaki Kaneda¹, Timo Pfau¹, Stephen Corteselli¹, Qi Yang², Andreas Leven³, Young-Kai Chen¹; ¹Bell labs, USA; ²State Key Laboratory of Optical Communication Technologies and Networks, China; ³Bell Laboratories, Alcatel-Lucent, Germany. We review an implementation of real-time coherent optical OFDM receiver in FPGAs. 28.6-Gb/s data per optical wavelength is demonstrated in intradyne detection. QPSK modulated sub-carriers are detected using 9.83-GS/s ADCs and DSP implemented on FPGAs.

SpTu1A.2 • 09:00

Multi-Band OFDM versus Single-Carrier DP-QPSK for 100 Gbps Long-Haul WDM Transmission, Julie Karaki¹, erwan pincemin¹, Didier Grot¹, Thierry Guillosoy¹, Yves Jaouën², Raphaël Le Bidan³; ¹France Telecom Orange Labs, France; ²Telecom ParisTech, France; ³Telecom Bretagne, France. We experimentally compare the performance of coherent DP-MB-OFDM and DP-QPSK for 100 Gbps long-haul WDM transport. We show that, after transmission over 1000 km of DCF-free G.652 fiber line, DP-MB-OFDM and DP-QPSK have nearly the same performance at 100 Gbps.

SpTu1A.3 • 09:15

Nonlinear transmission performance of reduced guard interval OFDM and quasi-Nyquist WDM, Sean Kilmurray¹, Tobias Fehenberger¹, Polina Bayvel¹, Robert Killely¹; ¹Univ. College London, UK. The nonlinear transmission performance of reduced guard interval OFDM and quasi-Nyquist-WDM (PDM-QPSK, PDM-QAM-8 and PDM-QAM-16) with high information spectral densities is compared over ULAF and SMF, both by simulations and analytically.

SpTu1A.4 • 09:30 

Real-time OFDM and Nyquist transmitters, Juerg Leuthold¹; ¹Karlsruher Institut für Technologie, Germany. We compare OFDM and Nyquist WDM multi-carrier transmission. Single-laser 26 Tbit/s OFDM and 32.5 Tbit/s Nyquist WDM transmission is reported. Experimentally we demonstrate a spectral efficiency of 18 bit/s/Hz.

08:30–10:00

JTu1B • Joint IPR & NP Plenary Session II 

Wieslaw Krolikowski; Australian National Univ., Australia; Dan-Xia Xu; National Research Council, Canada, *Presider*

JTu1B.1 • 08:30  

Technology Platforms for Photonic Integrated Circuits, Michael J. Wale¹; ¹Oclaro Technology Ltd, UK. Generic technology platforms offer attractive design and manufacturing routes of photonic integrated circuits. This paper reviews current position, with particular reference to European platforms based on InP, silicon and dielectric materials.

JTu1B.2 • 09:15  

Complex Nonlinear Opto-Fluidics, Mordechai Segev¹; ¹Technion Israel Institute of Technology, Israel. Our work on symbiotic dynamics of light and nano-particles in liquids will be reviewed. Light-force varies the local particle density, modifies the fluid properties, inducing flow patterns, causing synergetic nonlinear-dynamics of light, nano-particles and fluid.

10:00–10:30 Coffee Break, Centennial Room

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

07:30–18:00 Registration, Lower Lobby, Conference Level

08:30–10:00

BTu1C • Grating Properties and Fabrication: Long Period Gratings

Hans Limberger; Ecole Polytechnique Federale de Lausanne, Switzerland, *Presider*

BTu1C.1 • 08:30

Wavelength-Selective Mode-Switching in a Reflective Long Period Grating Mach-Zehnder Interferometer, John Canning¹, Martin Kristensen^{2,1}, Kevin Cook³; ¹Univ. of Sydney, Australia; ²Engineering, Aarhus Univ., Denmark. We demonstrate that two consecutive long-period-gratings separated by 100mm interfere with high visibility allowing us to switch easily between the core and the cladding mode with a small wavelength shift of 3.2nm, corresponding to a signal switching contrast better than 14dB.

BTu1C.2 • 08:45

Polarization-dependent refractometer based on a surface long-period grating inscribed in a D-shaped photonic crystal fiber, Hyun-Joo Kim¹, Oh-Jang Kwon¹, Young-Geun Han¹; ¹Hanyang Univ., Republic of Korea. Transmission characteristics of a surface long-period grating (SLPG) inscribed in a D-shaped photonic crystal fiber (PCF) are investigated, which exhibits strong dependence on TE and TM polarization modes.

BTu1C.3 • 09:00

Hybrid Sagnac interferometer based on a D-shaped polarization-maintaining fiber incorporating a fiber Bragg grating and a long-period fiber grating, Oh-Jang Kwon¹, Cheolju Kang¹, Young-Geun Han¹; ¹Hanyang Univ., Republic of Korea. A hybrid Sagnac interferometer with a locally D-shaped polarization maintaining fiber (PMF) incorporating a fiber Bragg grating (FBG) and a long-period fiber grating (LPG), is investigated for simultaneous measurement of ambient index and temperature.

BTu1C.4 • 09:15

Long-period fiber grating inscribed in a tapered fiber, Min-Seok Yoon¹, Hyun-Joo Kim¹, Young-Geun Han¹; ¹Hanyang Univ., Republic of Korea. A long-period fiber grating (LPG) written in a tapered fiber was proposed and experimentally demonstrated. Strain sensitivity of the proposed LPG based on a tapered fiber was improved to be -2.99 nm/me.

BTu1C.5 • 09:30

Phase Reconstruction from Transmission for Long-Period Fiber Gratings, Bing Zou¹, Kin S. Chiang¹; ¹Department of Electronic Engineering, City Univ. of Hong Kong, Hong Kong. We demonstrate a method to reconstruct the phase spectrum of a long-period fiber grating (LPG) from its transmission spectrum. We apply the method to different kinds of LPGs and verify it both numerically and experimentally.

BTu1C.6 • 09:45

Post-fabrication wavelength trimming of fiber Bragg gratings by using a 213-nm 8-ps pulsed laser, Yuval P. Shapira¹, Vladimir Smulakovski¹, Boris Spektor¹, Moshe Horowitz¹; ¹Technion - Israel Institute of Technology, Israel. We demonstrate post-fabrication wavelength trimming of FBGs in two fiber types by using a 213-nm pulsed laser and show that it has significant advantages compared to trimming by using Argon-Ion laser.

08:30–10:00

STu1D • Fiber & Fabrication

Shibin Jiang; AdValue Photonics, Inc., USA, *Presider*

STu1D.1 • 08:30

Laser Annealing of Amorphous Silicon Core Optical Fibers, Noel Healy¹, Sakellaris Mailis¹, Todd D. Day², Pier J. Sazio¹, John V. Badding², Anna C. Peacock³; ¹Optoelectronics Research Centre, UK; ²Penn State Univ., USA. Laser annealing of an optical fiber with an amorphous silicon core is demonstrated. The annealing process produces a fiber that has a highly crystalline core, whilst reducing the optical transmission losses by ~3 orders of magnitude.

STu1D.2 • 08:45

Annealing of Semiconductor Core Optical Fibers, Nishant Gupta¹, Colin McMillen², Rajendra Singh^{1,2}, Ramakrishna Podila⁴, Apparao Rao⁴, Thomas Hawkins⁵, Paul Foy³, Stephanie Morris⁵, Kelvin Poole¹, Lin Zhu¹, John Ballato⁵, Robert Rice⁶; ¹Holcombe Department of Electrical and Computer Engineering, Clemson Univ., USA; ²Center for Silicon Nanoelectronics, Clemson Univ., USA; ³Department of Chemistry, Clemson Univ., USA; ⁴Department of Physics and Astronomy, Clemson Univ., USA; ⁵The Center for Optical Materials Science and Engineering Technologies (COMSET) and the School of Materials Science and Engineering, Clemson Univ., USA; ⁶Dreamcatchers Consulting, USA. Ex-situ rapid photothermal annealing is shown, through X-ray diffraction, Raman spectroscopy and Schottky diodes, to enhance the structural homogeneity of silicon optical fibers by increasing local crystallinity, thus advancing their optoelectronic performance.

STu1D.3 • 09:00

Fabrication of Polymeric Micro-Photonic Structures on the Tip of Optical Fibers, Stephen M. Kuebler^{1,2}, Henry E. Williams¹, Daniel J. Freppon¹, Raymond C. Rumpf³; ¹Chemistry Department, Univ. of Central Florida, USA; ²CREOL, The College of Optics and Photonics, Univ. of Central Florida, USA; ³EM Lab, W. M. Keck Center for 3D Innovation, Univ. of Texas at El Paso, USA. A method is described for fabricating truly three-dimensional micro-photonic structures directly onto the end face of an optical fiber.

STu1D.4 • 09:15

Fabrication of Microstructured Fibers Using an Effect of Pressure Self-Regulation in Sealed Holes, Sergey Semjonov¹, Alexander N. Denisov¹, Evgeny Dianov¹; ¹Fiber Optics Research Center, Russian Federation. Theoretical aspects of drawing the holey preform with sealed holes at the top end are discussed. Experimental results on drawing in such a regime are presented.

STu1D.5 • 09:30

One-step Multi-material Preform Extrusion for Robust Chalcogenide Glass Optical Fibers, Guangming Tao¹, Soroush Shabahang¹, Ayman F. Abouraddy¹; ¹Univ. of Central Florida, CREOL, USA. We demonstrate a novel process of one-step extrusion of multi-material fiber preforms containing chalcogenide glasses and polymers. The polymer lends mechanical robustness to the drawn chalcogenide infrared fibers and tapers.

STu1D.6 • 09:45

Molten Core Fabrication of Crystalline Oxide Core Optical Fiber, John Ballato¹, Colin McMillen², Thomas Hawkins¹, Paul Foy¹, Lin Zhu³, Robert Rice⁴, Oscar Stafsudd⁵; ¹The Center for Optical Materials Science and Engineering Technologies (COMSET) and the School of Materials Science and Engineering, Clemson Univ., USA; ²Department of Chemistry, Clemson Univ., USA; ³Holcombe Department of Electrical and Computer Engineering, Clemson Univ., USA; ⁴Dreamcatchers Consulting, USA; ⁵Department of Electrical and Computer Engineering, Univ. of California- Los Angeles, USA. A reactive molten core process was employed to make optical fibers with cores in the bismuth germanate family, containing a biphasic crystalline mixture of acentric Bi₂GeO₅ and cubic bismuth oxide (δ -Bi₂O₃/BiO₂-x).

10:00–10:30 Coffee Break, Centennial Room

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

10:30–12:30

SpTu2A • OFDM IINoriaki Kaneda; *Bell Labs, USA, Presider***SpTu2A.1 • 10:30** 

DSP-enabled OFDM superchannel transmission, Sethumadhavan Chandrasekhar¹, Xiang Liu¹; ¹*Alcatel-Lucent Bell Labs, USA*. Digital signal processing has enabled the generation and detection of orthogonal-frequency-division-multiplexing based superchannels that advantageously leverage parallelism to achieve high data-rate, high spectral-efficiency, and potentially low cost-per-bit.

SpTu2A.2 • 11:00

Raised-Cosine OFDM for Enhanced Out-of-Band Suppression at Low Subcarrier Counts, Rene M. Schmogrow¹, Benedikt Baeuerle¹, David Hillerkuss¹, Bernd Nebendahl¹, Christian Koos^{1,2}, Wolfgang Freude^{1,2}, Juerg Leuthold^{1,2}; ¹*Institute of Photonics and Quantum Electronics, Karlsruhe Institute of Technology, Germany*; ²*Institute for Microstructure Technology, Karlsruhe Institute of Technology, Germany*; ³*Agilent Technologies, Germany*. Raised-cosine instead of rectangular windowing of OFDM symbols provides a steeper spectral roll-off. After dispersion-compensated transmission, inverse windowing at the receiver maintains orthogonality. Therefore, multiple OFDM bands even with few subcarriers can be efficiently multiplexed.

SpTu2A.3 • 11:15

Spectral Shaping on DFT-OFDM for Higher Transmission Reach, Susmita Adhikari¹, Maxim Kuschnerov², Sander L. Jansen², Adriana Lobato³, Oscar Gaete⁴, Beril Inan⁴, Werner Rosenkranz¹; ¹*Christian Albrechts Univ., Germany*; ²*Nokia Siemens Networks, Germany*; ³*Federal Armed Forces Univ., Germany*; ⁴*Technical Univ. of Munich, Germany*. We investigate spectral shaping on DFT-OFDM and show that transmission reach can be significantly improved by 31% and 7% when compared to OFDM and DFT-OFDM for dispersion managed standard single mode fiber links.


SpTu2A.4 • 11:30 

High Performance, Low Overhead CO-OFDM for Next Generation Fiber Transmission Systems, Qunbi Zhuge¹, Mohammad E. Mousa-Pasandi¹, Mohamed Morsy-Osman¹, Xian Xu¹, Mathieu Chagnon¹, Ziad Elsahn¹, David Plant²; ¹*McGill Univ., Canada*. We present novel channel equalization and phase estimation approaches to reduce overhead in reduced-guard-interval (RGI) CO-OFDM systems. We also discuss the tolerance of RGI CO-OFDM to laser phase noise and fiber nonlinearity.


10:30–12:30

ITu2B • Waveguides, Polarizers, and Dispersion Jason Orcutt; *Massachusetts Institute of Technology, USA, Presider***ITu2B.1 • 10:30** 


Silicon-Photonics Devices for Low-Power, High-Bandwidth Optical I/O, Joris Van Campenhout¹, Marianna Pantouvaki¹, Peter Verheyen¹, Hui Yu², Peter De Heyn², Guy Lepage¹, Wim Bogaerts², Philippe Absil¹; ¹*InterUniv. Microelectronics Center, Belgium*; ²*Photonics Research Group, Dept. of Information Technology, Ghent Univ. - imec, Center of Nano- and Biophotonics (NB Photonics), Belgium*. Electro-optic transceivers integrated in silicon-photonics interposers are attractive for realizing low-power high-bandwidth Optical I/O for future advanced logic and memory. We review recent results obtained at imec on low-voltage silicon ring modulators and Ge photodetectors.

ITu2B.2 • 11:00 

High Extinction, Broadband, and Low Loss Planar Waveguide Polarizers, Jared F. Bauters¹, Martijn Heck¹, Daoxin Dai¹, Demis D. John¹, Jonathon Barton¹, Daniel Blumenthal¹, John E. Bowers¹; ¹*UCSB - ECE, USA*. A technique for making high extinction and broadband polarizers in a low loss planar waveguide platform is presented and characterized. Extinction greater than 78 dB is obtained with low loss for the desired polarization.

ITu2B.3 • 11:15 

Engineering Spectral Variation of FSR by Tailoring Dispersion for Octave-Spanning Comb Generation Based on Micro-Resonators, Lin Zhang¹, Vivek Singh¹, Pao-Tai Lin¹, Anuradha Agarwal¹, Lionel C. Kimerling¹, Jurgen Michel¹; ¹*Microphotonics Center and Department of Materials Science and Engineering, Massachusetts Institute of Technology, USA*. The free spectral range of integrated resonators is engineered over an octave-spanning frequency range with greatly improved uniformity, which is enabled by dispersion tailoring using a nano-scale slot structure, for on-chip frequency comb generation.

ITu2B.4 • 11:30 

Waveguide arrays in diffusive photopolymers, Eric Moore¹, Adam Urness¹, Robert McLeod¹; ¹*Electrical, Computer, and Energy Engineering, Univ. of Colorado, USA*. We describe two methods, liquid deposition photolithography and holographic lithography, for fabricating two-dimensional arrays of optical waveguides with high channel counts. Both methods rely on refractive index patterning via monomer diffusion in photosensitive polymers.

10:30–12:30

ITu2C • Slow Light in Photonic CrystalsThomas Krausz; *Univ. of St Andrews, UK, Presider***ITu2C.1 • 10:30** 

Ultrafast nonlinearities and dispersion in slow-light photonic crystal lattices, Chee Wei Wong¹, J. F. McMillan¹, T. Gu¹, M. Marko¹, X. Li¹, P. Hsieh¹, S. Kocaman¹; ¹*Columbia Univ., USA*. We describe the ab initio control of photons in highly-dispersive slow-light photonic crystals and superlattices. Ultrafast nonlinearities such as chip-scale four-wave mixing, regenerative oscillations, self-phase modulation, and phase-resolved soliton dynamics and compression will be highlighted.

ITu2C.2 • 11:00

Narrowband Optical Parametric Gain in Slow Light Photonic Crystal Waveguides, Sourabh Roy¹, Marco Santagiustina¹, Gadi Eisenstein², Amnon Willinger², Sylvain Combrié³, Alfredo De Rossi³; ¹*Department of Information Engineering, Università degli Studi di Padova, Italy*; ²*Electrical Engineering Department, Technion, Israel*; ³*Thales Research and Technology, France*. A complete and rigorous model of parametric gain in photonic crystal waveguides, including dispersive losses, has been derived. The predicted narrowband amplification might enable tuneable slow light device applications.

ITu2C.3 • 11:15

Efficient Parametric Gain at 1.55 μm in a GaInP Photonic Crystal Waveguide, Isabelle Cestier¹, Gadi Eisenstein¹, Sylvain Combrié², Alfredo De Rossi³; ¹*Technion Israel Institute of Technology, Israel*; ²*Thales Research and Technology, France*. We demonstrate efficient optical parametric amplification in 1.5mm long GaInP photonic crystal waveguides operating at 1.55 μm . Owing to low linear and nonlinear losses we achieved a 10.6 dB gain using 31ps, 800mW pump pulses.

ITu2C.4 • 11:30

Distributed Feedback Effects in Active Semiconductor Photonic Crystal Waveguides, Yaohui Chen¹, Jesper Mork¹; ¹*DTU Fotonik, Technical Univ. of Denmark, Denmark*. We present a rigorous coupled-wave analysis of slow-light effects in active photonic crystal waveguides. The presence of active material leads to coherent distributed feedback effects that significantly alter the magnitude and phase of output fields.

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

10:30–12:30

NTu2D • Nonlinear Systems and Nonlinear Dynamics

Dmitry Skryabin; Univ. of Bath, UK, Presider

NTu2D.1 • 10:30

Pulse shaping assisted investigation of interacting dispersion-managed solitons, Alexander Hause¹, Philipp Rohrmann¹, Fedor Mitschke¹; ¹*Institut für Physik Universität Rostock, Germany*. Fiber-optic dispersion-managed solitons can form stable molecules. Systematically mapping out parameter space using a flexible pulse shaper, we investigate the binding mechanism and confirm predictions. Phenomena off equilibrium are also described and explained.

NTu2D.2 • 10:45

Soliton Eigenvalue Evolution in Plasma-Influenced Nonlinear Gas-Fiber Optics, John C. Travers¹, Wonkeun Chang¹, Philipp Hoelzer¹, Philip Russell^{1,2}; ¹*Max Planck Institute for the Science of Light, Germany*; ²*Department of Physics, Univ. of Erlangen-Nuremberg, Germany*. We study the influence of ionization on soliton evolution and the self-frequency blue-shift in a gas-filled photonic crystal fiber by numerically solving the direct scattering problem of a suitably perturbed nonlinear Schrödinger equation.

NTu2D.3 • 11:00

Adler synchronization of spatial laser solitons pinned by defects, Yoann Noblet¹, Pavel Paulau², Craig McIntyre¹, William Firth¹, Pere Colet³, Gian-Luca Oppo¹, Thorsten Ackemann¹; ¹*Physics, Univ. of Strathclyde, UK*; ²*Institut für Theoretische Physik, Technischen Universität, Germany*; ³*IFISC, Universitat Illes Balears, Spain*. Spatial disorder due to growth fluctuations in broad-area semiconductor lasers induces pinning and frequency shifts of spatial laser solitons. We demonstrate frequency and phase-locking between two spatial solitons in VCSELs with frequency-selective feedback.

NTu2D.4 • 11:15

Vector Solitons with Slowly Precessing States of Polarization, Chengbo Mou¹, Sergey Sergeev¹, Aleksey Rozhin¹, Sergei K. Turitsyn¹; ¹*Photonics Research Group, Aston Uni, UK*. We observed new types of polarization rotating vector solitons in a carbon nanotube mode locked fiber laser with anomalous dispersion cavity.

NTu2D.5 • 11:30

Characterization of Temporal Cavity Solitons by Frequency Resolved Optical Gating (FROG), Jae K. Jang¹, Stuart G. Murdoch¹, Stephane Coen¹; ¹*Physics, The Univ. of Auckland, New Zealand*. Temporal cavity solitons, i.e., persistent pulses of a continuously-pumped nonlinear fiber ring cavity, are held stable for several minutes, allowing for the first time their characterization in both amplitude and phase, using FROG.

10:30–12:30

BTu2E • Applications of Gratings and Poled Glass: FBG Sensors and Interrogation systems

Jose Azana; INRS-Energie Materiaux et Telecom, Canada, Presider

BTu2E.1 • 10:30 **Invited**

Plasmons and nanoparticle coatings on optical fibers: playing with Tilted Fiber Bragg Gratings, Jacques Albert¹, Christophe Caucheteur², Li-Yang Shao³, Anatoli Ianoul¹, Sean Barry¹; ¹*Carleton Univ., Canada*; ²*Université de Mons, Belgium*; ³*China Jiliang Univ., China*. Strong, narrowband, and polarized cladding mode resonances from tilted fiber Bragg gratings are used to probe uniform and granular nanoscale metal coatings. The effects of Plasmon field localization on the grating transmission are described.

BTu2E.2 • 11:00

A shear-displacement sensor based on a ferrofluidic defected microstructured optical fibre Bragg grating, Alessandro Candiani^{1,2}, Maria Konstantaki¹, Walter Margulis³, Stavros Pissadakis¹; ¹*IESL, FORTH, Greece*; ²*Department of Fiber Photonics, ACREO, Sweden*; ³*Department of Information Engineering, Univ. of Parma, Italy*. A shear sensor based on a ferrofluid infiltrated microstructured optical fiber Bragg grating is presented. Shear displacements between 250µm and 4.5mm are measured, corresponding to spectral changes in the reflected spectra greater than 5dB.

BTu2E.3 • 11:15

Femtometer-Resolution Wavelength Interrogation of a Phase-Shifted Fiber Bragg Grating Sensor Using an Optoelectronic Oscillator, Ming Li¹, Wangzhe Li², Jianping Yao³, Jose Azana¹; ¹*INRS-Energie Materiaux et Telecom, Canada*; ²*Univ. of Ottawa, Canada*. A novel technique to achieve femtometer-resolution wavelength interrogation of a PSFBG sensor is proposed and demonstrated using an optoelectronic oscillator. Wavelength interrogation of a PSFBG strain sensor with a resolution of 360fm is experimentally demonstrated.

BTu2E.4 • 11:30

Use of an FBG Sensor for In-situ Temperature Measurements of Gas Dielectric Barrier Discharges, Meenu Ahlawat¹, Bachir Saoudi¹, Elton Soares de Lima Filho¹, Michel Wertheimer¹, Raman Kashyap^{1,2}; ¹*Department of Engineering Physics, Ecole Polytechnique de Montreal, Canada*; ²*Department of Electrical Engineering, Ecole Polytechnique de Montreal, Canada*. We report the use of a fibre Bragg grating (FBG), which is immune to electromagnetic-fields and/or high-voltages encountered in plasma environments, to measure the temperature in various noble gases, Nitrogen and air dielectric barrier discharge.

10:30–12:30

STu2F • Fiber Based Devices

Li Qian; Univ. of Toronto, Canada, Presider

STu2F.1 • 10:30 **Invited**

Optical Microfibers and Nanofibers, Limin Tong¹; ¹*Zhejiang Univ., China*. Optical micro-nanofibers exhibit interesting properties including tight optical confinement, high fractional evanescent waves, steep field gradient and abnormal dispersion, which open opportunities for developing microscale fiber-optic components, devices ranging from resonators, lasers to sensors.

STu2F.2 • 11:00 **Invited**

High Power All-Fiber Isolator for 1 Micron Fiber Lasers, Shibin Jiang¹; ¹*AdValue Photonics, Inc., USA*. We successfully developed an all-fiber isolator by using our proprietary Faraday rotator fiber. The throughput power of all-fiber isolator is several times higher than that of current free-space fiber pigtailed isolator.

STu2F.3 • 11:30

A Novel Dual-Core Photonic Crystal Fiber Coupler With A Metal Wire, Shuyan Zhang¹, Xia Yu¹, Ying Zhang¹; ¹*Precision Measurements Group, Singapore Institute of Manufacturing Technology, Singapore*. We report a novel fiber coupler design with plasmonics effect. The coupling length is reduced by 40 times in the near infrared region. The air hole diameter and the pitch size will affect coupler performance.


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

SpTu2A • OFDM II—Continued**SpTu2A.5 • 12:00**


Improving PDL Tolerance of Long-Haul PDM-OFDM Systems Using Polarization-Time Coding, Elie Awwad¹, Yves Jaouën¹, Ghaya Rekaya-Ben Othman¹; ¹Institut Télécom / Télécom ParisTech, France. We show that Polarization-Time codes can mitigate PDL impairments in long-haul OFDM systems. Coding gains are maintained in weakly non-linear regime and no extra penalty is added when non-linear effects become severe.

SpTu2A.6 • 12:15

Beyond 1Tb/s Superchannel Optical Transmission based on Polarization Multiplexed Coded-OFDM over 2300 km of SSME, Ding Zou¹, Ivan B. Djordjevic¹; ¹Electrical and Computer Engineering, Univ. of Arizona, USA. The novel OFDM channel estimation method is used to compensate for chromatic dispersion and polarization-mode dispersion separately. Together with low-density parity-check coded multi-band OFDM, we can achieve beyond 1Tb/s serial transmission over 2300km of SSME without any countable error.

ITu2B • Waveguides, Polarizers, and Dispersion—Continued**ITu2B.5 • 11:45** 

Asymmetric Codirectional Coupler between Regular Nanowaveguide and Slot-waveguide for Polarization Conversion, Benjamin Wohlfeil¹, Lars Zimmermann², Klaus Petermann¹; ¹Institut für Hochfrequenztechnik, Technische Universität Berlin, Germany; ²IHP GmbH, Germany. A polarization converter based on an asymmetric codirectional coupler made of SOI nanowaveguides is proposed. Strong coupling between the fundamental TM mode of a nanowaveguide and the fundamental TE mode of a slot-waveguide is achieved.

ITu2B.6 • 12:00 

An Integratable Electrically Tunable Dispersion Trimming, Kambiz Jamshidi¹, Stefan Meister², Bulent Franke², Aws AlSaadi², Sebastian Kupijai², Thomas Schneider¹; ¹Inst. of High Frequency Technology, HFTL, Germany; ²TU Berlin, Institut für Optik und Atomare Physik, Germany. An electrically tunable dispersion trimming method is proposed which can be integrated in a CMOS compatible process. Feasibility of the method is studied by simulations to produce or compensate variable dispersions up to 65 ps/nm.

ITu2B.7 • 12:15

Withdrawn

ITu2C • Slow Light in Photonic Crystals—Continued**ITu2C.5 • 11:45**

How Much Can Slow Light Increase the Efficiency in Thin-Film Planar Solar Cell Devices?, Olivier G. Deparis¹, Ounsi El Daif¹; ¹Facultes Univ Notre-Dame de la Paix, Belgium; ²IMEC, Belgium. Slow-light induced enhancement of solar light absorption is predicted in Bragg resonators built from layers of active (photovoltaic) and passive (transparent conductive oxide) materials. Applications to photo-current enhancement in realistic thin-film solar cells are discussed.


ITu2C.6 • 12:00 

Resonance fluorescence in a photonic crystal waveguide: Mollow triplet sampling of the slow-light modes, Stephen Hughes¹; ¹Queen's Univ. at Kingston, Canada. We introduce a formalism to study resonance fluorescence of a driven quantum dot in a photonic crystal waveguide. Unusual Mollow triplets emerge due to simultaneous sampling of different parts of the slow-light band structure.

12:30–13:30 Lunch Break, On Your Own


13:30–15:30**SpTu3A • DSP Algorithm I**

Moshe Nazarathy; Technion Israel Institute of Technology, Israel, Presider

SpTu3A.1 • 13:30 

Hardware Efficient Carrier Recovery Algorithms for Single-Carrier QAM systems, Xiang Zhou¹; ¹AT&T Corp, USA. This paper presents an overview on recent advancement of carrier synchronization techniques for optical systems using single-carrier quadrature-amplitude-modulation (QAM), with a special emphasis on a class of newly proposed multi-stage carrier phase recovery algorithms

13:30–15:30**ITu3B • Microphotonic Filters**


Jean Benoit Heroux; IBM Japan, Japan, Presider 

ITu3B.1 • 13:30 

Refractive Index Engineering with Subwavelength Gratings in Silicon Waveguides, Pavel Cheben¹; ¹National Research Council Canada, Canada. Subwavelength structures in silicon waveguides are presented, including practical components such as fiber-chip grating couplers, waveguide crossings, a polarization converter, a waveguide multiplexer and a Terahertz optical switch.

13:30–15:30**ITu3C • Tunable Delay**

Thomas Krauss; Univ. of St Andrews, UK, Presider

ITu3C.1 • 13:30 

Application of Time-Space Duality to Temporal Cloaking, Alexander L. Gaeta¹, Moti Fridman¹, Alessandro Farsi¹, Yoshitomo Okawachi¹; ¹Cornell Univ., USA. We utilize time-lens technology based on parametric four-wave mixing to create a short temporal gap in a light beam that can allow for one dimensional cloaking of an event.

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

NTu2D • Nonlinear Systems and Nonlinear Dynamics—Continued

NTu2D.6 • 11:45

Spatio-temporal collapse of ultrashort pulses in multimode optical fibers, Graham D. Hesketh¹; ¹*Optoelectronics Research Centre, UK*. Investigating MW peak-power ultra-short pulse propagation in multimode fibers using a multimode Schrödinger equation reveals nonlinear and dispersive effects can cause dramatic compression in space-time even for launch peak powers below the self-focusing power, Pcrit.

NTu2D.7 • 12:00

All-fiber transform-limited spectral compression by self-phase modulation of amplitude-shaped pulses, Julien Fatome¹, Bertrand Kibler¹, Esben R. Andresen², Hervé Rigneault³, Christophe Finot⁴; ¹*Laboratoire Interdisciplinaire CARNOT de Bourgogne, France*; ²*Institut Fresnel, France*. We demonstrate efficient spectral compression of picosecond pulses in an all-fiber configuration at telecommunication wavelengths. Thanks to parabolic pulse shaping, a spectral compression by a factor 12 is achieved with an enhanced Strehl ratio.

NTu2D.8 • 12:15

Beam steering using spatial OPA in Kerr media: a space-time analogy of parametric slow-light, Gil Fanjoux¹, Thibaut Sylvestre¹; ¹*Université de Franche-Comté, France*. In a way similar to an optical pulse that can be optically delayed via slow light propagation, we theoretically demonstrate that beam steering can be readily achieved using optical parametric amplification in Kerr-type nonlinear media.

BTu2E • Applications of Gratings and Poled Glass: FBG Sensors and Interrogation systems—Continued

BTu2E.5 • 11:45

Transverse load tilted fiber Bragg grating sensor with variable sensitivity, Tingting Sun^{1,2}, Yang Zhang¹, Jacques Albert¹; ¹*Department of Electronics, Carleton Univ., Canada*; ²*School of Physics and Optoelectronics Engineering, Nanjing Univ. of Information Science & Technology, China*. A transverse load sensor for small forces (<7N) is demonstrated with a tilted fiber Bragg grating compressed between soft materials. The sensitivity of the device is optimized for different force ranges by changing the material.

BTu2E.6 • 12:00

Simultaneous Sensing of Temperature and Strain by Combined FBG and Mode-Interference Sensors, Alexander Siekiera^{1,2}, Rainer Engelbrecht^{1,2}, Lars Buehne¹, Bernhard Schmauss^{1,2}; ¹*Lehrstuhl für Hochfrequenztechnik, Universität Erlangen, Germany*; ²*Erlangen Graduate School in Advanced Optical Technologies, Universität Erlangen, Germany*. We examine the combination of a FBG and mode-interference sensor for simultaneous temperature and strain sensing. Results for temperature and strain sensitivities are presented and the sensor performance in a simultaneous measurement experiment is evaluated.

BTu2E.7 • 12:15

Real-time 3D shape sensing and reconstruction scheme based upon fibre optic Bragg gratings, Ranjeet S. Bhamber¹, Thomas Allsop², G. Lloyd³, David Webb², Juan D. Ania-Castanon¹; ¹*Instituto De Optica "Daza De Valdes", Spain*; ²*Photonics Research Group, Dept of Electronic Engineering, Aston Univ., UK*; ³*Moog Insensys Ltd, UK*. An array of FBG curvature sensors are wavelength-interrogated and the recovered data combined with a three-dimensional algorithm to reconstruct in real time the enveloped object with a 1% to 9% volumetric error.

STu2F • Fiber Based Devices—Continued

STu2F.4 • 11:45

Polymer Optical Fibers for Luminescent Solar Concentration, Esmaeil-Hooman Banaei¹, Ayman F. Abouraddy¹; ¹*Univ. of Central Florida, CREOL, USA*. We present the design and numerical optimization of an all-polymer fiber as a luminescent solar concentrator. Large-area, lightweight, and flexible fabrics constructed of such fibers are a low-cost solar-energy harvesting alternative useful for mobile applications.

STu2F.5 • 12:00

Design and Analysis of Heterogeneous Trench-Assisted Multi-core Fiber under Bending Condition, Jiajing Tu¹, Kunimasa Saitoh¹, Masanori Koshiba¹, Katsuhiro Takenaga², Shoichiro Matsuo²; ¹*Division of Media and Network Technologies, Hokkaido Univ., Japan*; ²*Optics and Electronics Laboratory, Fujikura Ltd, Japan*. Heterogeneous trench-assisted multi-core fiber (Hetero-TA-MCF) is proposed to achieve larger effective area. The crosstalk value at 1550-nm of Hetero-TA-MCF can be lower than -50 dB after 100-km propagation.

STu2F.6 • 12:15

Multimaterial Fibers for Generating Structured Nanoparticles, Joshua J. Kaufman¹, Guangming Tao¹, Soroush Shabahang¹, Esmaeil-Hooman Banaei¹, Ayman F. Abouraddy¹; ¹*Univ. of Central Florida, CREOL, USA*. We present a pathway to the fabrication of structured spherical nanoparticles that leverages the scalability of fiber fabrication technology and an in-fiber Playteau-Rayleigh capillary instability. Thermal treatment of multi-material fibers post-drawing produces spherical nanoparticles.

12:30–13:30 Lunch Break, On Your Own

13:30–15:30

NTu3D • Nonlinearities in Novel Propagation Environments

Anna Peacock; *Univ. of Southampton, UK, Presider*

NTu3D.1 • 13:30 **Invited**

Photonic microcells, Fetah Benabid¹; ¹*Univ. of Bath, UK*. We review the recent progress on hollow-core photonic crystal fibers and its integrated form of photonic microcells in both their design and fabrication and in their applications for coherent optics, Raman comb generation laser metrology, and discharge based lasers.

13:30–15:30

BTu3E • Sensor Symposium I

Sophie LaRoche; *Universite Laval, Canada, Presider*

BTu3E.1 • 13:30 **Invited**

Measuring Detonation, Deflagration and Burn Velocities with Fiber-optic Bragg Grating Sensors, Jerry Benterou¹, Eric Udd²; ¹*Detonation Science, Lawrence Livermore National Laboratory, USA*; ²*Applied Science, Columbia Gorge Research, USA*. Embedded fiber-optic Bragg grating sensors allow the measurement of the progress of high-speed reactions inside energetic materials. These sensors show promise as tools to measure the performance of solid rocket motor propellants and high explosives.

13:30–15:30

STu3F • Mid IR

Ishwar Aggarwal; *Univ of North Carolina at Charlotte, USA, Presider*

STu3F.1 • 13:30

Guided mode resonance filter as wavelength selecting element in Er:ZBLAN fiber laser, Eric G. Johnson¹, Yuan Li¹, Ryan Woodward¹, Menelaos Poutous¹, Indumathi Raghu¹, Ramesh Shori²; ¹*Clemson Univ., USA*; ²*Naval Air warfare Center, USA*. A Guided Mode Resonance filter is fabricated and integrated into a Er:ZBLAN fiber laser as a selective feedback element, with a tunable laser range between 2.7–2.9 μm .

STu3F.2 • 13:45

High-purity tungstate-tellurite glasses for Mid-IR, Vitaly Dorofeev¹, Alexander Moiseev¹, Igor Kraev¹, Sergey Motorin¹, Alexey F. Kosolapov²; ¹*Institute of Chemistry of High-Purity Substances RAS, Russian Federation*; ²*Fiber Optics Research Center RAS, Russian Federation*. Monolithic preforms of high-purity TeO₂-WO₃-La₂O₃-Bi₂O₃ glasses were produced. Absorption of hydroxyl groups was down to $n \times 0.001 \text{ cm}^{-1}$ at $\sim 3 \mu\text{m}$ in both core and cladding. Optical fibers with loss less than 0.5 dB/m at region of 1.2–2.8 μm were made from them.

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

SpTu3A • DSP Algorithm I—Continued

SpTu3A.2 • 14:00

Joint ICI Cancellation based on Adaptive Cross-Channel Linear Equalizer for Coherent Optical Superchannel Systems, Cheng Liu¹, Jie Pan¹, Thomas F. Detwiler^{1,2}, Andrew J. Stark¹, Yu-Ting Hsueh¹, Gee-Kung Chang¹, Stephen E. Ralph¹, ¹Georgia Institute of Technology, USA; ²Adtran Inc., USA. We demonstrate a novel joint adaptive ICI cancellation algorithm based on "super receiver" architecture for superchannel coherent systems. Improved performance over conventional coherent receivers is achieved for both BTB and after 960km SSMF transmission.

SpTu3A.3 • 14:15

Inter-Channel Crosstalk Cancellation by MAP Detection for Nyquist-WDM Superchannel, Jie Pan¹, Cheng Liu¹, Thomas F. Detwiler¹, Andrew J. Stark¹, Yu-Ting Hsueh¹, Stephen E. Ralph¹, ¹Electrical and Computer Engineering, Georgia Institute of Technology, USA. A novel maximum a posteriori (MAP) inter-channel interference (ICI) cancellation algorithm for the Nyquist-WDM system is proposed and demonstrated with improved system performance.

SpTu3A.4 • 14:30 **Invited**

Efficient Training-Based Channel Estimation for Coherent Optical Communication Systems, Fabio Pittala^{1,2}, Amine Mezghani³, Fabian N. Hauske¹, Yabin Ye¹, Idelfonso T. Monroy², Josef A. Nossek¹, ¹European Research Center, Huawei Technologies Co Ltd, Germany; ²Fotonik, Technical Univ. of Denmark, Denmark; ³Institute for Circuit Theory and Signal Processing, Technische Universität München, Germany. A low-complexity technique for frequency domain channel estimation based on constant amplitude zero-autocorrelation (CAZAC) sequences is theoretically investigated.

SpTu3A.5 • 15:00

Outage Probability derivations for PDL-disturbed Coherent Optical Communication, Pierre Delesques^{1,2}, Philippe Ciblat², Gwillerm Froc¹, Yves Jaouën², Cédric Ware², ¹System, Network & Services, Mitsubishi Electric R&D Centre Europe, France; ²Communications & Electronics, Institut Télécom/Télécom ParisTech, France. We derive in closed-form the outage probability for different statistical models of PDL and evaluate their accuracy. From the resulting expressions, we quantify its impact on optical transmissions as an SNR penalty.

ITu3B • Microphotonic Filters—Continued

ITu3B.2 • 14:00 **▶**

Design and Fabrication of Mid-IR Guided Mode Resonance Filters, Eric G. Johnson¹, Ryan Woodward¹, Menelaos Poutous¹, Aaron Pung¹, Yuan Li¹, Indumathi Raghun¹, ¹Clemson Univ., USA. This paper summarizes design and fabrication results for Mid-IR Guided Mode Resonance filters based on Hexagonal and Rectangular arrays for use at 2.8 μm . The devices are fabricated in Quartz substrates with Hafnium Dioxide.

ITu3B.3 • 14:15 **▶**

Apodized comb filters on SOI using sidewalled sampled gratings, Venkatakishnan Veerasubramanian¹, Guillaume Beaudin², Alexandre Giguere², Boris Le Drogoff³, Vincent Aimez², Andrew G. Kirk¹, ¹McGill Univ., Canada; ²Univ. of Sherbrooke, Canada; ³INRS, Canada. We propose comb filters using sidewalled sampled gratings, where the etch depths in the fingers and spaces have been apodized in a complementary fashion. We numerically demonstrate filters with 40 dB SMSR, 92 GHz bandwidth, 200 GHz channel spacing, and 120 dB/decade roll-off.

ITu3B.4 • 14:30 **▶**

Differentiation between changes in liquid refractive index and surface adsorbed molecular thickness using SOI wire waveguide ring resonator biosensor arrays, Yuki Atsumi^{1,2}, Dan-Xia Xu¹, Andre Delage¹, Jens Schmid¹, Martin Vachon¹, Pavel Cheben¹, Siegfried Janz¹, Nobuhiko Nishiyama², Shigehisa Arai^{2,3}, ¹Institute for Microstructural Sciences, National Research Council Canada, Canada; ²Dept. of Electrical and Electronic Engineering, Tokyo Institute of Technology, Japan; ³Quantum Nanoelectronics Research Center, Tokyo Institute of Technology, Japan. For silicon wire based ring resonator biosensors, we investigate the retrieval of changes in the cladding-liquid refractive index and adsorbed molecular-film thickness by monitoring the resonance-shifts of sensors operating in the TE and TM polarizations.

ITu3B.5 • 14:45 **▶**

Low cross-talk silica arrayed-waveguide grating for visible light spectroscopy, Junya Odori¹, Takemasa Yoshida¹, Keisuke Sorimoto¹, Hisao Iitsuka², Hitoshi Kawashima², Tsuda Hiroyuki¹, ¹Science and Technology, Keio Univ., Japan; ²National Institute of Advanced Industrial Science and Technology, Japan. Silica arrayed-waveguide grating with a channel spacing of 2 nm for visible light was fabricated. The loss and the cross-talk at around the center wavelength of 671.2 nm were 5.39 dB and -30.1 dB, respectively.

ITu3B.6 • 15:00 **▶**

Widely and continuously tunable narrow-band photonic filters with MEMS integration, Guanquan Liang¹, ¹Electrical and Computer Engineering, National Univ. of Singapore, Singapore. A planar silicon photonic structure is designed for narrow-band filtering (~2 nm) in a wide photonic band gap (~210 nm) with broad tunable resonant range (~100 nm) around the optical communication wavelength 1550 nm.

ITu3C • Tunable Delay—Continued

ITu3C.2 • 14:00 **Invited**

On-chip Slow and Fast Light Using Stimulated Brillouin Scattering, Ravi Pant¹, Adam Byrnes¹, Christopher G. Poulton², Enbang Li¹, Duk-Yong Choi², Steve J. Madden³, Barry Luther-Davies³, Benjamin J. Eggleton¹, ¹CUDOS School of Physics, Univ. of Sydney, Australia; ²CUDOS, School of Mathematical Sciences, Univ. of Technology Sydney, Australia; ³CUDOS, Laser Physics Centre, Australian National Univ., Australia. We report the first demonstration of on-chip SBS slow and fast light using stimulated Brillouin scattering. Slow (~2307 km/s), fast and negative (~-6818 km/s) group velocities were observed in a 7cm long chalco-genide waveguide.

ITu3C.3 • 14:30

Highly Tunable Delay Line with Linear Phase Modulation and Optical Filtering, Arash Mokhtari¹, Kambiz Jamshidi¹, Stefan Preussler¹, Avinoam Zadok², Thomas Schneider¹, ¹Institut für Hochfrequenztechnik, Hochschule für Telekommunikation Leipzig, Germany; ²Faculty of Engineering, Bar-Ilan Univ., Israel. Tunable delay and advancement of 10 GHz pulses by over 300 ps and minimal distortion is demonstrated experimentally. The method is based on frequency-to-time mapping, subsequent modulation by a simple sine wave and judicious filtering.

ITu3C.4 • 14:45

Phase Characteristics of EIT-Like Spectral Responses in Coupled Ring-Resonators, Xiaoyan Zhou¹, Lin Zhang², Hao Zhang¹, Wei Pang¹, ¹State Key Laboratory of Precision Measuring Technology and Instruments, Tianjin Univ., China; ²Microphotonics Center and Department of Materials Science and Engineering, Massachusetts Institute of Technology, USA. We show different phase responses in the coupled ring-resonators that exhibit an EIT-like amplitude response, corresponding to three operating regimes. This deepens our understanding of the double-resonator devices in terms of delay and nonlinear performance.

ITu3C.5 • 15:00 **Invited**

Physics and applications of slow and fast light in semiconductor optical waveguides, Jesper Mørk¹, Yaohui Chen¹, Sara Ek¹, Minhao Pu¹, Kresten Vind¹, ¹Danmarks Tekniske Universitet, Denmark. We review the physics of slow and fast light based on coherent population oscillations in active semiconductor waveguides. Exploiting these effects, microwave phase shifters realizing 360 degree phase shift and operating at tens of GHz have been realized.

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

NTu3D • Nonlinearities in Novel Propagation Environments—Continued

NTu3D.2 • 14:00

Theory of photoionization-induced nonlinear phenomena in gas-filled photonic crystal fibers, Mohammed F. Saleh¹, Wonkeun Chang¹, Philipp Hoelzer¹, John C. Travers¹, Nicolas Joly^{1,2}, Philip Russell^{1,2}, Fabio Biancalana¹, ¹Max-Planck-Inst Physik des Lichts, Germany; ²Physics, Univ. of Erlangen-Nuremberg, Germany. Based on a recently developed model that is able to describe pulse propagation in gas-filled hollow-core PCFs, we show that the photoionization process can lead to soliton self-frequency blue-shift, self-phase modulation, and modulation instability.

NTu3D.3 • 14:15

Cross-Phase Modulation in a Hydrogenated Amorphous Silicon Optical Fiber, Priyanth Mehta¹, Noel Healy¹, Todd D. Day², Pier J. Sazio¹, John V. Badding², Anna C. Peacock¹, ¹Optoelectronics Research Centre, Univ. of Southampton, UK; ²Department of Chemistry and Materials Research Institute, Pennsylvania State Univ., USA. We experimentally demonstrate cross-phase modulation (XPM) in a hydrogenated amorphous silicon-silica optical fiber. Additional numerical analysis shows that shifts in the probe wavelength are induced by the pump indicating potential for Kerr based switch applications.

NTu3D.4 • 14:30

Nonlinear control of the trajectory and spectrum of Airy beams, Yi Hu^{1,2}, Zhe Sun², Domenico Bongiovanni¹, Daohong Song², Zhuoyi Ye³, Cibo Lou², Jingjun Xu², Zhigang Chen^{2,3}, Roberto Morandotti¹, ¹INRS-EMT, UNIV. OF QUEBEC, Canada; ²TEDA Applied physics school, Nankai Univ., China; ³Department of Physics & Astronomy, San Francisco State Univ., USA. We demonstrate the nonlinear control of self-accelerating Airy beams. We show that under both self-focusing/defocusing nonlinearities, the ballistic trajectory of an Airy beam persists while its spatial spectrum reshapes, leading to distance-dependent negative/positive spectral defects

NTu3D.5 • 14:45

Nonlinearity-induced suppression of Landau-Zener tunneling, Alois Regensburger^{1,2}, Christoph Bersch^{1,2}, Georgy Onishchukov², Ulf Peschel¹, ¹Institute of Optics, Information and Photonics, Univ. of Erlangen/Nuremberg, Germany; ²Max Planck Institute for the Science of Light, Germany. We experimentally demonstrate discrete temporal diffraction, Bloch oscillations and Landau-Zener tunneling in a fiber network. For increasing power levels Landau-Zener tunneling is suppressed thus leading to nonlinear localization at a few lattice sites.

NTu3D.6 • 15:00

Kovacs and inverse Kovacs effect in the optical scale-free regime, Eugenio Del Re^{1,2}, Jacopo Parravicini^{1,2}, Aharon Agranat³, Claudio Conti^{1,4}, ¹Physics, Univ. of Roma La Sapienza, Italy; ²CNR-IPCE, Univ. of Rome Sapienza, Italy; ³Applied Physics, Hebrew Univ. of Jerusalem, Israel; ⁴CNR-ISC, Univ. of Rome Sapienza, Italy. We demonstrate a Kovacs and inverse Kovacs effect in the optical response of out-of-equilibrium ferroelectrics by activating scale-free optical propagation and diffraction cancellation through small-amplitude temperature humps.

BTu3E • Sensor Symposium I—Continued

BTu3E.2 • 14:00 **Invited**

Miniaturized Photonic Sensors with Fiber Lasers, Geoffrey A. Cranch¹, Gary A. Miller¹, Clay Kirkendall¹, ¹US Naval Research Laboratory, USA. This manuscript and accompanying talk will describe a range of miniature photonic sensors that have been developed based on fiber laser strain sensor technology. These include hydrophones, inertial and magnetic field sensors.

BTu3E.3 • 14:30 **Invited**

Regenerated Gratings for Optical Sensing in Harsh Environments, John Canning¹, ¹Univ. of Sydney, Australia. Regeneration and its application to developing high temperature resistant gratings and applications is reviewed.

BTu3E.4 • 15:00 **Invited**

Polymer optical fibre Bragg gratings, David J. Webb¹, ¹Aston Institute of Photonic Technologies, Aston Univ., UK. This paper provides a review of the current state of research and development into polymer fibre Bragg gratings, along with a description of some current challenges.

STu3F • Mid IR—Continued

STu3F.3 • 14:00

Modeling and experimental research of nano- and microstructured IR fibers (2-40 μm) based on defective crystals, Andrey I. Chazov¹, Alexandr S. Korsakov¹, Dmitry S. Vrublevsky¹, Viktor S. Korsakov¹, Vladislav V. Zhukov¹, Liya V. Zhukova¹, Sergey Kortov¹, ¹Ural Federal Univ. named after the first President of Russia B.N.Eltsin, Russian Federation. Microstructured infrared fibers made of silver halide solid solutions doped with TlI are discussed. A few types of fibers have been designed using dedicated software. The waveguides manufactured showed wider transmission range up to 2-40 μm , low optical losses of 0.1 dB/m and improved flexibility.

STu3F.4 • 14:15

Reactive In-Situ Processing of Silicon Optical Fiber, Stephanie Morris¹, Thomas Hawkins¹, Paul Foy¹, Colin McMillen², Jiahua Fan³, Lin Zhu³, Roger Stolen¹, John Ballato¹, Robert Rice⁴, ¹The Center for Optical Materials Science and Engineering Technologies (COMSET) and the School of Materials Science and Engineering, Clemson Univ., USA; ²Department of Chemistry, Clemson Univ., USA; ³Department of Electrical and Computer Engineering, Clemson Univ., USA; ⁴Dreamcatchers Consulting, USA. Silicon carbide (SiC) is added to the silicon (Si) core of crystalline core optical fibers to provide an in-situ reactive getter of oxygen to achieve oxygen-free fibers in order to minimize scattering and propagation loss.

STu3F.5 • 14:30 **Invited**

Progress in Fluoride Glass Fibers, Mohammed Saad¹, ¹Irphotonics, Canada. Recently, tremendous progress has been made in fluoride glass fiber technology. Fiber transmission has been extended up to 5.5 μm by using indium fluoride glass fibers. Current Fiber loss is around 45 dB/km and more than 100 kpsi mechanical strength.

STu3F.6 • 15:00

Mid-IR coherent supercontinuum generation in all-solid step-index soft glass fibers, Alexander M. Heidt¹, Francesco Poletti¹, Jonathan Price¹, David J. Richardson¹, ¹Optoelectronics Research Centre, Univ. of Southampton, UK. We numerically demonstrate that normal dispersion femtosecond pumping of tailored soft glass step-index fibers can generate highly coherent mid-IR supercontinuum light with two octaves bandwidth, suitable for recompression to few-cycle pulse durations.

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

SpTu3A • DSP Algorithm I—Continued**SpTu3A.6 • 15:15**

On the Performance of a Soft Decision FEC Scheme Operating in Highly Non-Linear Regime, Paolo Leoni¹, Vincent Sleiffer², Stefano Calabrò³, Maxim Kuschnerov³, Sander L. Jansen³, Bernhard Spinnler³, Berthold Lankl¹; ¹Institut für Informationstechnik, Universität der Bundeswehr München, Germany; ²COBRA institute, Eindhoven Univ. of Technology, Netherlands; ³Nokia Siemens Networks GmbH & Co. KG, Germany. We investigated the performance of a hybrid FEC scheme against nonlinearities, implementing a 100 Gbps-PDM-DQPSK system, with equally modulated neighboring channels. Experimental results show that the code input-output BER relationship remains unaffected.

ITu3B • Microphotonic Filters—Continued**ITu3B.7 • 15:15**

Polarization-Independent Guided-Mode Resonance Filter with Crossed Integration of Waveguide Cavity Resonators, Kenji Kintaka¹, Tatsuya Majima², Koji Hatanaka², Junichi Inoue², Shogo Ura²; ¹Natl Inst of Adv Industrial Sci & Tech, Japan; ²Kyoto Institute of Technology, Japan. A cavity-resonator-integrated guided-mode resonance filter (CRIGF) can provide high-efficiency narrowband reflection with a small aperture. Polarization-independent reflection was experimentally demonstrated by crossed integration of two CRIGFs with 10 μm aperture for the first time.

ITu3C • Tunable Delay—Continued

15:30–16:00 Coffee Break, Centennial Room

16:00–18:00**SpTu4A • Subsystems**

Kim Roberts; Ciena Corporation, Canada, President

SpTu4A.1 • 16:00 **Invited**

Dynamic optical arbitrary waveform generation and measurement for telecommunications, Nicolas K. Fontaine¹, David J. Geisler², Ryan P. Scott², S.J. Ben Yoo²; ¹Alcatel-Lucent Bell Labs, USA; ²Dept. of Electrical and Computer Engineering, Univ. of California, Davis, USA. Spectral slice optical arbitrary waveform generation and measurement techniques synthesize and characterize wideband waveforms in many spectral slices. We show 160-GHz bandwidth measurements using 4 slices and 60-GHz bandwidth waveform generation in 6 slices.

SpTu4A.2 • 16:30

Spurious-Free Dynamic Range of a High-Speed Photonic Time-Stretch A/D-Converter System, Caroline Gee¹, George Seffler¹, Peter DeVore¹, George Valley¹; ¹The Aerospace Corporation, USA. We measure spurious-free dynamic range (SFDR) for a 10GHz photonic time-stretch A/D-Converter (TS-ADC) system. Second-order spurs limit the SFDR to 92dB-Hz^{1/2} near 5GHz. Simulations that include modulator arm bias mismatch and equalization agree with experiments.

SpTu4A.3 • 16:45

Single-shot and real-time self-referenced phase characterization of GHz-rate QPSK signals, Hamed Pishvai Bazargani¹, Jose Azana¹, Claire Callender², Antonio Malacarne¹, Jean-Baptiste Quéléne¹, Patrick Dumais²; ¹INRS, Canada; ²Communications Research Center (CRC, Canada). Phase Reconstruction using Optical Ultrafast Differentiation (PROUD) is implemented in an integrated-waveguide format, demonstrating self-referenced phase characterization of GHz-rate Quadratic Phase-Shift Keying (QPSK) signals in a single-shot and in real-time.

16:00–18:00**ITu4B • Integration of Silicon Photonics with Other Technologies**

Christopher Doerr; Alcatel-Lucent, USA, President

ITu4B.1 • 16:00 **Invited**

Hybrid Si/III-V Devices for Optical Interconnects, John E. Bowers¹, Martijn J. Heck¹, Yongbo Tang¹, Siddharth Jain¹; ¹Univ. of California Santa Barbara, USA. A hybrid silicon integrated broadband (60 nm) DFB array and high-speed modulator (50 Gbps) are presented, showing the potential of this technology for future transmitters in optical interconnects.

ITu4B.2 • 16:30 **Invited**

Silicon-silica monolithic photonic integration for telecommunications applications, Tai Tsuchizawa¹, Hidetaka Nishi¹, Rai Kou¹, Hiroshi Fukuda², Hiroyuki Shinjima¹, Yasuhiko Ishikawa², Kazumi Wada², Koji Yamada¹; ¹NTT Corporation, Japan; ²Univ. of Tokyo, Japan. Applying silicon photonics to telecommunications, which requires low loss and polarization independence, we have developed a photonic platform monolithically integrating dynamic devices made with Si wire waveguides and passive devices made with high-delta silica waveguides.

16:00–18:00**ITu4C • Metamaterials, Sensors, and Optical Properties of Nanoparticles**

Anatoly Zayats; Univ of London King's College London, UK, President

ITu4C.1 • 16:00 **Invited**

The Road Ahead for Metamaterials: Improved material Building Blocks, Alexandra Boltasseva^{1,2}; ¹Purdue Univ., USA; ²Technical Univ. of Denmark, Denmark. New plasmonic materials such as transparent conducting oxides and transition-metal nitrides could replace conventional silver and gold in optical metamaterials and offer many advantages including low loss, compatibility with standard semiconductor nanofabrication processes, and tunability.

ITu4C.2 • 16:30

200ps compact tunable true-time delay line for microwave photonic applications, Sylvain Combré¹, Pierre Colman^{1,2}, Gaëlle Lehoucq¹, Alfredo De Rossi¹; ¹Thales Research and Technology, France; ²Danmarks Tekniske Universitet, Denmark. Using the large group indices ($v_g < c/50$) available in Photonic Crystal waveguides, a 200ps tunable true-time delay line is demonstrated over a 20GHz bandwidth. The total footprint of the device is about 1.5mm x 15μm.

ITu4C.3 • 16:45

Sensitive Detection of Organic Compounds by Positional Localization on Asymmetric Split Ring Resonator Arrays, Richard M. De La Rue^{1,2}; ¹Universiti Malaya, Malaysia; ²School of Engineering, Univ. of Glasgow, UK. Asymmetric Split-Ring Resonators (A-SRRs) exhibit steep reflection resonances and trapped-modes. By localizing polymethyl-methacrylate (PMMA) films at specific positions on A-SRR nanoantenna arrays, it is possible to obtain sensitive detection and enhancement of molecular resonance features.

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

NTu3D • Nonlinearities in Novel Propagation Environments—Continued

NTu3D.7 • 15:15

Sub-Wavelength Nonlinear Accelerating Beams, Ido Kaminer¹, Mordechai Segev¹; ¹*Technion Israel Institute of Technology, Israel*. We show that optical nonlinearities allow sub-wavelength beams to propagate in circular trajectories without being attenuated in spite of their partially evanescent spectrum. Such beams are exact solutions to Maxwell's equations with Kerr or saturable nonlinearity

BTu3E • Sensor Symposium I—Continued

STu3F • Mid IR—Continued

STu3F.7 • 15:15

Ultra low loss fluoride glass fibers for supercontinuum generation and fiber lasers, Gwenael Maze¹, Marcel Poulain¹; ¹*Le Verre Fluore, France*. Low optical losses at pump and emission wavelengths are required for supercontinuum generation and high power fiber lasers. Metal fluoride of high purity are needed for that purpose.

15:30–16:00 Coffee Break, Centennial Room

16:00–18:00

NTu4D • Spatial Effects and Periodic Structures

Karsten Rottwitt, *Danmarks Tekniske Universitet, Denmark, Presider*

NTu4D.1 • 16:00 **Invited**

Parametric Cavity Polariton Solitons, Falk Lederer¹, Oleg A. Egorov²; ¹*Univ. of Jena, Germany*. We review stable resting 1D bright cavity polariton solitons in semiconductor microcavities. These solitons exist due to phase-matched parametric mixing in cases where the product of dispersion and nonlinearity has the 'wrong' sign.

NTu4D.2 • 16:30

Observation of spontaneous parametric down-conversion in quadratic nonlinear waveguide arrays, Alexander S. Solntsev¹, Frank Setzpfandt², Falk Eilenberger², Che W. Wu¹, Dragomir Neshev¹, Andrey A. Sukhorukov¹, Thomas Pertsch², Yuri S. Kivshar¹; ¹*Nonlinear Physics Centre, Australian National Univ., Australia*; ²*Institute of Applied Physics, Abbe Center of Photonics, Friedrich-Schiller-Universität Jena, Germany*. We characterize experimentally the process of bi-photons generation through spontaneous parametric down-conversion in LiNbO₃ waveguide arrays. We demonstrate the formation of unique spatial-spectral distribution of photons and its dependence on phasematching conditions.

NTu4D.3 • 16:45

Observation of Discrete Solitons and Truncated Bloch-Wave Solitons in Time, Christoph Bersch^{1,2}, Georgy Onishchukov¹, Ulf Peschel¹; ¹*Max-Planck Institute for the Science of Light, Germany*; ²*Institute of Optics, Information and Photonics, Univ. Erlangen-Nuremberg, Germany*. We experimentally observe the formation of discrete temporal solitons, truncated Bloch-wave solitons and arbitrary soliton clusters in time-periodic potentials. In the recirculating fiber-loop setup, the complete nonlinear evolution is monitored with an all-optical oscilloscope.

16:00–17:30

BTu4E • Sensor Symposium II

Morten Ibsen; *Univ. of Southampton, UK, Presider*

BTu4E.1 • 16:00 **Invited**

Advanced Optical FBG Sensor Systems and Examples of Their Application in Energy Facility Monitoring, Reinhardt Willsch¹, Wolfgang Ecke¹, Manfred W. Rothhardt¹, Hartmut Bartelt¹; ¹*Institute of Photonic Technology (IPHT), Germany*. Design and realization of fiber Bragg grating sensor systems are described for implementation of structural health monitoring in energy plants. Application examples in conventional, renewable, and nuclear energies demonstrate their potential in advanced energetics.

BTu4E.2 • 16:30 **Invited**

Fiber Bragg Gratings in Air-Hole Microstructured Fibers for High-Temperature Pressure Sensing, Rongzhang Chen¹, Tong Chen¹, Qingqing Wang¹, Charles Jewart¹, Botao Zhang¹, Kevin Cook², John Canning², Dan Grobnic³, Stephen J. Mihailov³, Kevin P. Chen¹; ¹*Electrical and Computer Engineering, Univ. of Pittsburgh, USA*; ²*Interdisciplinary Photonics Laboratories, School of Chemistry, Univ. of Sydney, Australia*; ³*Communication Research Center Canada, Canada*. We report two types of high temperature fiber Bragg gratings fabricated in air-hole microstructured fibers using femtosecond laser direct writing and thermal regeneration. The gratings are tested for pressure sensing at temperature up to 800°C

16:00–18:00

STu4F • Fiber Lasers I

Scott Christensen; *Lockheed Martin Coherent Technologies, USA, Presider*

STu4F.1 • 16:00 **Invited**

Progress on Tm-doped Fiber Lasers, Lawrence Shah¹, Andrew Sims¹, Pankaj Kadwani¹, Joshua D. Bradford¹, Christina C. Willis¹, Martin Richardson¹; ¹*Univ. of Central Florida, CREOL, USA*. We will present recent efforts in the Laser Plasma Laboratory to develop 100 W polarized, narrow linewidth, quasi diffraction-limited CW Tm-fiber "light engines" for spectral beam combining and propagation experiments at 2030-2050 nm.

STu4F.2 • 16:30

High-energy and high-peak-power nanosecond pulse generation based on an all-fiber MOPA scheme, Wang Jianjun¹; ¹*Research Center of Laser Fusion, CAEP, China*. A high energy and high peak power nanosecond pulsed source based on all fiber configuration is presented. 36mJ/10ns and 3.6MW/10ns output was obtained.

STu4F.3 • 16:45

Theoretical and Experimental Results Comparing the Modal Instability Threshold in Photonic Crystal Fibers with and without Gain Tailoring, Clint Zeringue¹, Craig Robin², Iyad Dajani²; ¹*ZMod-Dynamic LLC, USA*; ²*High Power Solid State Lasers Branch, Air Force Research Laboratory, USA*. Approximately 1kW of continuous-wave output power is obtained, with (M₂) of <1.3 in fiber with preferential gain for the (LP₀₁) mode. Experimental results are compared to a recently developed model based on coupled-mode theory.

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

SpTu4A • Subsystems—Continued

SpTu4A.4 • 17:00 **Invited**

500Gb/s PIC Based Coherent Optical Modem, Jefferey Rahn¹, Saurabh Kumar¹, Matthew Mitchell¹, Roman Malendevich¹, Han Sun², Kuang-Tsan Wu², Pierre Mertz², Kevin Croussore¹, Gilad Goldfarb¹, Hong Wang¹, Masaki Kato¹, Vikrant Lal¹, Peter Evans¹, Damien Lambert¹, Huan-Shang Tsai¹, Parmijit Samra¹, Brian Taylor¹, Alan Nilsson¹, Atul Mathur¹, Xiangjun Zhao¹, Song Yu¹, Steve Grubb¹, Radhakrishnan Nagarajan¹, Fred Kish¹, David Welch¹; ¹Infinera Corporation, USA; ²Infinera Canada, Canada. We present a 500 Gb/s, PM-QPSK Photonic Integrated Circuit (PIC) based MODEM, software configurable into 250 Gb/s TCM mode, as a flexible optical network building block, operating over a 6000 km link with flex ROADMs.

SpTu4A.5 • 17:30

Impact of DSP on the design of InP-based transceivers for highly-compact cost-effective 100Gbit/s PM-QPSK, Donald S. Govan¹, Wladek Forsysiak¹, Chris F. Clarke¹; ¹Oclaro Technology Ltd, UK. We consider the design of InP-based modulators and receivers for applications in highly compact modular 100G PM-QPSK transceivers. Numerical simulations demonstrate that coherent detection followed by DSP enables reduction in electrical bandwidth requirements.

SpTu4A.6 • 17:45

Analysis of Parallel Optical Sampling Rate and ADC Requirements in Digital Coherent Receivers, Abel Lorences Riesgo¹, Michael Galili¹, Christophe Peucheret¹; ¹Photonics Engineering, Technical Univ. of Denmark, Denmark. We comprehensively assess analog-to-digital converter requirements in coherent digital receiver schemes with parallel optical sampling. We determine the electronic requirements in accordance with the properties of the free running local oscillator.

ITu4B • Integration of Silicon Photonics with Other Technologies—Continued

ITu4B.3 • 17:00

Long Period Gratings based on silica PLCs for optical signal processing applications, Jia Jiang¹, Patrick Dumais¹, Christopher J. Ledderhof¹, Claire Callender¹; ¹Communications Research Centre Canada, Canada. Planar waveguide long period gratings have been implemented by creating a permanent refractive index modulation on the lower cladding of a waveguide. Design and fabrication of silica and polymer LPG devices for applications in high-speed optical signal processing are presented.

ITu4B.4 • 17:15

Single Mode 3D Diffusive Photopolymer Optics for Optical Integrated Circuits, Chunfang Ye¹, Keith Kamysiak¹, Amy Sullivan¹, Robert McLeod¹; ¹Univ. of Colorado at Boulder, USA; ²Agnes Scott College, USA. We demonstrate single mode three-dimensional optics fabricated via direct-write lithography in diffusive photopolymers, including uniform waveguides, symmetrical waveguide tapers, 900 sharp waveguide bends and waveguides through thin hybrid subcomponents.

ITu4B.5 • 17:30 **Invited**

High Density Hybridly Integrated Light Source with a Laser Diode Array on a Silicon Optical Waveguide Platform, Takao Shimizu^{1,2}, Nobuaki Hatori^{1,2}, Makoto Okano^{1,3}, Masashige Ishizaka^{1,2}, Yutaka Urino^{1,2}, Tsuyoshi Yamamoto^{1,2}, Mashiko Mori^{1,3}, Takahiro Nakamura^{1,2}, Yasuhiko Arakawa^{1,4}; ¹PECST, Japan; ²PETRA, Japan; ³AIST, Japan; ⁴The Univ. of Tokyo, Japan. A novel high-density hybridly integrated light source with a laser diode array on a silicon optical waveguide platform was developed. This light source is a practical candidate for use with photonic integrated circuits for interchip optical interconnection.

ITu4C • Metamaterials, Sensors, and Optical Properties of Nanoparticles—Continued

ITu4C.4 • 17:00

Optical Properties of Nanoscale Suspensions, Anna Kudryavtseva¹, Nickolay V. Tcherniega¹; ¹P.N. Lebedev Physical Institute, Russian Federation. Stimulated Low-Frequency Raman Scattering with high conversion efficiency was registered in colloid suspension of diamond nanoparticles. Luminescence in blue range and directed X-ray radiation induced by laser pulses was observed in ZnS aqueous suspensions.

ITu4C.5 • 17:15

Laser Direct Microfabrication Using Light-Induced Nanoparticle Incandescence, Mathieu Hautefeuille¹, Victor Velazquez¹, Juan Hernández-Cordero², Reinher Pimentel², Lucia Cabriales¹, Enrique López-Moreno¹, Marcela Grether¹; ¹Facultad de Ciencias, Universidad Nacional Autónoma de México, México; ²Instituto de Investigación en Materiales, Universidad Nacional Autónoma de México, México. We report the application of nanoparticle incandescence induced by low-power, near infrared focused laser beams to microfabrication. Microstructures have been successfully etched and sintered in polymeric matrices in which microclusters of different nanomaterials were incorporated.

ITu4C.6 • 17:30

Laser Triggered Displacement of Embedded Carbon Microparticles in PDMS, Francisco Sánchez-Arévalo¹, Juan Hernández-Cordero¹, Reinher Pimentel-Domínguez²; ¹Reología y mecánica de Materiales, Instituto de Investigaciones en Materiales, UNAM, México. We present experimental evidence of laser-triggered displacement of carbon microparticles embedded in PDMS. Changes in the PDMS surface due to thermal effects owing to optical absorption of the microparticles are evaluated using dynamic speckle analysis.

ITu4C.7 • 17:45

Nanoparticle self-assembly a new approach to fabricating optical interconnects, single photon sources and more, John Canning¹, Masood Naqshbandi¹, Brant Gibson², Melissa Nash¹, Hari Jayaseelan¹, Maxwell Crossley¹; ¹Univ. of Sydney, Australia; ²Physics, Univ. of Melbourne, Australia. A novel approach to fabricating optical waveguides and self-assembled structures at room temperature opens the way for integrating complex materials onto existing platforms. We demonstrate the fabrication of 7cm optical microwires, and integrate nanodiamonds in these waveguides.

18:00–19:30 Joint Poster Sessions & Reception/ Exhibit, Centennial Room & Terrace

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

NTu4D • Spatial Effects and Periodic Structures—Continued

NTu4D.4 • 17:00

Enhanced Čerenkov second-harmonic emission in nonlinear photonic structures, Ksawery K. Kalinowski¹, Philip Roedig², Yan Sheng¹, Mousa Ayoub², Jörg Imbrock², Cornelia Denz², Wieslaw Z. Krolikowski¹; ¹Laser Physics Centre, Research School of Physics and Engineering, Australian National Univ., Australia; ²Institute of Applied Physics and Center for Nonlinear Science, Westfälische Wilhelms-Universität, Germany. We demonstrated significant (over 2×10^2) enhancement of the Čerenkov second-harmonic generation in periodically poled nonlinear crystal. We show that this effect is caused by the simultaneous fulfillment of the Čerenkov and Raman-Nath emission conditions.

NTu4D.5 • 17:15

Nonlinear propagation below cut-off in line-defect waveguides, Stefania Malaguti¹, Gaetano Bellanca¹, Sylvain Combrié², Alfredo De Rossi², Stefano Trillo¹; ¹Università degli Studi di Ferrara, Italy; ²Thales Research and Technology, France. We describe nonlinear propagation in a line-defect photonic crystal waveguide below transmission cut-off in terms of novel temporal gap-soliton solutions. All-optical control of the group-velocity over mm-length scales is envisaged.

NTu4D.6 • 17:30

Modulational Instability in Nonlinear PT-symmetric Photonic Lattices, Yaakov Lumer¹, Mikael C. Rechtsman¹, Mordechai Segev¹; ¹Physics, Technion, Israel. We study nonlinear PT-symmetric lattices, and find a variety of new phenomena, among them nonlinearly-induced transition to stable PT-symmetry, instability suppression at high nonlinearities and modulation instability in unexpected regimes.

NTu4D.7 • 17:45

Observation of all-optical Berezinskii-Kosterlitz-Thouless crossover in a photonic lattice, Guohai Situ¹, Jason W. Fleischer¹; ¹Princeton Univ., USA. We experimentally observe an all-optical Berezinskii-Kosterlitz-Thouless transition, in which vortices spontaneously appear due to nonlinear interactions. We show that the number of vortices and their correlations agree with predictions from mean-field theory.

BTu4E • Sensor Symposium II—Continued

BTu4E.3 • 17:00

Invited

Resonant Waveguide Grating Biosensors for Cell Biology and Drug Discovery, Ye Fang¹; ¹Corning Incorporated, USA. Label-free optical biosensors have been long used for biomolecular interaction analysis. Here I review recent advances of resonant waveguide grating biosensor systems for whole cell sensing, and their applications in cell biology and drug discovery.

STu4F • Fiber Lasers I —Continued

STu4F.4 • 17:00

Short-wavelength fiber Raman laser pulse-pumped by multi-mode laser diode at 806 nm, Tianfu Yao¹, Johan Nilsson¹; ¹Univ. of Southampton, UK. We demonstrate a fiber Raman laser emitting at 835 nm when pumped by bursts of 50 - 100 ns pulses from a multi-mode laser diode at 806 nm. The slope efficiency reaches 38%.

STu4F.5 • 17:15 **Tutorial**

Recent Developments in Fiber Lasers, Mode Stability Issues in LMA Fibers, Jens Limpert¹, Cesar Jauregui¹; ¹Friedrich-Schiller-Universität Jena, Germany. The very high average powers currently extracted from Large Mode Area Fibers show that thermally-related effects will play a very prominent role in the future development of fiber laser systems.

18:00–19:30 Joint Poster Sessions & Reception/ Exhibit, Centennial Room & Terrace

18:00–19:30

JTu5A • Joint Poster Session II

JTu5A.1

General Memory Polynomial for Transmission Impairments Mitigation in Coherent Communication Systems, Nelson Costa^{1,2}, Daniel Fonseca^{1,3}, Adolfo Cartaxo¹, Tiago F. Alves¹; ¹Instituto de Telecomunicações, Portugal; ²Nokia Siemens Networks Portugal, S.A., Portugal; ³Nokia Siemens Networks LLC US, USA. A general memory polynomial (GMP) for transmission impairments mitigation in optical coherent detection systems is proposed. An error vector magnitude improvement of 9 dB, resulting mainly from the regenerator characteristic of the GMP, is shown.

JTu5A.2

A Novel Restoration Algorithm for Business and Residential FTTx Broadband Access Networks, Navid Ghazisaidi¹; ¹Ericsson Inc., USA. A novel restoration algorithm for FTTx broadband access networks based on the concept of utility optimization is introduced to maximize both business and residential end-users happiness by scoring different scenarios.

JTu5A.3

Extended WDM-PON Employing High Polarization Dependence R-SOAs and EDFA/Raman Amplification, Ulysses Duarte¹, Joao Rosolem¹, Murilo Romero¹; ¹Converged Networks, Research and Development Center in Telecommunications (CPqD), Brazil; ²Electrical Engineering, Univ. of Sao Paulo (USP), Brazil. An extended WDM-PON employing high polarization dependence R-SOAs and EDFA/Raman amplification at the CO is proposed in this work. We experimentally demonstrated error free operation over 70 km using directly modulated R-SOAs at 1.25 Gb/s.

JTu5A.4

Simplified Numerical Simulation of Bursty Packet Traffic Amplification by Erbium-Doped Fiber Amplifier, Telmo Pelicano^{1,2}, João Pinto^{1,2}, Paulo S. Andre^{1,2}; ¹Instituto de Telecomunicações, Portugal; ²Physics Department, Aveiro Univ., Portugal. We propose a simplified numerical model to study burst induced signal distortion in EDFAs. The obtained experimental and simulated results for the signal amplitude decay rate are comparable, with a simulation time of 4.7 μ s/bit.

JTu5A.5

Experimental Demonstration of an Indoor Localization System with Single Channel Imaging Receiver, KE WANG^{1,2}, Ampalavanapillai Nirmalathas^{1,3}, Christina Lim², Efstratios Skafidas^{1,2}; ¹National ICT Australia - Victoria Research Laboratory, Australia; ²Department of Electrical and Electronic Engineering, The Univ. of Melbourne, Australia. In this paper we experimentally demonstrate an optical wireless based indoor localization system with single channel imaging receiver. Compared with the system with non-imaging receiver, the localization accuracy can be improved from ~13.08cm to ~5.1cm.

JTu5A.6

Thermal radiation from patterned Pt microstructures, Gabriel Vasile^{1,2}, Mustafa Arikian¹, Snorri Ingvarsson¹; ¹Science Institute, Univ. of Iceland, Iceland; ²National Institute of Research and Development for Cryogenics and Isotopic Technologies, Romania. We investigate the thermal radiation in the infrared regime of micro-fabricated Platinum (Pt) heaters, i.e. resistively heated wires, with Gold (Au) nanoparticles deposited on the surface and photonic crystals (holes, pillars and gratings).

JTu5A.7

A reinterpretation of the metamaterial perfect absorber, Yong Zeng¹; ¹Los Alamos National Laboratory, USA. We analytically prove that the appearance of two almost out-of-phase currents inside a metamaterial is necessary for a perfect absorber. We further show that evanescent waves consume the electromagnetic energy significantly.

JTu5A.8

All-Optical Delta Sigma Modulator Employing Semiconductor Ring Lasers, Azeemuddin Syed^{1,2}, Mohammad R. Sayeh¹; ¹Center for VLSI and Embedded Systems Technology, International Institute of Info Tech, India; ²Electrical and Computer Engineering, Southern Illinois Univ. Carbondale, USA. A semiconductor ring laser is designed so as to work as an inverted integrator coupling three of such integrators an all-optical Delta Sigma Modulator is designed. The phenomenon of injection locking and switching is used.

JTu5A.9

Design of Doubly Coupled Resonator Optical Waveguides, Shuntaro Makino¹, Yuki Kawaguchi¹, Kunimasa Saitoh¹, Masanori Koshiba¹; ¹Graduate School of Information Science and Technology, Hokkaido Univ., Japan. We propose doubly-coupled resonator optical waveguides (D-CROWs). D-CROWs are composed of cascaded ring resonators based on 1-D photonic crystals. We show that D-CROWs realize small group velocity compared with conventional 1-D photonic crystals based CROWs.

JTu5A.10

Bending devices based on Long-Range Surface Plasmon Polariton Waveguides embedded in Fluorinated Polymer, Jia Jiang¹, Sarkis Jacob¹, Claire Callender¹; ¹Communications Research Centre Canada, Canada. This work presents low-loss bending waveguides based on long-range surface plasmon polaritons (LRSP) excited by end-fire coupling. The waveguides were fabricated by embedding thin film stripes of gold in a low optical absorption perfluorocyclobutane (PFCB) polymer.

JTu5A.11

Spoof plasmon polaritons formed by 1D strip grating, ELAMINE Hatem^{1,2}, Guizal Brahim¹, Oueslati Meherzi¹, Gharbi Tijani¹; ¹Raman Spectroscopy, Tunisia; ²Femto-ST, UMR CNRS No. 6174, Route de Gray, France; ³Charles Coulomb Laboratory, UMR 5221 CNRS-UM2 (L2C), France. We demonstrate using the parametric formulation of combined boundary condition method (CBCM) with the adaptive spatial resolution (ASR) that 1D metallic strip grating infinitely thin and perfectly conducting create spoof plasmon polaritons.

JTu5A.12

Nano-selective area growth of InGaAs/InP using CBr4 in-situ etching, Nadezda Kuznetsova¹, Elizaveta Semenova¹, Shima Kakhkhozadeh², Martin Schubert¹, Kresten Yvind¹; ¹Photonics Engineering, DTU, Denmark; ²Center for Electron Nanoscopy, DTU, Denmark; ³Modern Optics and Photonics, The Univ. of Konstanz, Germany. We are investigating the conditions for nano-patterned selective area epitaxial growth using e-beam lithography on HSQ resist and in-situ etching in the MOVPE reactor.

JTu5A.13

Modeling of a nano-metallic surface plasmonic lens for wider optical window operation, Ghanshyam Singh¹, Abhishek Goyal¹, Vijay Janyani¹; ¹Malaviya National Institute of Tech., India. A simplified implementation of the Nano-metallic lens with equidistant slits but bearing different widths is evaluated. The design tolerance and variation in the focal point position in accordance to alteration in the properties of the lens are explored in brief.

JTu5A.14

Design and Development of a New Polymer Microstructured Fiber for Application in FTTH Networks, Katrin Welikow¹, Pawel Gdula^{1,2}, Pawel Szczepanski^{1,2}, Ryszard Buczynski^{3,4}, Ryszard Piramidowicz²; ¹Institute of Microelectronics and Optoelectronics, Warsaw Univ. of Technology, Poland; ²National Institute of Telecommunication, Poland; ³Institute of Electronic Materials Technology, Poland; ⁴Faculty of Physics, Univ. of Warsaw, Poland. This paper is focused on designing and modeling of a new type of microstructured plastic optical fiber for application in Fiber-To-The-Home systems, with improved modal dispersion and bending losses.

JTu5A.15

Optical Dispersion Measurements in Chalcogenide Glass Fibers and Tapers, Soroush Shabahang¹, Guangming Tao¹, Ayman F. Abouraddy¹; ¹Univ. of Central Florida, CREOL, USA. Dispersion of chalcogenide (ChG) bulk samples, multiple-ChG fibers and tapers is measured. We demonstrate normal and anomalous waveguide dispersion in the tapers and support the results with finite-element simulations.

JTu5A.16

Cladding Glass Development for Semiconductor Core Optical Fibers, Stephanie Morris¹, Thomas Hawkins¹, Paul Foy¹, John Balato¹, Steve Martin², Robert Rice³; ¹The Center for Optical Materials Science and Engineering Technologies (COMSET) and the School of Materials Science and Engineering, Clemson Univ., USA; ²Department of Materials Science & Engineering, Iowa State Univ. of Science and Technology, USA; ³Dreamcatchers Consulting, USA. Cladding glass compositions have been developed to minimize thermal expansion mismatch in the glass clad crystalline core fibers. These tailored compositions have also shown to reduce oxygen content in the fibers.

JTu5A.17

Engineerable waveguide arrays in a 7-core fiber via tapering, Darren D. Hudson¹, Thomas Büttner¹, Eric Mägi¹, Alvaro Casas Bedoya¹, Thierry Taunay², Benjamin J. Eggleton¹; ¹School of Physics, Univ. of Sydney, Australia; ²OFI Laboratories, USA. We present a method to create coupled waveguide arrays via tapering 7-core germanosilicate fiber. Using an ultrashort pulse laser system the device is shown to exhibit nonlinear waveguide array physics, including nonlinear optical pulse chopping.

JTu5A.18

Quantum Frequency Conversion by Four-wave Mixing Using Bragg Scattering, Lasse Mejling¹, Karsten K. Rottwitz¹, Colin J. McKinstrie², Michael G. Raymer³; ¹Department of photonics engineering, Technical Univ. of Denmark, Denmark; ²Bell Laboratories, Alcatel-Lucent, USA; ³Department of physics, Univ. of Oregon, USA. Two theoretical models for frequency conversion (FC) using nondegenerate four-wave mixing are compared, and their range of validity are discussed. Quantum-state-preserving FC allows for arbitrary reshaping of states for an appropriate pump selection.

JTu5A.19

Fiber Raman Depolarizer, Sergey Sergeyev¹; ¹Aston Univ., UK. We report on a theoretical study of activated de-correlation of signal and pump states of polarization based on an advanced vector model of a fiber Raman amplifier accounting for random birefringence and periodic fiber spinning.

JTu5A.20

Thin Plasmonic Grating for All-Optical Switching Mark Bloemer¹, Giuseppe D'Aguzzo², Nadia Mattiucci²; ¹AMRDEC, USA; ²AEGIS Tech., USA. We utilize narrow Fano-like resonances in gratings composed of metal films that support long range surface plasmons to provide all-optical switching with low input powers. Switching is illustrated for a grating embedded in chalcogenide glass.

JTu5A.21

Saturable Absorption of Cr:YAG Crystal in Visible Region for Passively Q-switched Pr:YLF Laser, Fumihiko Kannari¹, Ryo Abe¹, Junichiro Kojou¹; ¹Keio Univ., Japan. We experimentally prove that a Cr:YAG crystal exhibits saturable absorption in 639, 607, and 521 nm. We demonstrate passively Q-switched Pr:YLF lasers at these visible wavelengths using a Cr:YAG crystal for the first time.

JTu5A.22

Higher-Order Moment Characterisation of Rogue Wave Statistics in Supercontinuum Generation, Simon Toft Sørensen¹, Ole Bang¹, Benjamin Wetzel¹, John M. Dudley²; ¹DTU Fotonik, Department of Photonics Engineering, Technical Univ. of Denmark, Denmark; ²Institut FEMTO-ST, Université de Franche-Comté, France. The noise characteristics of supercontinuum generation are characterized using higher-order statistical moments. Measures of skew and kurtosis, and the coefficient of variation allow quantitative identification of spectral regions dominated by rogue wave like behaviour.

JTu5A • Joint Poster Session II—Continued

JTu5A.23

THIRD-HARMONIC GENERATION IN OPTICAL MICRO-FIBERS, Aurélien Coillet^{1,2}, Philippe Grelu¹, ¹ICB UMR 6303 Université de Bourgogne, France; ²FEMTO-ST UMR 6174 Université de Franche-Comté, France. We explain the relatively easy, wideband, THG conversion that we observe experimentally in silica glass microfibers by the tapering geometry. As a challenging perspective, we compare THG effective efficiencies in silica and tellurite glasses.

JTu5A.24

Nonlinear Surface Plasmon Polaritons, Miriam Deutsch¹, ¹Univ. of Oregon, USA. We present analytical analyses of the nonlinear interaction of SPP fields at a silver-vacuum interface, in the presence of a third order optical susceptibility in the metal. Both sum- and difference-frequency generation interactions are addressed.

JTu5A.25

Coherent Superposition of ω and 2ω Spectral Components in Supercontinuum Pulse Generated in Ar-Gas-Filled Hollow Core Fiber, Kenta Yoshikiyo¹, Shohei Kondo¹, Yu Oishi¹, Fumihiko Kan-nari¹, ¹Electronics and Electrical Engineering, Keio Univ., Japan. 800 and 400 nm broadband components generated by phase modulation based on nonlinear copropagation of fundamental and second-harmonic femtosecond pulses in an Ar-gas-filled hollow core fiber were separately compressed and coherently superposed to generate broadband shaped laser pulses.

JTu5A.26

Multiple transmission filters for enhanced energy in mode-locked fiber lasers, J. N. Kutz¹, Feng Li², Alex P. K. A. Wai², Edwin Ding³, ¹Univ. of Washington, USA; ²Electronic and Information Engineering, The Hong Kong Polytechnic Univ., China; ³Mathematics and Physics, Azusa Pacific, USA. We demonstrate that incorporating multiple sets of waveplates and polarizers in a ring cavity laser allows for the suppression of multi-pulsing and a significant enhancement (an order of magnitude) of the mode-locked pulse energy.

JTu5A.27

Interaction of dark vector polariton solitons, Albrecht Werner^{1,2}, Oleg A. Egorov^{1,2}, Falk Lederer^{1,2}, ¹Institute of Condensed Matter Theory and Solid State Optics, Friedrich Schiller Univ., Germany; ²Abbe Center of Photonics, Friedrich Schiller Univ., Germany. We study the interaction dynamics and stability properties of dark vector polariton solitons in a semiconductor microcavity. We observe both the spontaneous symmetry breaking of polarization and the fusion of two vector solitons.

JTu5A.28

PM Raman fiber laser at 1679 nm, Ask S. Svane¹, Karsten K. Rottwitt¹, ¹DTU Fotonik, Technical Univ. of Denmark, Denmark. We demonstrate a PM Raman fiber laser emitting light at 1679 nm. The laser has a slope efficiency of 67 % and an output power of more than 275 mW with a 27 pm linewidth.

JTu5A.29

Multi-solitons in a Dispersion Managed Fiber Laser using a Carbon Nanotube-Coated Taper Fiber, Amos Martinez¹, Mika Omura², Masato Takiguchi³, Bo Xu¹, Takahiro Kuga³, Takaaki Ishigure², Shinji Yamashita¹, ¹Electronic Engineering, The Univ. of Tokyo, Japan; ²Faculty of Science and Technology, Keio Univ., Japan; ³Institute of Physics, The Univ. of Tokyo, Japan. Stable, phase-locked, sub 300fs soliton pairs and triplets are generated in a dispersion-managed mode-locked fiber laser using a taper fiber coated with a carbon nanotube (CNT)-polymer as a saturable absorber.

JTu5A.30

Formation of dissipative soliton during self-diffraction of waves, Svitlana Bugaychuk¹, Robert Conte^{2,3}, ¹Institute of Physics NAS Ukraine, Ukraine; ²LRC MESO École normale supérieure de Cachan (CMLA), France; ³Service de physique de l'état condensé (CNRS URA 2464), France. We derive complex Ginzburg-Landau equations (CGLEs) for wave self-diffraction at four-wave mixing in nonlinear cavity. Either bright or dark dissipative solitons of the intensity spatial pattern are formed inside a cavity that is described by CGLEs.

JTu5A.31

Bifurcation to chaotic polarization mode hopping in vertical-cavity surface-emitting lasers, Martin Virte^{1,2}, Marc Sciamanna¹, Krassimir Panajotov^{2,3}, ¹OPTEL Research Group, Supelec, Laboratoire Matériaux Optiques, Photoniques et Systèmes (LMOPS) EA-4423, France; ²Department of Applied Physics and Photonics (IR-TONA), Vrije Universiteit Brussels, Belgium; ³Institute of Solid State Physics, Bulgaria. We make an in-depth analysis of a bifurcation scenario that leads to chaotic hopping between two elliptically polarized modes in VCSELs. Our work brings new light on recent experiments using quantum dot VCSELs.

JTu5A.32

Rectangular Similariton solutions to the Nonlinear Schrödinger Equation, Neil Broderick¹, Claude Agueraray¹, Vladimir Kruglov¹, ¹Physics, Univ. of Auckland, New Zealand. In this paper we extend the class of self-similar solutions to the Nonlinear Schrödinger Equation to Rectangular pulses, show how they could be generated experimentally and discuss practical applications.

JTu5A.33

Withdrawn

JTu5A.34

Effect of the modulation parameters on the evolution of a spectrally phase modulated pulse in a tapered fiber for supercontinuum generation, Pedro L. Bertarini¹, Emiliano R. Martins¹, Sérgio C. Zilio¹, Ben-Hur V. Borges¹, ¹Escola de Engenharia de São Carlos, Universidade de São Paulo, Brazil; ²School of Physics and Astronomy, Univ. of St Andrews, UK; ³Instituto de Física de São Carlos, Universidade de São Paulo, Brazil. In this paper we demonstrate how the supercontinuum (SC) generated by a spectrally phase modulated femtosecond pulse in a tapered fiber is influenced by the modulation parameters.

JTu5A.35

Threshold and Above Threshold Analysis of Two-Dimensional Square Lattice Index and Gain Coupled Photonic Crystal Laser with Transverse Magnetic Polarization, Marcin Koba^{1,2}, Pawel Szczepanski^{2,3}, ¹Univ. of Warsaw, Poland; ²Warsaw Univ. of Technology, Poland; ³National Institute of Telecommunications, Poland. In this work, a threshold and an above threshold analyses based on the coupled mode theory for square lattice photonic crystal band edge laser with gain and index modulation are presented.

JTu5A.36

Photon and phonon coupling by electrostrictive forces in photonic crystal fiber, Jean Charles Beugnot¹, Vincent Laude¹, ¹Institut FEMTO-ST, France. We demonstrate that the acoustic phonons involved in stimulated Brillouin scattering (both forward and backward) in optical fibers can be completely described by using electrostrictive forces. Numerical calculations for photonic crystal fiber illustrate the model.

JTu5A.37

Tunable Wavelength Broadcasting in a PPLN with Multiple QPM Peaks, Meenu Ahlawat¹, Amirhossein Tehrani², Krishnamoorthy Pandiyan³, Myoungsik Cha⁴, Raman Kashyap^{1,2}, ¹Department of Engineering Physics, Ecole Polytechnique de Montreal, Canada; ²Department of Electrical Engineering, Ecole Polytechnique de Montreal, Canada; ³School of Electrical and Electronic Engineering, SASTRA Univ., India; ⁴Department of Physics, Pusan National Univ., Democratic People's Republic of Korea. Tunable multiple-idler broadcasting of a signal to selective WDM channels is demonstrated utilizing temperature-assisted tuning of QPM pump wavelengths based on cascaded nonlinear mixing in bulk PPLN with an aperiodic domain in the center.

JTu5A.38

Pulse delaying using Raman-assisted parametric amplification in polarization-maintaining fibers, Nour NASSER¹, Gil FANJOUX¹, Eric Lantz¹, Thibaut Sylvestre¹, ¹department of Optics, FEMTO-ST, France. We study both analytically and numerically pulse delaying and advancement through Raman-assisted optical parametric amplification in polarization-maintaining fibers and show that the Raman gain enhances the optical delay up to 35%.

JTu5A.39

Existence regime of stable fiber-optic three-soliton molecules, Philipp Rohrmann¹, Alexander Hause¹, Fedor Mitschke¹, ¹Universität Rostock, Germany. We investigate conditions for existence of stable compounds of three solitons in dispersion-managed fiber. With such compounds one might transmit 2 bits per timeslot in a solitonic system.

JTu5A.40

High-repetition-rate ultrashort pulse generation in nonlinear fibers with exponentially decreasing dispersion, Qian Li¹, K. Nakkeeran², Ping Kong A. Wai¹, ¹The Hong Kong Polytechnic Univ., Hong Kong; ²Univ. of Aberdeen, UK. A simple method for the generation of ultrashort pulse train with high-repetition-rate is proposed and demonstrated numerically.

JTu5A.41

Nonlinear propagation of incoherent waves in single-mode fibers: from wave turbulence theory to experiments, Stephane Randoux¹, Pierre Suret¹, Antonio Picozzi², ¹Université de Lille 1, France; ²Institut Carnot de Bourgogne, France. We revisit the traditional treatment of the wave turbulence theory and we study theoretically, numerically and experimentally the nonlinear propagation of partially incoherent optical waves in single mode optical fibers.

JTu5A.42

Self-induced transparency quadratic solitons in noncentrosymmetric media doped with quantum dots, Sergey A. Ponomarenko¹, ¹Dalhousie Univ., Canada. We discover and numerically explore self-induced transparency quadratic solitons (SIT-QS) in semiconductor waveguides doped with quantum dots. We discuss a hybrid nature of the SIT-QS and the material parameter range for their experimental realization.

JTu5A.43

Extreme value statistics in quasi-CW Raman fiber lasers, Dmitry V. Churkin^{1,3}, Oleg Gorbunov^{2,3}, Sergey Smirnov^{2,3}, ¹Aston Univ., UK; ²Novosibirsk State Univ., Russian Federation; ³Institute of Automation and Electrometry SB RAS, Russian Federation. It is found that rare extreme events are generated in a Raman fiber laser. The mechanism of the extreme events generation is a turbulent-like four-wave mixing of numerous longitudinal generation modes.

JTu5A.44

Withdrawn

JTu5A.45

Dissipative Optical Solitons in Dense Media of Doped Waveguides, Alexey Prokhorov¹, Mikhail Y. Gubin¹, Andrey Y. Leksin¹, Maxim G. Gladush², Alexander P. Alodjants¹, Sergei M. Arakelian¹, ¹Department of Physics and Applied Mathematics, Stoletov's Vladimir State Univ., Russian Federation; ²Department of Molecular Spectroscopy, Institute for Spectroscopy RAS, Russian Federation. We consider the problem of formation of optical solitons for -scheme of Raman-type atom-field interaction in dense medium doped by silica waveguide taking into account dissipative and nonlinear (local) field effects in general.

JTU5A • Joint Poster Session II—Continued

JTU5A.46

Withdrawn

JTU5A.47

Q-Switched Fiber Laser Based on Dynamic Spectral Overlapping of a Fiber Bragg Grating and a Tunable Fiber Fabry-Perot Filter, Rodolfo Martinez¹, MONGA J. kaboko¹, Mikhail G. Shlyagin², Johan Meyer³, ¹Electrical & Electronic Engineering Science, Univ. of Johannesburg, South Africa; ²Optics, CICESE, Mexico. An active Q-switched Erbium-doped fiber ring laser is presented. The Q-switching principle is based on dynamic spectral overlapping of two filters, namely a Fiber Bragg Grating based filter and a tunable Fabry - Perot filter.

JTU5A.48

Superposed Bragg grating made with femtosecond radiation for multiparameter sensing, Dan Grobnić, Stephen J. Mihailov¹, Robert B. Walker¹, Christopher W. Smelser¹; ¹Communications Research Centre, Canada. We report the result of superposing IR ultrafast type II gratings made with different order phase masks in unloaded SMF-28 fiber. The process and the resulting spectra are described.

JTU5A.49

Highly Strain-Sensitive Long-Period Grating in Hi-Bi Fiber with a Reference Fiber Bragg Grating, Toru Mizunami¹, Toshihiro Mori¹, Tsubasa Fujiyoshi¹; ¹Electrical Engineering and Electronics, Kyushu Institute of Technology, Japan. A fiber Bragg grating was fabricated in PANDA fiber with a long-period grating strain sensor for determination of polarization. A strain sensitivity of 3.6 pm/ $\mu\epsilon$ was obtained. Strain/temperature discrimination was also discussed.

JTU5A.50

Fiber Bragg Grating Inscription With Ultraviolet Radiation and Two Beam Interference in Microstructured Optical Fiber, Martin Becker¹, Thomas Geernaert², Tigran Bagdasaryan², Kay Schuster¹, Pawel Mergo³, Manfred W. Rothhardt¹, Hartmut Bartelt¹, Francis Berghmans², Hugo Thienpont²; ¹Institute of Photonic Technology, Germany; ²Brussels Photonics Team B-PHOT, Vrije Universiteit Brussel, Belgium; ³Maria Curie-Skłodowska Univ., Poland. Fiber Bragg grating (FBG) inscription in microstructured optical fibers (MOF) is accompanied (by) low intensity and contrast ratio of the interference. Nanosecond and femtosecond ultraviolet exposure reveal the feasibility of gratings pure silica MOFs.

JTU5A.51

Chemical sensor using Mach-Zehnder interferometer based on a pair of largely tilted fiber gratings, Xianfeng Chen^{1,2}, Kaiming Zhou¹, Adebayo Adedotun¹, Lin Zhang¹; ¹Aston Univ., UK; ²School of Electronic Engineering, Bangor Univ., UK. We propose an in-fiber Mach-Zehnder interferometer formed by a pair of largely tilted fiber gratings. The interference spectral characteristics have been investigated. The experimental results using this device as a chemical sensor have a sensitivity as high as 719nm/RIU.

JTU5A.52

Synthesis of Arbitrary Group Delay Responses with All-Pass Optical Cavities Structures, Miguel A. Preciado¹, Xuewen Shu¹, Kate Sugden¹, Miguel A. Muriel²; ¹Photonics Research Group, Aston Univ., UK; ²Photonics Technology, Universidad Politécnica de Madrid, UK. We propose a systematic method for the synthesis of arbitrary group delay responses by using all-pass structures of coupled optical cavities. Optimum structure parameters design, in terms of filter order and accuracy, are obtained.

JTU5A.53

Fiber Bragg grating Fabry-Perot structures under loading and their applications in switchable multi-wavelength lasers, Xuewen Shu¹; ¹Aston Univ., UK. Characteristics of fiber Bragg grating based Fabry-Perot (FBG-FP) structures under transversal loading are investigated. A novel switchable multi-wavelength fiber laser employing loaded FBG-FP is also demonstrated.

JTU5A.54

Fiber-optic end probe with two-dimensional metallic slit arrays for sensing in the infrared region, Kyuho Kim¹, Sookyoung Roh¹, Dawoon Choi¹, Byoung-ho Lee²; ¹School of Electrical Engineering, Seoul National Univ., Republic of Korea. We demonstrate a fiber-optic SPR based sensor with metallic nanostructures on the fiber end facet. Two-dimensional metallic slit arrays are designed to induce the plasmonic reflection in the infrared region. The proposed sensor shows a high sensitivity of 1000 nm/RIU.

JTU5A.55

Output Radiating Arrayed Waveguide Grating: Characterization of Phase Errors and UV Trimming, David Sinefeld¹, Noam Goldshtein¹, Roy Zektzer¹, Nahum Gorbatov², Moshe Tur², Dan M. Marom¹; ¹Applied Physics, Hebrew Univ. of Jerusalem, Israel; ²Faculty of Engineering, Tel Aviv Univ., Israel. We developed a phase error measurement technique for AWG that radiate to free-space, based on pair-wise far-field interference of adjacent waveguide pairs. We also performed initial phase trimming experiments on individual waveguides with a UVlaser.

JTU5A.56

Frequency dependence of the Brillouin spectrum of an aluminosilicate optical fiber on temperature and strain, Francesca H. Mountfort¹, Mohammad Belal¹, Jayanta K. Sahu¹; ¹Optoelectronics Research Centre, Univ. of Southampton, UK. The spontaneous Brillouin spectrum of an aluminosilicate fiber shows two distinct peaks. Strain and temperature coefficients of 0.0392 \pm 0.0027MHz/ $\mu\epsilon$, 1.5 \pm 0.2MHz/ $^{\circ}$ C for Peak 1 and 0.031 \pm 0.0025MHz/ $\mu\epsilon$, 1.1 \pm 0.1MHz/ $^{\circ}$ C for Peak 2 is obtained for exploitation in temperature-strain distinction.

JTU5A.57

Generation and application of tunable supercontinuum, Zhao Lei¹; ¹Chinese Academy of Engineering Physics, China. Supercontinuum with tunable wavelength range from the blue end of the visible to the near-infrared is obtained. Fluorescence microscopy by a commercial confocal microscope is achieved using the tunable supercontinuum as illumination light.

JTU5A.58

Similaritons in fiber Bragg gratings written in fiber amplifiers, Yuval P. Shapira¹, Moshe Horowitz¹; ¹Electrical Engineering, Technion - Israel Institute of Technology, Israel. We show, by using numerical simulations, that self-similar pulses can be obtained at the output of a fiber Bragg grating written in a fiber amplifier.

Joint Signal Processing in Photonics Communications/
Access Networks and In-house Communications

Integrated Photonics Research, Silicon and Nano Photonics

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

07:30–18:00 Registration, Lower Lobby, Conference Level

08:30–10:00

JW1A • Joint SPPCom and ANIC Plenary Session

Chao Lu; Hong Kong Polytechnic Univ., Hong Kong, and Ed Harstead, Alcatel-Lucent, USA, Presiders

08:30–10:00

IW1B • Plasmonics and Applications

Alexandra Boltasseva; Purdue Univ., USA, Presider

JW1A.1 • 08:30

Plenary

Future optical access networks, Yun Chung¹; ¹Korea Advanced Inst of Science & Tech, Republic of Korea. This paper discusses the most competitive technical solutions for future optical access networks capable of providing >10-Gb/s service to each subscriber.

IW1B.1 • 08:30

Invited

Molding light propagation with phase discontinuities, Zeno Gaburro^{2,1}, N. Yu¹, M. A. Kats¹, F. Aieta^{1,4}, P. Genevet^{1,3}; ¹Harvard Univ., USA; ²Dipartimento di Fisica, Univ. of Trento, Italy; ³Institute for Quantum Studies and Department of Physics, Texas A&M Univ., USA; ⁴Dipartimento di Fisica e Ingegneria dei Materiali e del Territorio, Università Politecnica delle Marche, Italy. Conventional optical components rely on gradual phase shifts accumulated during light propagation to shape light beams. New degrees of freedom are attained by introducing abrupt phase changes over the scale of the wavelength.

IW1B.2 • 09:00

Design of Ultra-Small Mode-Evolution Type Polarization Rotator Based on Surface Plasmon Polariton, Masa-aki Komatsu¹, Kunimasa Saitoh¹, Masanori Koshiba¹; ¹Graduate School of Information Science and Technology, Hokkaido Univ., Japan. We propose an ultra-small polarization rotator based on a surface plasmon polariton phenomenon. Numerical simulations show that a 5- μm -long polarization rotator with extinction ratio better than -15 dB on the entire C-band is achievable.

JW1A.2 • 09:15

Plenary

Quo vadis, spatial multiplexing? Henning Buelow¹; ¹Alcatel-Lucent, Bell Labs, Germany. Application areas and motivation of high bit-rate transport over fiber bundle, multi-core fiber, and multimode fiber are revisited. With a focus on mode multiplexing, recent research is reviewed and direction of future research is discussed.

IW1B.3 • 09:15

Experimental Investigation of CMOS-Compatible Metal-Insulator-Silicon-Insulator-Metal Waveguides, Min-Suk Kwon¹, Jin-Soo Shin², Sang-Yung Shin²; ¹Electrical and Computer Engineering, Ulsan National Institute of Science and Technology, Republic of Korea; ²Electrical Engineering, Korea Advanced Institute of Science and Technology, Republic of Korea. Metal-insulator-silicon-insulator-metal waveguides are experimentally investigated. Their fabrication process is explained, and their measured characteristics are discussed. Their measured propagation loss is 0.262 (0.219) dB/ μm when the width of silicon is ~156 (~183) nm.

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

07:30–18:00 Registration, Lower Lobby, Conference Level

08:30–10:00

NW1C • Novel Nonlinear Effects

Neil Broderick; *Univ. of Auckland, Australia, President*

NW1C.1 • 08:30

Sagnac Interferometer for Background Reduction in Stimulated Raman Scattering Loss Spectroscopy, Sven Dobner¹, Michael Kues¹, Carsten Cleff¹, Carsten Fallnich¹, Petra Gross¹; ¹*Institute for Applied Physics, Westfälische Wilhelms-Universität, Germany*. We use a Sagnac interferometer for an unprecedented background reduction of 17dB in stimulated Raman scattering (SRS) loss spectroscopy employing a 1MHz ytterbium fiber laser/amplifier system.

NW1C.2 • 08:45

Enhancement of a nanocavity lifetime through slow light propagation, Patricio Grinberg¹, Kamel Bencheikh¹, Maia Brunstein¹, Alejandro M. Yacomotti¹, Yannick Dumeige², Juan A. Levenson¹, Philippe Hamel¹; ¹*Laboratoire de Photonique et de Nanostructures, Centre National Recherche Scientifique, France*; ²*FOTON, Université Européenne de Bretagne - CNRS, France*. We show that the lifetime of a semiconductor photonic crystal nanocavity is enhanced thanks to two cooperative effects: slow light propagation based on coherent population oscillations effect and cavity nonlinear refractive index dispersion.

NW1C.3 • 09:00

Self-locked OPO in CMOS-compatible microring resonators, Alessia Pasquazi¹, Marco Peccianti^{1,2}, Lucia Caspani¹, Luca Razzari^{1,3}, Marcello Ferrera^{1,4}, David Duchesne^{1,5}, Matteo Clerici¹, Brent Little⁶, Sai T. Chu^{6,7}, David J. Moss⁸, Roberto Morandotti¹; ¹*INRS-Energie Mat & Tele Site Varennes, Canada*; ²*Institute for Complex Systems - CNR, Italy*; ³*Italian Institute of Technology (IIT), Italy*; ⁴*Univ. of St Andrews, UK*; ⁵*Massachusetts Institute of Technology, USA*; ⁶*Infinera Ltd, USA*; ⁷*Department of Physics and Materials Science, Hong Kong*; ⁸*CUDOS, School of Physics, Univ. of Sydney, Australia*. We report a novel geometry for OPOs in a CMOS-compatible microring resonator. It exploits non-critical lasing of the pump inherently positioned within the resonances of the microcavity, thus counteracting the effect of thermal fluctuations.

NW1C.4 • 09:15

A novel extraction algorithm for spectral phase interferometry, Alessia Pasquazi¹, Marco Peccianti^{1,2}, Jose Azana¹, David J. Moss³, Roberto Morandotti¹; ¹*INRS-Energie Mat & Tele Site Varennes, Canada*; ²*Institute for Complex Systems - CNR, Italy*; ³*CUDOS, School of Physics, Univ. of Sydney, Australia*. We demonstrate an innovative extraction algorithm for X-SPIDER that significantly extends the measurement time window of the method without requiring device design modifications.


08:30–10:00

BW1D • Fundamentals of Photosensitivity and Poling: Direct Laser Writing and Thermal Poling 

Lionel Canioni; *CPMOH-Universite Bordeaux 1, France, President*

BW1D.1 • 08:30  

Optical anisotropy of self-assembled nanostructure in glass, Yasuhiko Shimotsuma¹, Miki Nakabayashi¹, Kiyotaka Miura¹, Kazuyuki Hirao¹, Peter G. Kazansky²; ¹*Department of Material Chemistry, Kyoto Univ., Japan*; ²*Optoelectronics Research Centre, Univ. of Southampton, UK*. Femtosecond laser direct writing of form birefringence originated from self-organized nanostructure in glass is reviewed. Its application to rewritable five-dimensional optical data storage is also demonstrated.

BW1D.2 • 09:00 

Direct Laser-Writing in a silver-zinc doped phosphate glass: Spatial discrimination of aggregates - Formation mechanism, Yannick Petit^{1,2}, Arnaud Royon¹, Nicolas Marquestaut¹, Gautier Papon¹, Kevin Bourhis², Marc Dussauze³, Oriane Mollet⁴, Aurélien Drezet⁴, Serge Huant⁴, Vincent Rodriguez², Thierry Cardinal², Lionel Canioni¹; ¹*ICMCB, Univ. Bordeaux / CNRS, France*; ²*LOMA, Univ. Bordeaux / CNRS, France*; ³*ISM, Univ. Bordeaux / CNRS, France*; ⁴*Néel Institute, Univ. Joseph Fourier / CNRS, France*. We report on spatially and spectrally-resolved linear optical properties induced by Direct Laser Writing in a prepared silver-doped phosphate glass, opening interesting possibilities for elementary photonics bricks. The formation mechanism of optical structures is proposed.

BW1D.3 • 09:15 

Thermally poled oxide glasses: correlation between polarization mechanisms and non linear optical properties, Vincent Rodriguez¹, Marc Dussauze¹, Tatiana Crémoux¹, Frédéric Adamietz¹, Evelyne Fargin², Thierry Cardinal²; ¹*ISM-Chimie, Université Bordeaux 1, France*; ²*ICMCB-CNRS, Université Bordeaux 1, France*. We have investigated structural rearrangements induced by poling on oxide glasses. Combined Raman/SHG micro-imaging technique has highlighted strong correlations between NLO properties and poling mechanisms.

08:30–10:00

SW1E • Fiber based Sensors

Michalis Zervas; *Univ. of Southampton, UK, President*

SW1E.1 • 08:30 

Novel Super-Lattice Polarization-Maintaining Photonic Crystal Fibre for Pressure Sensing, Hwa Yaw Tam¹, Ming-Leung Vincent Tse¹, Lok-Hin Cho², Chao Lu²; ¹*Electrical Engineering, Hong Kong Polytechnic Univ., Hong Kong*; ²*Electronics and Information Engineering, Hong Kong Polytechnic Univ., Hong Kong*. A novel super-lattice polarization-maintaining photonic crystal fiber designed for the realization of highly sensitive fiber-optic pressure sensor using the Sagnac loop interferometer method was fabricated. The fiber has a birefringence of 8.5x10⁻⁴.

SW1E.2 • 09:00

Acrylate coated optical fibers for up to 200°C application temperatures, Valery Kozlov¹, Kevin Bennett¹; ¹*Corning Incorporated, USA*. Optical fibers with specialty acrylate coatings (single and dual coat designs) were tested at temperatures up to 200°C in normal atmosphere to define fiber properties stability and maximum operating temperatures.

SW1E.3 • 09:15

A magnetic field sensor based on a ferrofluid infiltrated PMMA-microstructured optical fibre, Alessandro Candiani^{1,3}, Alexander Argyros², Richard Lwin², Sergio Leon-Saval², Stefano Selleri², Stavros Pissadakis¹; ¹*IESL, FORTH, Greece*; ²*Institute of Photonics and Optical Science, The Univ. of Sydney, Australia*; ³*Department of Information Engineering, Univ. of Parma, Italy*. A magnetic field sensor based on a ferrofluid infiltrated PMMA-microstructured optical fibre is presented. The infiltrated fibre sensor is operating in transmission mode while measuring magnetic fields up to 1250 Gauss.

Joint Signal Processing in Photonics Communications/
Access Networks and In-house Communications

Integrated Photonics Research, Silicon and Nano Photonics

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

JW1A • Joint SPPCom and ANIC Plenary Session—Continued

IW1B • Plasmonics and Applications—Continued

IW1B.4 • 09:30

Enhancement of thermal dissipation by encapsulation with MgF2 or SiO2 of Hybrid III-V/SOI nanolasers, Rama Raj¹, Alexandre Bazin¹, Fabrice Raineri¹; ¹LPN-CNRS, France. We report on the improvement of the thermal dissipation of hybrid III-V/SOI nanolasers by encapsulating the structures with MgF2 or SiO2. Careful design was necessary to obtain theoretical quality factor above 106. CW operation was then obtained.

IW1B.5 • 09:45

Angular Study of the Random Laser Emission, Crescencio Garcia-Segundo¹, Francisco Tenopala-Carmona¹, Natanael B. Cuando-Espitia², Juan Hernández-Cordero²; ¹Instrumentación y Medición, Centro de Ciencias Aplicadas y Desarrollo Tecnológico, Universidad Nacional Autónoma de México, Mexico; ²Reología, Instituto de Investigación en Materiales, Universidad Nacional Autónoma de México, Mexico. We present experimental results of a random laser in a cylindrical cell. With this configuration we manage to exhibit that the laser's lasing modes, the lasing threshold and the peak wavelength exhibit angular dependence.

10:00–10:30 Coffee Break, Colorado Gallery and Grand Rivers Gallery

NOTES

Lined area for taking notes, consisting of approximately 20 horizontal lines.

Nonlinear Photonics

Bragg Gratings, Photosensitivity, and Poling in Glass Waveguides

Specialty Optical Fibers

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

NW1C • Novel Nonlinear Effects—Continued

NW1C.5 • 09:30

Longitudinal power distribution in a random DFB fiber laser, Dmitriy V. Churkin^{1,2}, Atalla El-Taher¹, Ilya Vatik², Juan D. Ania-Castanon³, Paul Harper¹, Eugeny Podivilov², Sergey Babin^{2,4}, Sergei K. Turitsyn¹, ¹Aston Univ., UK; ²Institute of Automation and Electrometry SB RAS, Russian Federation; ³Instituto de Optica "Daza de Valdés, Spain; ⁴Novosibirsk State Univ., Russian Federation. We have measured the longitudinal power distribution inside a random distributed feedback fiber laser. Both analytic solution and results of direct numerical modeling are in excellent agreement with experimental observations.

NW1C.6 • 09:45

Demonstration of Kerr Nonlinearity in Silicon Microcylindrical Resonators, Natasha Vukovic¹, Noel Healy¹, Priyanth Mehta¹, Anna C. Peacock¹, ¹Optoelectronics Research Centre, Univ. of Southampton, UK. We investigate the Kerr nonlinearity in a-Si:H based microcylindrical resonators. The large resonant wavelength shift observed for pulsed excitation is used to demonstrate ultrafast all-optical switching.

BW1D • Fundamentals of Photosensitivity and Poling: Direct Laser Writing and Thermal Poling—Continued

BW1D.4 • 09:30

Picosecond Laser Pulse Induced Phase Transformation in Sapphire, Jiyeon Choi¹, Thierry Cardinal², Dongsik Shin¹, Yongkwon Cho¹, Jeong Suh¹, ¹Dept. of Laser and electron beam application, Korea institute of machinery and materials, Republic of Korea; ²ICMCB, Université Bordeaux, France. Picosecond laser-induced structural change in z-cut sapphire wafer were investigated through Raman spectroscopy and transmission electron microscopy. The broadening at 417 cm⁻¹ and the presence of a new Raman peak near 420 cm⁻¹ were observed.

BW1D.5 • 09:45

Zeosil formation by femtosecond laser irradiation, John Canning¹, Matthieu Lancry², Kevin Cook¹, Bertrand Poumellec², ¹Univ. of Sydney, Australia; ²LPCES, Université de Paris Sud, France. We report the fabrication of zeosil by exploiting rapid local heating and quenching, under very high induced pressures, when silica is irradiated by femtosecond near IR laser.

SW1E • Fiber based Sensors—Continued

SW1E.4 • 09:30 **Invited**

Light That Spins Inside Fibers, Siddharth Ramachandran¹, Poul Kristensen², ¹ECE Department, Boston Univ., USA; ²OFS-Fitel, Denmark. Polarisation- and phase-vortices are emerging as light-beams of immense interest in several scientific and technological applications. We review recently developed techniques for generating them, as well as manipulating their nonlinear optical properties, with optical fibers.

10:00–10:30 Coffee Break, Colorado Gallery and Grand Rivers Gallery

NOTES

Horizontal lines for taking notes.

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

10:30–12:30

AW2A • PON Technology Trends

Ampalavanapilla Nimalathias, Univ. of Melbourne, Australia, Presider

AW2A.1 • 10:30 **Invited**

Options for TDM PON beyond 10G, Doutje van Veen¹, Dusan Suvakovic¹, Hungkei Chow¹, Vincent Houtsma¹, Ed Harstead³, Peter J. Winzer², Peter Vetter¹; ¹Bell Labs, Alcatel-Lucent, USA; ²Bell Labs, Alcatel-Lucent, USA; ³Alcatel-Lucent, USA. This paper proposes an architecture to increase the downstream transmission of TDM PON from 10-Gbps to 40-Gbps. Challenges like chromatic dispersion tolerance, optical power budget, cost, and coexistence with legacy PONs are discussed.

AW2A.2 • 11:00

Auto-Tuning PID controller based on Genetic Algorithms for the Bandwidth Allocation in LR-PONs, Tamara Jimenez¹, Noemí Merayo¹, Ramón J. Durán¹, Patricia Fernández¹, Ignacio de Miguel¹, Juan Carlos Aguado¹, Rubén M. Lorenzo¹, Evaristo J. Abril¹; ¹Dpt. of Signal Theory, Communications and Telematic Engineering, Univ. of Valladolid, Spain. A new bandwidth allocation algorithm for LR-EPONs based on a PID controller tuned with Genetic Algorithms is proposed to efficiently fulfill the subscribers' bandwidth requirements.

AW2A.3 • 11:15

OSNR Monitoring Technique Using Bragg Gratings Imprinted in High Birefringent Fibers, Ana Sousa^{1,2}, Paulo S. Andre^{1,2}; ¹Instituto de Telecomunicacoes, Portugal; ²Physics, Aveiro Univ., Portugal. We propose a technique to monitor the optical signal to noise ratio, based on the use of high birefringent fibre Bragg gratings. This technique is effective with signals with OSNR up to 20 dB.

AW2A.4 • 11:30 **Invited**

Diverging applications for PON technologies, and future technology trends, Ed Harstead¹; ¹Alcatel-Lucent, USA. Until recently, the history of PON has been about FTTH: evolving to higher speeds while reducing costs to satisfy the requirements for residential access. That has begun to change. In this manuscript, the divergence of the PON application space and what it means for PON technology evolution will be surveyed.

10:30–12:30

SpW2B • Coherent System Implementation

Alan Lau; Hong Kong Polytechnic Univ., Hong Kong, Presider

SpW2B.1 • 10:30 **Invited**

Digital sub-banding - a signal processing architecture radically improving OFDM coherent optical receivers, Moshe Nazarathy¹, Alex Tolmachev¹; ¹Technion Israel Institute of Technology, Israel. We review a digital sub-banding ASIC/FPGA DSP architecture for optical OFDM receivers achieving record low complexity and high performance by digitally demultiplexing the received signal into multiple frequency-domain sub-bands to be processed in parallel.

SpW2B.2 • 11:00

A Novel Phase Modulation Detection Technique For Coherent Self-Heterodyne Optical Receiver, Tam Huynh¹, Lim Nguyen¹, Liam P. Barry¹; ¹Rince Institute, School of Electronic Engineering, Dublin City Univ., Ireland; ²Department of Computer and Electronics Engineering, Univ. of Nebraska-Lincoln, USA. We propose a novel self-heterodyne coherent receiver structure based on phase modulation detection that potentially simplifies the front-end of a coherent optical receiver. The scheme has been demonstrated via simulations and experimentally for 10 Gb/s DQPSK.

SpW2B.3 • 11:15

Joint Equalization and Polarization-Time Coding Detection to Mitigate PMD and PDL Impairments Souha Ben Rayana^{1,2}, Ghaya Rekaya-Ben Othman¹, Yves Jaouën¹, Hichem Besbes²; ¹COMTEC, Telecom ParisTech, France; ²COSIM, SupCom, Tunisia. We propose new criteria to joint linear time-domain equalization and ML detection supporting polarization-time codes and avoiding noise enhancement induced by PDL effect. An almost full-mitigation of PMD and PDL impairments is demonstrated.

SpW2B.4 • 11:30 **Invited**

Recent advances in signal processing for real-time implementation - 40Gb/s, 100Gb/s and beyond, Maxim Kuschnerov¹, O. Agazzi², V. Veljanovski¹, J. Slovak¹, M. Herrmann¹, C. Hofer¹, U. Bauer¹, T. Rieger¹, S. Camatel¹, P. Voois², N. Swenson², M. Bohn¹; ¹Nokia Siemens Networks, Germany; ²ClariPhy Communications Inc., USA. The progress of signal processing is presented for coherent optic product applications. Requirements are discussed for present and future products. Common pitfalls in system testing are described.

10:30–12:30

IW2C • Nanophotonics for Energy Conversion and Applications

Zeno Gaburro; Harvard Univ., USA, Presider

IW2C.1 • 10:30 **Invited**

Template-Stripped Plasmonic Films For Photovoltaics, David Norris¹; ¹ETH Zurich, Switzerland. Template stripping is a simple and versatile process for creating smooth patterned films from various materials. We demonstrate improved plasmonic performance for template-stripped metals and discuss the use of such films for photovoltaic applications.

IW2C.2 • 11:00

Efficiency Improvement in Ultrathin Plasmonic Organic Bulk Heterojunction Solar Cells, Shiva Shahin¹, Palash Gangopadhyay¹, Robert A. Norwood¹; ¹College of Optical Sciences, Univ. of Arizona, USA. Au NP plasmonic effect enhances light absorption and thus the efficiency of organic BHJ solar cells. Using an optimized 20% surface coverage of Au NPs followed by only 50nm of P3HT: PCBM increases the efficiency by 30%.

IW2C.3 • 11:15

Temporal and Spatial Imaging of Energy Flow at the Nanoscale via Molecular Plasmonics, Gary Wiederrecht¹, Jasmina Hranisavljevic¹; ¹Center for Nanoscale Materials, Argonne National Laboratory, USA. Efforts to spatially and temporally resolve photoinduced energy and charge transfer in hybrid plasmonic nanostructures are discussed. The ability to use these nanostructures to characterize photoinduced energy and charge transfer processes important for solar energy conversion is described.

IW2C.4 • 11:30

Highly Sensitive SOI Optical Sensors with Porous Si, Zhixuan Xia², Murtaza Askari², Stanley C. Davis¹, Kenneth H. Sandhage¹, Ali Adibi²; ¹Georgia Institute of Technology, USA; ²School of Electrical and Computer Engineering, Georgia Institute of Technology, USA. We demonstrate microring resonators using a thin layer of porous silicon (pore size ~30 nm) as the cladding. With a loaded Q factor of 25,000, this new type of resonators is promising for bio/chemical sensing.

IW2C.5 • 11:45

Wide Stiffness Range Cavity Optomechanical Sensors for Atomic Force Microscopy, Yuxiang Liu^{1,2}, Houxun Miao^{1,2}, Vladimir Aksyuk¹, Kartik Srinivasan¹; ¹Center for Nanoscale Science & Technology, National Institute of Standards & Techno, USA; ²Institute for Research in Electronics and Applied Physics, Univ. of Maryland, USA. We present chip-based sensors that integrate nanomechanical cantilevers with near-field optical readout for atomic force microscopy. Cantilever stiffness is varied over four orders of magnitude while maintaining fm/Hz^{1/2} displacement sensitivity, indicating potential in wide-ranging applications.

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

10:30–12:30

NW2D • Theory of Novel Nonlinear Processes

Nail Akhmediev, Australian National Univ., Australia, *President*

NW2D.1 • 10:30 **Invited**

Polariton Solitons, Dmitry V. Skryabin¹; ¹Univ. of Bath, UK. Abstract not available

NW2D.2 • 11:00

Classical Optical Simulation of Bi-Photon Generation in Quadratic Waveguide Arrays, Markus Gräfe¹, Alexander S. Solntsev², Robert Keil¹, Andreas Tünnermann¹, Stefan Nolte¹, Alexander Szameit¹, Andrey A. Sukhorukov², Yuri S. Kivshar²; ¹Institute of Applied Physics, Abbe Center of Photonics, Friedrich-Schiller-Universität Jena, Germany; ²Australian National Univ., Australia. We suggest and demonstrate experimentally that evolution of classical light can simulate bi-photon generation through spontaneous parametric downconversion and correlated quantum walks in waveguide arrays, including violation of Bell's inequality.

NW2D.3 • 11:15

Incoherent soliton turbulence, Bertrand Kibler¹, Claire Michel², Josselin Garnier³, Antonio Picozzi¹; ¹Laboratoire Interdisciplinaire Carnot de Bourgogne, France; ²Laboratoire de Physique de la Matière Condensée, France; ³Ecole Normale Supérieure, France. We report a phenomenon of incoherent soliton turbulence in nonlocal nonlinear media: It is thermodynamically advantageous for the system to generate an incoherent soliton in order to reach the most disordered equilibrium state (maximum entropy).

NW2D.4 • 11:30

Multi-shocks generation and collapsing instabilities induced by competing nonlinearities, Andrea Fratolocchi¹, Stefano Trillo³, Matteo Crosta^{1,2}; ¹Physical Science and Engineering, KAUST Univ., Saudi Arabia; ²Physics, Sapienza Univ., Italy; ³Electrical Engineering, Ferrara Univ., Italy. We investigate dispersive shock dynamics in materials with competing cubic-quintic nonlinearities. Whitham theory of modulation, hydrodynamic analysis and numerics demonstrate a rich physical scenario, ranging from multi-shock generation to collapse.

NW2D.5 • 11:45

Dispersive shock waves in quadratic media, Matteo Conforti¹, Fabio Baronio¹, Stefano Trillo²; ¹Dipartimento di Ingegneria dell'Informazione, Università di Brescia, Italy; ²Dipartimento di Ingegneria, Università di Ferrara, Italy. We investigate dispersive shock wave formation driven by a pulse undergoing phase-mismatched second-harmonic generation in a quadratic medium.

10:30–12:15

BW2E • Applications of Gratings and Poled Glass: Novel Bragg Grating Filters

Stavros Pissadakis; FORTH-IESL Greece, *President*

BW2E.1 • 10:30 **Invited**

Silver Nanowire Coated Tilted Fibre Bragg Gratings, Alexander Bialayeu¹, Jacques Albert¹, Anatoli Ianoul¹, Adam Bottomley², Daniel Prezgot²; ¹Department of Electronics, Carleton Univ., Canada; ²Department of Chemistry, Carleton Univ., Canada. A 3.5-fold increase in sensitivity of Tilted Fibre Bragg grating based refractometers is reported. The sensor was coated with silver nanowires which resulted in strong polarization dependence of the grating resonances.

BW2E.2 • 10:45 **Invited**

All-fibre Lyot filters based on 45° tilted gratings UV-inscribed in PM fibre, Zhijun Yan¹, Kaiming Zhou¹, Adebayo Adedotun¹, Lin Zhang¹; ¹Photonics Research Group, Aston Univ., UK. We report all-fibre Lyot filters formed by concatenating fibre gratings with structure tilted at 45° UV-inscribed in PM fibre. Such polarisation filters exhibit distinct transmission property for potential application in fibre lasers and sensors.

BW2E.3 • 11:00 **Invited**

Bragg grating notch filters in silicon-on-insulator waveguides, Yves Painchaud¹, Michel Poulin¹, Christine Latrasse¹, Nicolas Ayotte¹, Marie-Josée Picard¹, Michel Morin¹; ¹TeraXion Inc, Canada. Bragg gratings containing a central π phase shift or used in a Fabry-Perot configuration are found to provide ultra-narrow spectral features. Transmission notches having a full width at half maximum as small as 530 MHz (4.3 pm) are reported.

BW2E.4 • 11:15 **Invited**

Continuously Tunable Chirped Microwave Pulse Generation Using an Optically Pumped Tilted Fiber Bragg Grating, Jianping Yao¹, Hiva Shahoei¹; ¹Univ. of Ottawa, Canada. Photonic generation of a continuously tunable chirped microwave waveform using a tilted-fiber-Bragg-grating written in an erbium/ytterbium co-doped fiber is proposed. A chirped waveform with a tunable chirp rate from 1.8 to 7 GHz/ns is generated.

BW2E.5 • 11:30 **Invited**

Phase Manipulation of RF Signals Using a Fiber Bragg Grating with Step Group Delay Profile, Manik Attygalle¹, Dmitrii Stepanov¹; ¹Defence Science & Technology Organisation, Australia. We propose a novel technique to achieve fixed or time varying phase shifts in radio-frequency (RF) signals using a single fiber Bragg grating (FBG) with a step group delay profile.

BW2E.6 • 11:45 **Invited**

Apodized Point-by-Point Fiber Bragg Gratings In An All-Optical, Actively Q-switched All-Fibre Laser, Robert J. Williams¹, Nemanja Jovanovic^{1,2}, Graham Marshall¹, M. J. Steel¹, Michael J. Withford¹; ¹Centre for Ultrahigh-bandwidth Devices for Optical Systems (CUDOS), MQ Photonics Research Centre, Department of Physics and Astronomy, Macquarie Univ., Australia; ²Macquarie Univ. Research Centre in Astronomy, Astrophysics & Astrophotonics, Department of Physics and Astronomy, Macquarie Univ., Australia. We report an all-optical, actively Q-switched, all-fibre laser utilizing an ultrafast laser-inscribed, wavelength-tunable, apodized fibre Bragg grating. The tailored spectrum of the apodized point-by-point gratings enables an order of magnitude improvement in pulse duration.

10:30–12:30

SW2F • Fiber Lasers II

Bryce Samson; Nufern USA, *President*

SW2F.1 • 10:30 **Invited**

Harvesting the Full Absorption in Cladding-Pumped Fibers, Michalis N. Zervas^{1,2}; ¹Optoelectronics research Centre, Univ. of Southampton, UK; ²SPI Lasers, UK. We investigate the wavelength and length dependence of the pump absorption along cladding-pumped single as well as coupled multimode fibers showing strong depatures from Beer's law.

SW2F.2 • 11:00

High power, linearly polarized, continuously tunable ytterbium-doped rod-type photonic crystal fiber laser, Romain ROYON¹, Jerome Lhermite¹, Laurent Sarger², Eric Cormier¹; ¹CELIA, CNRS, France; ²LOMA, CNRS, France. An ytterbium-doped fiber laser continuously tunable from 976nm to 1120nm and delivering up to 30W of average power linearly-polarized is demonstrated. Moreover the bandwidth of our system can be tuned from 100pm to more than 1nm.

SW2F.3 • 11:15

1 mJ Pulse Energies in Tm-doped Photonic Crystal Fiber, Pankaj Kadwani¹, Andrew Sims¹, Lasse Leick², Jes Broeng², Lawrence Shah¹, Martin Richardson¹; ¹Univ. of Central Florida, CREOL, USA; ²NKT Photonics A/S, Denmark. Thulium doped PCF have been inspected in cw and pulsed configurations at 2 microns. Greater than 400 μ J, 49 ns pulses in Q-switched oscillator configuration and 1.05 mJ pulses in amplifier configuration have been demonstrated.

SW2F.4 • 11:30 **Invited**

High Efficiency 1908nm Tm-doped Fiber Laser Oscillator, Daniel J. Creedon¹, Benjamin R. Johnson¹, Scott D. Setzler¹; ¹BAE Systems, USA. We report a monolithic, high power, high efficiency oscillator in Tm-doped fiber operating in the 1908nm region. With this approach, we have generated >100W of power with over 47% optical efficiency and 20% electrical efficiency.

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

AW2A • PON Technology Trends—Continued**AW2A.5 • 12:00** **Invited**

Optical and Wireless Convergence, Milos Milosavljevic¹, Wansu Lim¹, Pandelis Kourtessis¹, John Senior¹; ¹Univ. of Hertfordshire, UK. This paper presents the requirements and possible solutions for wireless convergence in next generation PONs. System level simulation of LTE was performed to evaluate two different approaches for connecting eNBs to ONU.

SpW2B • Coherent System Implementation—Continued**SpW2B.5 • 12:00** **Invited**

1 Tb/s Coherent Transceiver, Kim Roberts¹; ¹Ciena Corporation, Canada. Abstract: CMOS DACs, spectral shaping of subcarriers, frequency selective optical switching, and polarization multiplexed (PM) 16-QAM allows 1 Tb/s to be transmitted within 200 GHz of optical spectrum alongside commercial 100 Gb/s WDM signals.

IW2C • Nanophotonics for Energy Conversion and Applications—Continued**IW2C.6 • 12:00**

Dispersion engineering of modified annular photonic crystals and their use in polarization independent optical devices, Mirbek Turduev¹; ¹Electrical and Electronics Engineering, TOBB Economics and Technology Univ., Turkey. A novel type of PC named MAPC is studied for bandgap engineering and polarization-independent device applications. By introducing asymmetry to the unit-cell of PC, conventional EFCs for the second-band is transformed into tilted rectangular shapes.

IW2C.7 • 12:15

Raman Enhancement from Arrays of Etched Silicon Nanowires, Jaspreet Walia¹, Mohammadreza Khorasaninejad¹, Simarjeet S. Saini¹; ¹ECE and Waterloo Institute of Nanotechnology, Univ. of Waterloo, Canada. Etched silicon nanowires (SiNWs) display a Raman scattering enhancement per unit volume (REV) of 70 and 7 over bulk silicon and SOI wafers. The enhancement is understood in terms of optical confinement in the SiNWs.

12:30–13:30 Lunch Break, On Your Own

13:30–15:30**AW3A • Indoor Networks**

Rene Schmogrow; Karlsruhe Inst. of Technology, Germany, Presider

13:30–15:30**SpW3B • High Capacity System**

Juerg Leuthold; Karlsruhe Institut fur Technologie, Germany, Presider

13:30–15:30**IW3C • Photonic Crystals**

David Norris; ETH Zurich, Switzerland, Presider

AW3A.1 • 13:30 **Invited**

Wireless Networks Indoor Application, Green Broadband Wireless Networks, Ampalavanapilla Nirmalathas¹; ¹Univ. of Melbourne, Australia. Abstract not available

SpW3B.1 • 13:30 **Invited**

Spectrally Efficient Transmission: a Comparison between Nyquist-WDM and CO-OFDM Approaches, Gabriella Bosco¹; ¹Politecnico di Torino, Italy. We compare Nyquist-WDM and CO-OFDM techniques for the generation of superchannels based on PM-16QAM modulation. We analyze by simulation the robustness to optical filtering and to crosstalk induced by adjacent superchannels.

IW3C.1 • 13:30 **Invited**

Electrically driven photonic crystal nanocavity devices, Gary Shambat¹, Bryan Ellis¹, Jan Petykiewicz¹, Arka Majumdar¹, Marie Mayer², Tomas Sarmiento¹, James Harris¹, Eugene Haller², Jelena Vuckovic¹; ¹Stanford Univ., USA; ²Materials Science, UC Berkeley, USA. We demonstrate electrically driven photonic crystal cavity lasers and LEDs with record low control energies. Our lateral injection platform opens the door to new opportunities in active control of photonic crystal devices.

AW3A.2 • 14:00 **Invited**

Accurate Localization Technique for Smart Fiber-Wireless In-House Networks, Eduward Tangdiongga¹, Solomon Abraha¹, Antonino Crivellaro², Chigo Okonkwo¹, Roberto Gaudino², Ton Koonen¹; ¹COBRA Research Institute, Eindhoven Univ. of Technology, Netherlands; ²Dipartimento di Elettronica, Politecnico di Torino, Italy. The use of a RoF scheme for localization purposes of mobile stations for in-house networks is presented. Using impulse radio UWB over SMF and time-of-arrival localization method, mobile stations can be localized within centimeters accuracy.

SpW3B.2 • 14:00

Reduction of crosstalk-induced OSNR penalties in high bit rate optical spatially multiplexed systems, Matthias Westhäuser¹, Simon Akhtari¹, Martin Finkenbusch¹, Peter Krummrich¹; ¹TU-Dortmund (LS-HFT), Germany. We investigate and compare the performance of various optimization techniques for reduction of crosstalk-induced OSNR penalties in spatially multiplexed systems by optical MIMO equalization. Residual penalties were greatly reduced using RLS and matrix inversion optimizers.

IW3C.2 • 14:00 **Invited**

Integrable ultralow-power nanophotonic devices on InP photonic crystals, Kengo Nozaki¹, Akihiko Shinya¹, Shinji Matsuo², Tomonari Sato², Yasumasa Suzuki², Toru Segawa², Ryo Takahashi², Masaya Notomi¹; ¹NTT Basic Research Laboratories, Japan; ²NTT Photonics Laboratories, Japan. Photonic crystal nanocavities are expected to greatly reduce the size and energy consumption of various optical devices. We have demonstrated this feature in all-optical switches and random access memories for on-chip nanophotonic integration.

SpW3B.3 • 14:15

Mitigation of combined PMD- and crosstalk-induced signal distortions in spatially-multiplexed multi-core fiber networks, Matthias Westhäuser¹, Martin Finkenbusch¹, Simon Akhtari¹, Peter Krummrich¹; ¹TU-Dortmund (LS-HFT), Germany. We investigate the performance of optical equalization of combined PMD- and crosstalk-induced distortions in 112 Gbit/s multi core fiber systems. The residual mean OSNR penalties are reduced to < 0.1 dB.

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

NW2D • Theory of Novel Nonlinear Processes—Continued

NW2D.6 • 12:00

Analytic theory of fiber-optic Raman polarizers, Victor V. Kozlov^{1,2}, Javier Nuno³, Juan D. Ania-Castanon³, Stefan Wabnitz²; ¹Department of Information Engineering, Università degli Studi di Brescia, Italy; ²Department of Physics, St. Petersburg State Univ., Russian Federation; ³Instituto de Óptica, Consejo Superior de Investigaciones Científicas, Spain. The Raman polarizer is a Raman amplifier which not only amplifies but also repolarizes light. We propose a relatively simple and analytically tractable model, the ideal Raman polarizer, for describing the operation of this device.

NW2D.7 • 12:15

Radiative decay of bright solitons in nonlocal nonlinear media with random noise, Fabian Maucher^{1,3}, Wieslaw Z. Krolikowski³, Stefan Skupin^{1,2}; ¹Max Planck Institute for the Physics of Complex Systems, Germany; ²Institute of Condensed Matter Theory and Optics, Friedrich Schiller Univ., Germany; ³Laser Physics Centre, RSPHSE, Australian National Univ., Australia. We show that radiative decay of bright solitons decreases dramatically with the nonlocality-induced finite correlation length of the random noise. We give an analytical expression for the soliton life-time in the weakly nonlocal regime.

BW2E • Applications of Gratings and Poled Glass: Novel Bragg Grating Filters—Continued

BW2E.7 • 12:00

Optical Spectrum Analyzer using a 45° tilted fiber grating, Kaiming Zhou¹, Xianfeng Cheng¹, Zhijun Yan¹, Adebayo Adedotun¹, Lin Zhang¹; ¹Electronic engineering department, Aston Univ., UK. We report an optical spectrum analyzer utilizing direct side-tapping by a 45° tilted fiber grating. The angular dispersion is analyzed and 45° is found to give highest dispersion. High resolution up to 0.13nm was obtained.

SW2F • Fiber Lasers II—Continued

SW2F5 • 12:00 **Invited**

Short-Pulse Fiber Lasers using CNT and Graphene, Shinji Yamashita¹; ¹Univ. of Tokyo, Japan. We review our works on the short-pulse fiber lasers passively mode-locked by carbon nanotubes (CNT) and graphene. We have demonstrated operations at various wavelength regions, high output powers, and high repetition rates.

12:30–13:30 Lunch Break, On Your Own

13:30–15:30

NW3D • Rogue Waves and Novel Propagation Effects

Falk Lederer; Friedrich-Schiller-Univ. Jena, Germany, *Presider*

NW3D.1 • 13:30 **Invited**

Light with no spatial scale: diffraction cancellation, anti-diffraction, scale-free instability and subwavelength beam propagation in dipolar glasses, E DelRe^{1,2}, Aharon Agranat³, Claudio Conti^{1,4}; ¹Physics, Univ. of Roma La Sapienza, Italy; ²IPCF-CNR, Univ. of Roma La Sapienza, Italy; ³Applied Physics, Hebrew Univ. of Jerusalem, Israel; ⁴ISC-CNR, Univ. of Roma La Sapienza, Italy. We discuss the experiments and theory of scale-free optical propagation and diffraction cancellation in nanodisordered ferroelectrics, where light beams manifest a variety of effects that are incompatible with known linear and nonlinear phenomenology, such as subwavelength beam propagation.

NW3D.2 • 14:00

Do optical event horizons really exist? The physics of nonlinear reflection at a soliton boundary, Goëry Genty¹, Miro Erkintalo^{1,2}, John M. Dudley³; ¹Tampere Univ. of Technology, Finland; ²Univ. of Auckland, New Zealand; ³Université de Franche-Comté, France. We discuss the physics of optical event horizons and clarify how the observed horizon dynamics can be interpreted in the framework of wave mixing processes between a soliton and an incident linear dispersive wave.

NW3D.3 • 14:15

Longitudinal and periodic modulation of the dispersion of an optical fiber: a new degree of freedom in nonlinear optics, arnaud mussot¹, Maxime Droques¹, Alexandre Kudlinski¹, Geraud Bouwmans¹, Gilbert Martinelli¹; ¹Phlam/ircica, Univ. of Lille, France. We investigate experimentally the MI process in a dispersion oscillating fiber. An important number of unstable frequencies over 10 THz are generated that then lead to a new degree of freedom for tailoring nonlinear effects.

13:30–15:30

BW3E • Applications of Gratings and Poled Glass: Lasers Grating Structures and Reflectors

Yves Painchaud; TeraXion Inc., Canada, *Presider*

BW3E.1 • 13:30 **Invited**

Advances and Prospects of Frequency Doublers Based On Periodically Poled Silica Fibres, Costantino Corbari¹, Albert Canagasabay¹, Morten Ibsen¹, Alexey V. Gladyshev², Peter G. Kazansky³; ¹Optoelectronics Research Centre, Univ. of Southampton, UK; ²Fiber Optics Research Center, Russian Academy of Sciences, Russian Federation. Record high efficient frequency doublers in periodically poled silica fibres are demonstrated for light generation at 532 nm and 775 nm. The onset of nonlinear conductivity is shown to limit the maximum $\chi(2)$ in glass.

BW3E.2 • 14:00

Laser Cavity Made with Ultrafast IR Type II Gratings In Heavily Doped Er-Yb fiber, Dan Grobnic¹, Stephen J. Mihailov¹, Robert B. Walker¹, Christopher W. Smelser¹; ¹Communications Research Centre, Canada. We are reporting for the first time a laser cavity built in heavily doped Er-Yb fiber with type II Bragg gratings mirrors made with IR femtosecond radiation using the phase mask method.

BW3E.3 • 14:15

Highly Efficient Distributed Feedback Brillouin Fiber Laser, Kazi S. Abedin¹, Paul Westbrook¹, Tristan Kremp¹, Benyuan Zhu¹, Jeffrey W. Nicholson¹, Jerome Porque¹, Xiaoping Liu¹; ¹OFS Laboratories, USA. An efficient single frequency distributed feedback (DFB) Brillouin fiber laser producing 22mW of Stokes output, using 81mW of pump from a semiconductor DFB laser, is shown. The laser operated for a pump frequency detuning >1GHz.

13:30–15:30

SW3F • Applications of Fiber Lasers/ Devices

Dan Creedon; Massachusetts Inst of Tech Lincoln Lab, USA, *Presider*

SW3F.1 • 13:30 **Invited**

Military Interest in Fibers, Iyad Dajani¹, Craig Robin¹, Angel Flores¹; ¹USA. There is great interest in optical fibers for military applications. We focus on fiber laser research for directed energy platforms. Power scaling of fiber amplifiers and beam combining are the cornerstones of developing these platforms

SW3F.2 • 14:00 **Invited**

Progress on Mid IR Chalcogenide Fiber and Devices, Francois Chenard¹; ¹IRflex Corporation, USA. Ongoing efforts on high-purity chalcogenide glasses and fiber draw processes enable the production of commercial-grade mid-infrared fibers for 2-10 micron transmission. Our fiber supports the development of cutting-edge devices for mid-infrared applications.

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

AW3A • Indoor Networks—Continued**AW3A.3 • 14:30**

Impact of Polarization State on High-Speed Indoor Optical Wireless Communication System, KE WANG^{1,2}, Ampalavanapillai Nirmalathas^{1,2}, Christina Lim², Efstratios Skafidas^{1,2}; ¹National ICT Australia - Victoria Research Laboratory, Australia; ²Department of Electrical and Electronic Engineering, The Univ. of Melbourne, Australia. In this paper we experimentally investigate the impact of polarization state on our recently proposed indoor gigabit optical wireless communication system. Our findings indicate that ~0.7 dB variation in the receiver sensitivity will be introduced.

AW3A.4 • 14:45 **Invited**

Relevant Wavelengths for Free Space Optics in Future Broadband Networks, Erich Leitgeb¹, Markus Löschnigg¹, Thomas Plank¹; ¹Technische Universität Graz, Austria. In modern access networks the optical domain is playing the dominant role, because only in optics the high carrier frequency allows a huge bandwidth with high available data rates. We show Optical Wireless solutions for future networks.

AW3A.5 • 15:15

Different modulation formats for Gigabit-over-POF, Stefano Straullu¹, Silvio Abrate¹, Antonino Nespola¹, Paolo Savio¹, Roberto Gaudino²; ¹ISMB, Italy; ²Politecnico di Torino, Italy. Comparison of the performances of 2-PAM and duobinary modulation formats for the transmission of Gigabit Ethernet signal over SI-POF. We demonstrated that duobinary provides the best performances, without any significant increase in implementation complexity.

SpW3B • High Capacity System—Continued**SpW3B.4 • 14:30** **Invited**

MIMO Processing for Space-Division Multiplexed Transmission, Sebastian Randel¹, Roland Ryf, Christian Schmidt¹, Miguel A. Mestre¹, Peter J. Winzer¹, R. J. Essiambre¹; ¹Bell Laboratories, Alcatel-Lucent, USA. We review recent progress in space-division multiplexed transmission over fibers that support multiple coupled modes. We show that mode coupling can almost completely be undone by multiple-input multiple-output digital signal processing, even after long distance transmission.

SpW3B.5 • 15:00

Symbol spaced adaptive MIMO equalization for ultra high bit rate coherent optical communication, Albert (Alik) Gershtein^{1,2}, Dan Sadot^{1,2}; ¹Ben Gurion Univ. of the Negev, Israel; ²MultiPhy Networks Ltd., Israel. An improved adaptive MIMO equalizer is proposed for 1Sample/Symbol coherent systems ISI introduced by the AAF is kept and eventually recovered by MLSE. 1dB improvement is achieved compared to conventional MIMO.

SpW3B.6 • 15:15

Non-linearity Compensation Limits in Optical Systems with Coherent Receivers, Gabriella Bosco¹, Andrea Carena¹, Pierluigi Poggiolini¹, Vittorio Curri¹, Fabrizio Forghieri²; ¹Politecnico di Torino, Italy; ²Cisco Systems, Italy. We use an analytical model for fiber propagation in uncompensated optical systems to analyze the bandwidth of nonlinear noise in WDM transmission in order to assess the limits of non-linearity compensation in coherent receivers.

IW3C • Photonic Crystals—Continued**IW3C.3 • 14:30**

All Optical Ultrafast Gates with surface grown QWs in Photonic Crystals heterogeneously Integrated on SOI, Rama Raj¹, Fabrice Raineri¹, Alexandre Bazin¹; ¹France. Ultrafast AOG activated with low energies is demonstrated in InGaAs surface QW Photonic crystals on SOI. Recovery time of such gates is 12ps and are activated with pulses with energies as low as 40fJ

IW3C.4 • 14:45

InGaAsP photonic crystal nanocavities with a Fano line shape resonant at 1.55 μm , Yi Yu¹, Sara Ek¹, Mikkel Heuck¹, Kresten Yvind¹, Jesper Mork¹; ¹Department of Photonics Engineering, Technical Univ. of Denmark, Denmark. We fabricated and characterized InGaAsP photonic crystal nanocavities. By carefully tailoring the structural parameters, both an efficient coupling and a suitable Q-factor can be achieved. Depending on the design of the coupling region, sharp Fano lines may be observed.

IW3C.5 • 15:00

Demonstration of Optically Controlled re-Routing in a Photonic Crystal Three-Port Switch, Sylvain Combrié¹, Mikkel Heuck², Stephane Xavier¹, Gaëlle Lehoucq¹, Stefania Malaguti³, Gaetano Belanca², Stefano Trillo³, Philip T. Kristensen², Jesper Mork², Alfredo De Rossi¹; ¹Thales Research and Technology, France; ²Department of Photonics Engineering, Danmarks Tekniske Universitet, Denmark; ³Department of Engineering, Univ. of Ferrara, Italy. We present an experimental demonstration of optically controlled re-routing of a signal in a photonic crystal cavity-waveguide structure with 3 ports. This represents a key functionality of integrated all-optical signal processing circuits.

IW3C.6 • 15:15

Ultra-Compact Silicon Waveguide Photodetectors Utilizing Critically-Coupled Photonic Crystal Cavities at 1.55 μm , Richard R. Grote¹, Jeffrey B. Driscoll¹, Nicolae C. Panoiu², Richard M. Osgood³; ¹Electrical Engineering, Columbia Univ., USA; ²Department of Electronic & Electrical Engineering, Univ. College London, UK. We present a waveguide photodetector design for weak absorbers, such as ion-implanted silicon and polysilicon, utilizing a critically-coupled 1D photonic crystal cavity. Device lengths of < 15 μm can be achieved if scattering loss is managed.

15:30–16:00 Coffee Break, Colorado Gallery and Grand Rivers Gallery

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

NW3D • Rogue Waves and Novel Propagation Effects—Continued

NW3D.4 • 14:30

Modulational Instability and Solitons in Nonlocal Media with Competing Nonlinearities, Wieslaw Z. Krolikowski¹, Bo Esbensen¹, Alex Wlotzka², Ole Bang¹, Morten Bache¹; ¹*Technical Univ. of Denmark, Denmark*; ²*Univ. of Karlsruhe, Germany*; ³*Australian National Univ., Australia*. We investigate propagation and spatial localization of light in nonlocal media with competing nonlinearities. We show that the competing focusing and defocusing nonlinearities enable coexistence of dark or bright spatial solitons in the same medium by varying the intensity of the beam.

NW3D.5 • 14:45

Kuznetsov-Ma Soliton Dynamics in Nonlinear Fiber Optics, Bertrand Kibler¹, Julien Fatome¹, Christophe Finot¹, Guy Millot¹, Goëry Genty², Nail N. Akhmediev³, Benjamin Wetzel⁴, Frederic Dias⁵, John M. Dudley⁴; ¹*Laboratoire Interdisciplinaire Carnot de Bourgogne, France*; ²*Tampere Univ. of Technology, Finland*; ³*The Australian National Univ., Australia*; ⁴*Institut FEMTO-ST, France*; ⁵*Univ. College Dublin, Ireland*. The Kuznetsov-Ma (KM) soliton is a solution of the nonlinear Schrödinger equation derived in 1977 but never observed experimentally. Here we report experiments showing KM soliton dynamics in nonlinear breather evolution in optical fiber.

NW3D.6 • 15:00

Rogue wave clusters with atom-like structures, David J. Kedziora¹, Adrian Ankiewicz¹, Nail N. Akhmediev¹; ¹*Australian National Univ., Australia*. We study the hierarchy of rational solutions of the nonlinear Schrödinger equation that are higher-order rogue waves in this model. This analysis reveals the existence of clusters, analogous to atoms with their shells of electrons.

NW3D.7 • 15:15

Dissipative rogue wave generation from a mode-locked fiber laser experiment, caroline Lecaplain¹, Philippe Grelu¹, Jose-Maria Soto-Crespo², Nail N. Akhmediev³; ¹*ICB UMR 6303, Université de Bourgogne, France*; ²*Instituto de Optica, CSIC, Spain*; ³*The Australian National Univ., Australia*. Rare events of extremely high optical intensity are experimentally recorded at the output of a mode-locked fiber laser operating in a chaotic multiple-pulse regime. These fluctuations result from ceaseless nonlinear interactions between pulses.

BW3E • Applications of Gratings and Poled Glass: Lasers Grating Structures and Reflectors—Continued

BW3E.4 • 14:30

A seven core fiber DFB, Paul Westbrook¹, Kazi S. Abedin¹, Thierry Taunay¹, Michael Fishteyn¹, Tristan Kremp¹, Jerome Porque¹; ¹*OFS Laboratories, USA*. We demonstrate fiber DFB lasers in a seven core Er doped fiber. DFB grating cavities were fabricated in all cores at once via a single UV exposure. Lasing was observed in all seven cores.

BW3E.5 • 14:45

Simulation of two-photon absorption in Raman DFB lasers, Tristan Kremp¹, Kazi S. Abedin¹, Paul Westbrook¹; ¹*OFS Laboratories, USA*. We present an efficient split-step solver for the nonlinear coupled mode equations with two-photon absorption to investigate the feasibility of Raman DFB lasers in highly nonlinear materials such as chalcogenide glasses.

BW3E.6 • 15:00

Raman DFB Fiber Laser with Truly Unidirectional Output, Jindan Shi¹, Shaif-ul Alam¹, Morten Ibsen¹; ¹*Optoelectronics Research Centre, Univ. of Southampton, UK*. We report a single-frequency, kilohertz-linewidth (<2.5kHz), 30cm-long Raman distributed-feedback fiber laser with unidirectional output. The threshold power, slope efficiency and maximum output power are observed to be ~980mW, 7.7% and 296mW respectively.

BW3E.7 • 15:15

Ultra-Wide Range Wavelength Conversion Using FWM in a Raman DFB Fiber Laser, Jindan Shi¹, Shaif-ul Alam¹, Morten Ibsen¹; ¹*Optoelectronics Research Centre, Univ. of Southampton, UK*. We demonstrate for the first time to our knowledge, four-wave-mixing (FWM) in a 30cm-long center π phase-shifted Raman distributed-feedback (DFB) fiber laser. The FWM-to-signal conversion efficiency is -24dB and the wavelength conversion range is 94.1nm.

SW3F • Applications of Fiber Lasers/ Devices—Continued

SW3F.3 • 14:30

Invited

Narrow Linewidth Fiber Amplifiers, Scott Christensen¹; ¹*Lockheed Martin Coherent Technologies, USA*. Abstract not available.

SW3F.4 • 15:00

Invited

Thulium-Doped Fiber Amplifier Development for NASA's ASCENDS Mission, Mark W. Phillips¹; ¹*Lockheed Martin Coherent Technologies, USA*. This paper describes the power-scaling capability and radiation resistance of a 2 micron Tm:glass single mode fiber amplifier that scales single frequency output power from 30mW to >8W while maintaining absolute frequency uncertainty of <1MHz.

15:30–16:00 Coffee Break, Colorado Gallery and Grand Rivers Gallery

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

16:00–18:00

AW4A • OFDM- and WDM-PON Technologies
Milos Milosavjevic; *Univ. of Hertfordshire,*
UK, Presider

AW4A.1 • 16:00 

Uplink Solutions for Future Access Networks, Rene M. Schmogrow¹, Philipp C. Schindler¹, David Hillerkuss¹, Christian Koos^{1,2}, Wolfgang Freude^{1,2}, Juerg Leuthold^{1,2}; ¹*Institute of Photonics and Quantumelectronics, Karlsruhe Institute of Technology, Germany;* ²*Institute for Microstructure Technology, Karlsruhe Institute of Technology, Germany.* We demonstrate an uplink with an optical carrier (seed) sent to the optical network unit over 75 km of SSME. Two ONUs transmit either 10 Gbit/s OFDM or sinc-shaped Nyquist pulses.

AW4A.2 • 16:30

Linearity Improvement of Directly Modulated PONs by Digital Pre-Distortion of Coexisting OFDM-based Signals, Tiago F. Alves¹, José Morgado¹, Adolfo Cartaxo¹; ¹*IST/Instituto de Telecomunicações, Portugal.* Digital pre-distortion of five OFDM-based wired-wireless signals for compensation of directly-modulated PONs nonlinearity is demonstrated experimentally. This technique leads to EVM-compliant levels in all signals and to EVM improvements that reach 5.7dB in UWB signals.

AW4A.3 • 16:45

Remote Heterodyne Reception of OFDM-QPSK as Downlink Solution for Future Access Networks, Philipp Schindler¹, Rene M. Schmogrow¹, David Hillerkuss¹, Moshe Nazarathy², Shalva Ben-Ezra³, Christian Koos¹, Wolfgang Freude¹, Juerg Leuthold¹; ¹*Institute of Photonics and Quantum Electronics, Karlsruhe Institute of Technology, Germany;* ²*Israel Institute of Technology, Israel;* ³*Finisar, Israel.* We demonstrate transmission of 46.5 Gbit/s OFDM-QPSK signals over a distance of 100 km within an optical bandwidth of 25 GHz, and heterodyne detection of the OFDM subcarriers with a remotely supplied local optical oscillator.

AW4A.4 • 17:00

An OFDM-PON with non-preselected ONUs: dimensioning and experimental results, Iván Cano¹, María C. Santos¹, Xavier Escayola¹, Victor Polo¹, Josep Prat¹; ¹*Universitat Politècnica de Catalunya, Spain.* An OFDM-PON with a simple centralized wavelength control of low-cost non-preselected independent ONU sources is presented, dimensioned, and tested experimentally. The rejection-ratio is reduced to less than 1% increasing the cost-effectiveness of the access network.

16:00–18:00

SPPCom Postdeadline Paper Session and Rump Session


16:00–18:00

IW4C • Bionanophotonics and Si Nanophotonics 


Gary Wiederrecht; *Argonne National Laboratory, USA, Presider*

IW4C.1 • 16:00  


Subwavelength Photonics for Biosensing, Brian T. Cunningham¹; ¹*Univ of Illinois at Urbana-Champaign, USA.* Nanostructured surfaces are applied towards point-of-care diagnostic biosensing. Photonic crystal enhanced fluorescence is used for detection of cancer biomarkers in serum. Metal nanodomains integrated with biomedical tubing to monitor intravenously delivered drugs and urinary metabolites.

IW4C.2 • 16:30 

λ -size Silicon Modulator, Volker J. Sorger¹, Noberto D. Lanzillotti-Kimura¹, Ren-Min Ma¹, Xiang Zhang^{1,2}; ¹*Univ. of California, Berkeley, USA;* ²*Materials Sciences Division, Lawrence Berkeley National Laboratory, USA.* We report an experimental demonstration of a 3λ -size, silicon waveguide-integrated electro-optic modulator with a record high extinction ratio exceeding 1dB/ μ m, extremely low insertion loss (-1dB) in the ON-state, and an ultra-broadband (>0.5 μ m) bandwidth based on free-carrier switching in ITO.

IW4C.3 • 16:45 

Ultralow-Power 160-Gb/s All-Optical Demultiplexing in Hydrogenated Amorphous Silicon Waveguides, Ke-Yao Wang¹, Keith G. Pettillo¹, Mark A. Foster¹, Amy C. Foster¹; ¹*Electrical and Computer Engineering, Johns Hopkins Univ., USA.* We demonstrate demultiplexing of 160-Gb/s OTDM data signals to 10 Gb/s using four-wave mixing in hydrogenated amorphous silicon nanowaveguides. We observe error-free (BER < 10⁻⁹) operation with record-low switching powers for an integrated device.

IW4C.4 • 17:00 

Polarization Insensitive Wavelength Conversion Based on Four-Wave Mixing in a Silicon Nanowire, Minhao Pu¹, Hao Hu¹, Christophe Peucheret¹, Hua Ji¹, Michael Galili¹, Leif K. Oxenlowe¹, Palle Jeppesen¹, Jorn M. Hvam¹, Kresten Yvind¹; ¹*DTU Fotonik, Photonics Engineering, Danmarks Tekniske Universitet, Denmark.* We experimentally demonstrate, for the first time, polarization-insensitive wavelength conversion of a 10 Gb/s NRZ-OOK data signal based on four-wave mixing in a silicon nanowire with bit-error rate measurements.

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

16:00–18:00

NP Postdeadline Paper Session

16:00–17:15

BW4E • Applications of Gratings and Poled Glass: FBG Applications to Optical Signal Processing

Sophie LaRochelle; Université Laval, Canada, Presider

BW4E.1 • 16:00

100 nm Wide Fiber Bragg Grating Dispersion Compensator Around Zero Dispersion Wavelength, Francois Trepanier¹, Michel Morin¹, Guillaume Brochu¹, Yves Painchaud¹, Desmond C. Adler², Wolfgang Wieser³, Robert Huber³; ¹TeraXion Inc, Canada; ²St. Jude Medical, USA; ³Ludwig Maximilians Univ., Germany. Nonlinearly chirped fiber Bragg gratings compensate 600 ps of chromatic dispersion from 4 km of SMF-28 fiber around the zero dispersion wavelength with less than 10 ps of residual delay over a 100 nm bandwidth.

BW4E.2 • 16:15

Tunable Fractional Order Temporal Differentiator Using an Optically Pumped Tilted Fiber Bragg Grating, Jianping Yao¹, Hiva Shahoei¹; ¹Univ. of Ottawa, Canada. An optically tunable photonic fractional temporal differentiator using a tilted-fiber-Bragg-grating written in an erbium/ytterbium co-doped fiber is proposed. The temporal differentiation of a Gaussian pulse with a bandwidth of 28 GHz at different orders is demonstrated.

BW4E.3 • 16:30

Design of picosecond flat-top optical pulse generator using a linearly-chirped fiber Bragg grating in Transmission, María R. Fernández-Ruiz^{1,2}, Alejandro Carballar², Jose Azana¹; ¹Energie, Matériaux et Télécommunications, Institut National de la Recherche Scientifique, Canada; ²Departamento de Ingeniería Electrónica, E.T.S. de Ingenieros, Spain. A picosecond rectangular pulse-shaper based on a linearly-chirped fiber Bragg grating in transmission is presented. The design exploits the space-to-frequency mapping and the degree of freedom in the reflection spectral phase specifications.

BW4E.4 • 16:45

Long period fiber grating designs for real-time ultra-fast Hilbert transformations, Reza Ashrafi¹, Jose Azana¹; ¹INRS-EMT (Institut National de la Recherche Scientifique - Energie, Matériaux et Télécommunications), Canada. A novel all-optical design for implementing THz-bandwidth Hilbert transformers based on a uniform-period long-period grating (LPG) with a properly designed grating apodization profile is proposed and numerically demonstrated.

BW4E.5 • 17:00

Ultrafast optical pulse shaping by exploiting the first-order Born approximation in long period gratings, Reza Ashrafi¹, Jose Azana¹; ¹INRS-EMT (Institut National de la Recherche Scientifique - Energie, Matériaux et Télécommunications), Canada. A novel general approach for THz-bandwidth optical filter synthesis, particularly interesting for ultrafast optical pulse shaping, based on the first-order Born approximation in long period gratings is proposed and numerically validated.

16:00–18:00

SW4F • Lasers, Components and Fiber Characterization

Iyad Dajani; US Air Force Research Laboratory, USA, Presider

SW4F.1 • 16:00 Invited

Making lower energy photons from fiber lasers, Stuart D. Jackson¹; ¹Institute of Photonics and Optical Science, Australia. I will briefly review progress in the development of high power longer wavelength fibre lasers with a special emphasis on fibre design for efficient performance.

SW4F.2 • 16:30

Flattened fundamental mode in optical Fibers, arnaud mussot¹, Constance Valentin¹, Yves Quiquempois¹, Geraud Bouwmans¹, Laurent Bigot¹, Marc Douay¹, Laure Lago², Pierre Calvet², Emmanuel Hugonnot³; ¹phlam, France; ²CEA, France. We present the design and the fabrication of a microstructured fiber that delivers a flat-top intensity profile. Characterization of this fiber shows that it is suitable for applications such as high-power amplification or micro-machining.

SW4F.3 • 16:45

Phase-locking a fiber laser array by phase contrast filtering and nonlinearity, François Jeux^{1,3}, Agnes Desfarges-Berthelemy¹, Vincent Kermene¹, Julien Guillot^{1,2}, Alain J. Barthelemy¹; ¹XLIM Research Institute, CNRS / Université de Limoges, France; ²CILAS, France; ³ASTRIUM, France. A new compound cavity is proposed to passively phase-lock an array of fiber lasers. Simulations show that the scheme enhances combining efficiency. Preliminary experiments with four lasers will be reported demonstrating the expected operation.

SW4F.4 • 17:00

Field-flattened high-order modes, Mike Messerly¹; ¹Lawrence Livermore National Laboratory, USA. We present a method for designing circularly-symmetric waveguides that support a field-flattened higher order mode and show that adding these flattened, concentric rings does not alter the effective index or flattened nature of the mode.

Arkansas

Access Networks and In-house Communications

Platte

Signal Processing in Photonics Communications

Colorado II

Integrated Photonics Research, Silicon and Nano Photonics

These concurrent sessions are grouped across two pages. Please review both pages for complete session information.**AW4A • OFDM- and WDM-PON Technologies—Continued****AW4A.5 • 17:15**

Wired-Wireless OFDM Signals Coexistence in LR-PONs Using Two Centralized Compensation Stages, Tiago F. Alves¹, Maria Morant², Adolfo Cartaxo¹, Roberto Llorente²; ¹IST/Instituto de Telecomunicações, Portugal; ²Nanophotonics Technology Centre, Universidad Politécnica de Valencia, Spain. Transmission in coexistence of five OFDM signals along LR-PONs employing two centralized compensation stages is demonstrated experimentally. All OFDM signals are EVM-compliant with EVM fluctuations below 1dB for OLT-ONU distances between 75km and 125km.

AW4A.6 • 17:30

Exploiting Faraday rotation in Reflective PON architectures, Stefano Straullu¹, Giuseppe Rizzelli², Valter Ferrero³, Roberto Gaudino³, Silvio Abrate¹, Fabrizio Forghieri¹; ¹ISMB, Italy; ²Politecnico di Torino, Italy; ³Cisco Photonics, Italy. We experimentally investigate on reflective PON architectures that includes Faraday rotation at the ONU, showing an increased resilience to back-scattering induced impairments.

AW4A.7 • 17:45

Uncooled operation of directly-modulated and polarization insensitive self-seeded Fabry-Perot laser diodes, Marco Presi¹, Andrea Chiuchiarrelli¹, Raffaele Corsini¹, Pallab Choudhury¹, Ernesto Ciaramella¹; ¹Institute of Communication, Information and Perception Technologies, Scuola Superiore Sant'Anna, Italy. We report an experimental characterization of uncooled operation (0-60°C) of directly-modulated self-seeded Fabry-Perot laser diodes. Error-free 1.25Gb/s operations across the C-band have been obtained with sensitivities compatible with power budget of short reach WDM-PON.

BGPP Postdeadline Paper Session**IW4C • Bionanophotonics and Si Nanophotonics—Continued****IW4C.5 • 17:15**

Trimming of Athermal Silicon Resonators, Vivek Raghunathan¹, Stefano Grillanda², Vivek Singh¹, Antonio Canciamilla², Francesco Morichetti², Anuradha Agarwal¹, Jurgen Michel¹, Andrea Melloni², Lionel C. Kimerling¹; ¹Materials Science and Engineering, Massachusetts Institute of Technology, USA; ²Electronics and Information, Politecnico di Milano, Italy. Thin photosensitive layer of As₂S₃ sandwiched in between a-Si core and negative thermo-optic polymer over-cladding enables trimming of athermal rings. Exposure to visible light can shift their resonances by 195GHz at trimming rates around 1GHz/min.

IW4C.6 • 17:30

Demodulation of 40 Gb/s DPSK Signals Using a Silicon Microring Resonator with Electro-Optic Wavelength Tuning, Gordon K. P. Lei^{1,2}, Ke Xu^{1,2}, Stanley M. G. Lo^{1,2}, Chester Shu^{1,2}, Hon K. Tsang^{1,2}; ¹Electronic Engineering, The Chinese Univ. of Hong Kong, Hong Kong; ²Center for Advanced Research in Photonics, The Chinese Univ. of Hong Kong, Hong Kong. We demonstrate demodulation of 40 Gb/s DPSK signals using a silicon microring resonator with electro-optic wavelength tuning. Error-free operations have been achieved with a 3.5-dB receiver sensitivity variation over the full tuning range.

IW4C.7 • 17:45

Ultra-Compact High-Speed Electro-Optic Switch Utilizing Hybrid Metal-Silicon Waveguides, Eric Dudley¹, Wounghang Park¹; ¹USA. This paper presents a design for an ultra-compact electro-optic switch based on hybrid waveguide technology. At 1V drive voltage, switching at speeds up to 30Gbits/sec can be achieved in a device that is 30 μm long.

18:30–21:30 Networking Dinner (tentative), Cheyenne Courtyard

Colorado I

Nonlinear Photonics

White River

Bragg Gratings, Photosensitivity, and Poling in Glass Waveguides

Rio Grande/Gunnison

Specialty Optical Fibers

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

NP Postdeadline Papers—Continued**BGPP Postdeadline Papers****SW4F • Lasers, Components and Fiber Characterization—Continued****SW4F5 • 17:15**

Low-Loss Coupling Between Single-Mode Optical Fibers with Very Different Mode-Field Diameters, Arash Mafi¹, Peter Hofmann^{2,3}, Clemence Jollivet Salvin², N. Peyghambarian³, Axel Schulzgen²; ¹Electrical Engineering, Univ. of Wisconsin Milwaukee, USA; ²The College of Optics and Photonics, Univ. of Central Florida, USA; ³College of Optical Sciences, Univ. of Arizona, USA. We show that short segments of graded-index optical fiber can provide broadband, very low-loss coupling between single-mode optical fibers with very different mode-field diameters.

SW4F6 • 17:30

Residual Dispersion Compensation with a Spiral PCF, Yousaf O. Azabi¹, Arti Agrawal¹, B.M. Azizur Rahman¹, Kenneth Grat-tan¹; ¹School of Engineering and Mathematical Sciences, City Univ. London, UK. We propose a novel Archimedean spiral PCF design for residual dispersion compensation. The proposed fiber can be fabricated using sheet rolling techniques, and shows $D \sim -149$ ps/nm/km in the range (1.3-1.7 μ m).

SW4F7 • 17:45

Geometric Control of Crystallography in Semiconductor Core Optical Fiber, Stephanie Morris¹, Colin McMillen¹, Thomas Hawkins¹, Paul Foy¹, Roger Stolen¹, John Ballato¹, Robert Rice²; ¹The Center for Optical Materials Science and Engineering Technologies (COMSET) and the School of Materials Science and Engineering, Clemson Univ., USA; ²Dreamcatchers Consulting, USA. Crystalline semiconductor core optical fibers have become a topic of recent interest. This work focuses on the role that the core geometry can play on the crystallinity and crystallography of crystalline semiconductor core optical fibers.

18:30–21:30 Networking Dinner, Cheyenne Courtyard

Wednesday, 20 June

07:30–12:30 Registration, Lower Lobby, Conference Level

08:30–10:00

NTh1A • Novel Nonlinear Materials ▶

Thibaut Sylvestre; Université de Franche-Comte, France, President

NTh1A.1 • 08:30 **Invited**

Four Wave Mixing in Silicon-Organic Waveguides, Manfred Eich¹; ¹Technische Universität Hamburg-Harburg, Germany. In order to achieve high conversion efficiencies in micro photonic waveguides we functionalize silicon waveguides with novel third order nonlinear polymers. Such structures are envisaged for high efficient entangled photon sources and parametric amplifiers.

NTh1A.2 • 09:00 ▶

Materials for Loss-Based Switching in Silicon-Organic Hybrid Devices, Joel M. Hales¹, Hyeonueu Kim¹, Anthony DeSimone¹, Henry Wen², Taige Hou^{2,3}, Alex Jen⁴, Seth Marder¹, Michal Lipson³, Alexander L. Gaeta², Joseph W. Perry¹; ¹School of Chemistry and Biochemistry, Georgia Institute of Technology, USA; ²School of Engineering and Applied Physics, Cornell Univ., USA; ³School of Electrical and Computer Engineering, Cornell Univ., USA; ⁴Department of Materials Science and Engineering, Univ. of Washington, USA. We determine the critical parameters to produce highly efficient all-optical switching via nonlinear-loss-based decoupling in silicon microring resonators with organic material claddings. Switching energies as low as 100 fJ are possible.

NTh1A.3 • 09:15 ▶

Surface Optical Nonlinearity in GaP Nanopillar Waveguides, Marcin Swillo¹, Reza Sanatinia², Srinivasan Anand²; ¹Royal Institute of Technology (KTH), Sweden; ²Royal Institute of Technology (KTH), Sweden. Second harmonic generation in GaP nanopillars is investigated by polarization measurements and light confinement analysis. Effective thickness of the nonlinear surface region is ~ 10nm and the corresponding nonlinear coefficient 20 times larger than in bulk.

NTh1A.4 • 09:30 ▶

Dual-Arm Z-scan for measuring nonlinearities of solutes in solution, Manuel R. Ferdinandus¹, Matthew Reichert¹, Trenton R. Ensley¹, Dmitry A. Fishman¹, Scott Webster¹, David J. Hagan¹, Eric W. Van Stryland¹; ¹CREOL, The College of Optics and Photonics, Univ. of Central Florida, USA. Performing identical and simultaneous Z-scans on two samples (solvent and solvent plus solute), the effects of solvent n₂ can be essentially eliminated, thus overcoming a longstanding problem in organic dye nonlinear characterization.

NTh1A.5 • 09:45 ▶

Towards mode-locked fiber laser using topological insulators, François Bernard¹; ¹OPERA-photonique, Université Libre de Bruxelles, Belgium. Topological insulators have lately been extensively studied. Their optical properties though have not been well described yet. We recently highlighted that a topological insulator exhibits saturable absorber-like behavior when placed in a 1550 nm laser beam.

08:30–10:00

SpTh1B • DSP Algorithm II

Fabio Pittalà; Huawei Technologies Co. Ltd., Germany, President

SpTh1B.1 • 08:30 **Invited**

Decision-aided carrier phase estimation for coherent optical communication systems, Changyuan Yu^{1,2}, Pooi-Yuen Kam¹, Shaoliang Zhang^{1,3}, Jian Chen⁴; ¹National Univ. of Singapore, Singapore; ²A*STAR Institute for Infocomm Research, Singapore; ³NEC Laboratories America, USA; ⁴Nanjing Univ. of Posts and Telecommunications, China. We review the performance of decision-aided maximum likelihood (DA ML) phase estimation and its adaptive counterpart in different modulation formats.

SpTh1B.2 • 09:00

Coherent Optical Single-carrier Frequency-division-multiplexing System with Overlap Frequency Domain Equalization, Chunxu Zhao¹, Zhang Su¹, Liu Di¹, Juhao Li¹, Fan Zhang¹, Zhangyuan Chen¹; ¹Peking Univ., China. Overlap FDE based on MMSE criterion is proposed and applied on the CO-SCFDM system without CP for the first time. Simulation results show it has similar characteristics as the conventional CO-SCFDM system.

SpTh1B.3 • 09:15

Fiber Nonlinearities Compensation by Polar Gaussian MLSD, Domenico Marsella¹, Marco Secondini¹, Enrico Forestieri¹, Roberto Magri²; ¹Scuola Superiore Sant'Anna, Italy; ²Ericsson, Italy. A novel maximum likelihood sequence detection (MLSD) strategy to combat fiber non-linearities is presented and compared to known compensation techniques such as backpropagation.

SpTh1B.4 • 09:30 **Invited**

Frequency-Domain Signal Processing for Chromatic Dispersion Equalization and Carrier Frequency Offset Estimation in Optical Coherent Receivers, Tadao Nakagawa¹; ¹NTT Network Innovation Laboratories, Japan. Frequency-domain equalization (FDE) and spectrum-based optical carrier frequency offset estimation (FOE) are presented. These signal processing operations are both carried out in frequency domain and suitable for coherent optical communications.

10:00–10:30 Coffee Break, Colorado Gallery and Grand Rivers Gallery

10:30–12:30

NTh2A • Nonlinear Effects in Optical Waveguides ▶

John Harvey, Univ. of Auckland, New Zealand, Presider

NTh2A.1 • 10:30 ▶

Four-Wave Mixing Fiber Source for Coherent Raman Scattering Microscopy, Simon Lefrancois¹, Dan Fu², Gary R. Holtom², Lingjie Kong¹, William J. Wadsworth³, Patrick Schneider⁴, Robert Herda⁴, Armin Zach⁴, Sunney X. Xie², Frank W. Wise¹; ¹Applied Physics, Cornell Univ., USA; ²Chemistry and Chemical Biology, Harvard Univ., USA; ³Physics, Univ. of Bath, UK; ⁴TOPTICA Photonics AG, Germany. We present a two-color picosecond fiber laser system based on four-wave mixing in photonic crystal fiber. Seeding the process overcomes pulse walk-off and noise. 1 μm pulses are converted to 800 nm for CARS microscopy.

NTh2A.2 • 10:45 ▶

Integrated liquid-core optical fiber for nonlinear liquid photonics, Khanh Kieu¹, Yegeniy Merzlyak¹, Lukas Schneebeli¹, Joel M. Hales², Joseph W. Perry², Robert A. Norwood¹, N. Peyghambarian¹; ¹College of Optical Sciences, Univ. of Arizona, USA; ²Georgia Technology Institute, USA. We have developed a technique that allows splicing of liquid core optical fiber (LCOF) to standard single-mode optical fiber with low loss (<1dB). As an example, we performed inverse Raman spectroscopy in a CCl₄ filled LCOF that is spliced to SMF28 on both sides

NTh2A.3 • 11:00 ▶

Supercontinuum generation with picosecond ultraviolet pulses in a solid-core photonic crystal fiber, Thibaut Sylvestre¹; ¹Universite de Franche-Comte, France. Black light supercontinuum generation is demonstrated as a result of picosecond pumping a solid-core photonic crystal fiber at 355-nm through the combined effects of intermodal four-wave mixing and cascaded Raman scattering.

NTh2A.4 • 11:15 ▶

Counting photon numbers of Bragg-Scattering FWM frequency conversion at telecom wavelengths, Katarzyna Krupa¹, Alessandro Tonello¹, Victor V. Kozlov^{2,3}, Vincent Couderc¹, Philippe Di Bin¹, Stefan Wabnitz²; ¹Universit  de Limoges, XLIM, UMR CNRS 7252, France; ²Department of Physics, St.-Petersburg State Univ., Russian Federation; ³Dipartimento di Ingegneria dell'Informazione, Universit  di Brescia, Italy. We experimentally study Bragg-Scattering Four-Wave Mixing in nonlinear fiber at telecom wavelengths with photon counters. We discuss frequency conversion of attenuated laser under different pump polarizations. Performances are limited by Raman noise.

NTh2A.5 • 11:30 ▶

Experimental demonstration of all-fiber continuous wave optical parametric amplifier operating at 1 μm , arnaud mussot¹, Alexandre Kudlinski¹, Laure Lago², Damien Bigourd², Thibaut Sylvestre¹, Min Lee³, Emmanuel Hugonnot³; ¹phlam, France; ²CEA, France; ³femto-st, France. We report the first experimental demonstration of an all-fiber optical parametric amplifier around 1 μm with a broad bandwidth of 16 nm and a high amplification gain of 25 dB

NTh2A.6 • 11:45 ▶

Octave-spanning Infrared Supercontinuum Generation in Robust Chalcogenide Nano-tapers, Soroush Shabahang¹, Guangming Tao¹, Mohammad U. Piracha¹, Dat Nguyen¹, Peter Delfyett¹, Ayman F. Abouraddy¹; ¹Univ. of Central Florida, CREOL, USA. We fabricate robust step-index chalcogenide nano-tapers. Using picosecond pulses at 1.55 μm , we generate octave-spanning low-power-threshold near-infrared and mid-infrared supercontinuum (0.85-2.35 μm).

NTh2A.7 • 12:00 ▶

Generation of Photon Pairs in Cubic Nonlinear Waveguide Arrays, Alexander S. Solntsev¹, Andrey A. Sukhorukov¹, Dragomir Neshev¹, Yuri S. Kivshar¹; ¹Australian National Univ., Australia. We analyze the quantum statistics of photon pair generation through spontaneous four-wave mixing in nonlinear waveguide arrays and predict pump power-controlled transition between bunching and anti-bunching correlations due to self-focusing of the pump beam.

NTh2A.8 • 12:15 ▶

All-optical fiber-based devices for ultrafast amplitude jitter magnification, Charles-Henri Hage¹, Bertrand Kibler¹, Julien Fatome¹, Christophe Finot¹; ¹Laboratoire Interdisciplinaire CARNOT de Bourgogne, France. We propose two fiber-based architectures that enable the all-optical magnification of ultrafast amplitude fluctuations of picosecond or femtosecond pulse trains. An increase of the fluctuations by more than one order of magnitude is experimentally achieved.

10:30–12:00

SpTh2B • Monitoring

Chao Lu; Hong Kong Polytechnic Univ., Hong Kong, Presider

SpTh2B.1 • 10:30 **Invited**

Performance monitoring through signal processing in current and future optical communication systems, Alan P. Lau¹, Fabian N. Hauske², Trevor B. Anderson^{3,4}, Chao Lu⁵; ¹Hong Kong Polytechnic Univ., Hong Kong; ²Huawei Technologies Duesseldorf GmbH, European Research Center, Germany; ³National ICT Australia, Victorian Research Laboratory, Univ. of Melbourne, Australia; ⁴Monitoring Division, Univ. of Melbourne, Australia; ⁵Dept. of Electronic and Information Engineering, The Photonics Research Center, The Hong Kong Polytechnic Univ., Hong Kong. We review the current status of Optical Performance Monitoring(OPM) in deployed optical networks and discuss on emerging OPM trends and challenges brought about by the migration towards coherent communications with digital coherent receivers.

SpTh2B.2 • 11:00

PDL-aware In-band OSNR Monitoring based on the Spectral Properties of Concatenated CAZAC Sequences, Fabio Pittal ^{1,2}, Fabian N. Hauske¹, Yabin Ye¹, Neil G. Guerrero¹, Idelfonso T. Monroy², Josef A. Nossek³; ¹European Research Center, Huawei Technologies Co Ltd, Germany; ²Fotonik, Technical Univ. of Denmark, Denmark; ³Institute for Circuit Theory and Signal Processing, Technische Universit t M nchen, Germany. A novel method for accurate in-band OSNR monitoring based on analysis of the power spectral density of concatenated received CAZAC training sequences is demonstrated over a wide range of combined linear distortions.

SpTh2B.3 • 11:15

Accurate Blind Chromatic Dispersion Estimation in Long-haul 112Gbit/s PM-QPSK WDM Coherent Systems, Vitor Ribeiro¹, Stenio Ranzini¹, J lio Oliveira¹, Vitor Nascimento¹, Eduardo Magalh es¹; ¹Photonics, CPqD, Brazil. Chromatic dispersion can vary due to optical network reconfigurations and hence blind estimators are desired. We propose an improved CD estimation method evaluated experimentally exhibiting good estimation accuracy and robustness to optical filtering and noise

SpTh2B.4 • 11:30

Natural Expression of the Best-Match Search Godard Clock-Tone Algorithm for Blind Chromatic Dispersion Estimation in Digital Coherent Receivers, Christian Malouin¹, Philip Thomas¹, Bo Zhang¹, Jason O'Neil¹, Ted Schmidt¹; ¹Juniper Networks Inc., USA. We reveal the natural expression of the "best-match search" Godard clock-tone algorithm for blind chromatic dispersion estimation. The complexity is reduced by more than 2 orders of magnitude compare to the conventional method

SpTh2B.5 • 11:45

PDL Monitoring based on the Eigenvalues Spread of a Data-Aided Zero-Forcing Frequency Domain Equalizer, Fabio Pittal ^{1,2}, Fabian N. Hauske¹, Yabin Ye¹, Neil G. Guerrero¹, Idelfonso T. Monroy², Josef A. Nossek³; ¹European Research Center, Huawei Technologies Co Ltd, Germany; ²Fotonik, Technical Univ. of Denmark, Denmark; ³Institute for Circuit Theory and Signal Processing, Technische Universit t M nchen, Germany. Precise and robust PDL monitoring is demonstrated over a wide range of combined channel impairments. The PDL value is extracted from the zero forcing filter matrix estimated by using short CAZAC training sequences.

Key to Authors and Presiders

- Adedotun, Adebayo - BW2E.2, BW2E.7, JTu5A.51
 Mezghani, Amine - SpTu3A.4
 Abe, Ryo - JTu5A.21
 Abedin, Kazi S. - BW3E.3, BW3E.4, BW3.5
 Abouou, Zambo - JM5A.45
 Abouraddy, Ayman F. - STu2F.4, STu1D.5, STu2F.6, JTu5A.15, NTh2C.6
 Abraha, Solomon - AW3A.2
 Abrate, Silvio - AW3A.5, AW4A.6, JM5A.6
 Abril, Evaristo J. - AW2A.2
 Absil, Philippe - ITu2B.1
 Ackemann, Thorsten - JM5A.34, NTu2D.3
 Adamietz, Frédéric - BW1D.3
 Adhikari, Susmita - SpTu2A.3
 Adibi, Ali - IW2C.4
 Adler, Desmond C. - BW4E.1
 Agarwal, Anuradha - ITu2B.3, IW4C.5
 Agazzi, O. - SpW2B.4
 Aggarwal, Nandita - BM4D.4
 Aggarwal, Ishwar - STu3F
 Agranat, Aharon - NTu3D.6, NW3D.1
 Agrawal, Arti - SW4F.6
 Aguado, Juan Carlos - AW2A.2
 Aguergaray, Claude - JTu5A.32, NM4C.2
 Ahlawat, Meenu - BTu2E.4, JTu5A.37
 Aieta, F. - IW1B.1
 Aimez, Vincent - ITu3B.3
 Akhmediev, Nail N. - NM4C.5, NW2D, NW3D.5, NW3D.6, NW3D.7
 Akhtari, Simon - SpW3B.2, SpW3B.3
 Akrouf, Akram - IM4B.7
 Aksyuk, Vladimir - IW2C.5
 Akturk, Akin - IM2A.5
 Alam, Shaif-ul - BW3E.6, BW3E.7
 Albert, Jacques - BTu2E.1, BTu2E.5, BW2E.1
 Alcon-Camas, Mercedes - JM5A.7
 Alkeskjold, Thomas T. - SM3E.4
 Alloatti, Luca - IM3A.3
 Allsop, Thomas - BTu2E.7
 Alodjants, Alexander P. - JM5A.22, JTu5A.45
 AlSaadi, Aws - ITu2B.6
 Alves, Tiago F. - AW4A.2, AW4A.5, JTu5A.1
 Amato Santamaria, Luigi - JM5A.44
 Amiranashvili, Shalva - NM2C.1
 Anand, Srinivasan - NTh1A.3
 Anchal, Abhishek - JM5A.27
 Anderson, Trevor B. - SpTh2B.1
 Andkjær, Jacob - IM2B.4
 Andre, Paulo S. - AW2A.3, JTu5A.4
 Andresen, Esben R. - NTu2D.7
 Andronico, Alessio - JM5A.16
 Ania-Castanon, Juan D. - BTu2E.7, JM5A.7, NW1C.4, NW2D.6
 Ankiewicz, Adrian - NW3D.6
 Anthur, Aravind - JM5A.21
 Appel, Patrick - IM3A.3
 Arai, Shigehisa - ITu3B.4
 Arakawa, Yasuhiko - ITu4B.5
 Arakelian, Sergei M. - JM5A.22, JTu5A.45
 Arévalo, Edward - JM5A.23
 Argyros, Alexander - SW1E.3
 Arikani, Mustafa - JTu5A.6
 Armaroli, Andrea - JM5A.39
 Arroyo Carrasco, Maximino L. - JM5A.54, JM5A.55
 Asghari, Mehdi - IM4A.1
 Ashrafi, Reza - BW4E.4, BW4E.5
 Askari, Murtaza - IW2C.4
 Athanasiou, George - SM3E.3
 Atsumi, Yuki - ITu3B.4
 Attygalle, Manik - BW2E.5
 Awwad, Elie - SpTu2A.5
 Ayotte, Nicolas - BW2E.3
 Ayoub, Mousa - JM5A.30, NTu4D.4
 Azabi, Yousaf O. - SW4F.6
 Azana, Jose - BTu2E, BTu2E.3, BW4E.3, BW4E.4, BW4E.5, NW1C.5, SpTu4A.3
 Babin, Sergey - JM5A.50, NW1C.4
 Bache, Morten - NW3D.4
 Badding, John V. - NTu3D.3, SM4E.3, STu1D.1
 Baehr-Jones, Tom - IM2B.1
 Baeuery, Benedikt - SpTu2A.2
 Bagdasaryan, Tigran - JTu5A.50
 Bale, Brandon G. - NM4C.4
 Ballato, John - JM1B, JTu5A.16, STu1D.2, STu1D.6, SM2E, SW4F.7
 Banaei, Esmail-Hooman - STu2F.4, STu2F.6
 Bang, Ole - JTu5A.22, NW3D.4
 Baronio, Fabio - NW2D.5
 Barry, Liam P. - BTu2E.1, SpW2B.2
 Bartelt, Hartmut - BTu4E.1, JM5A.56, JTu5A.50
 Barthelemy, Alain J. - SW4F.3
 Barton, Jonathon - ITu2B.2
 Barvieu, Benoit - NM2C.5
 Bauer, U. - SpW2B.4
 Bauters, Jared F. - ITu2B.2
 Bayvel, Polina - SpTu1A.3
 Baz, Assaad - SM3E.5
 Bazin, Alexandre - IW3C.3, IW1B.4
 Beaudin, Guillaume - ITu3B.3
 Becker, Martin - JM5A.56, JTu5A.50
 Becker, Ria G. - BM2D.4
 Beeker, Willem - JM5A.14
 Belai, Oleg V. - IM3B.5
 Belal, Mohammad - SM2E.6, JTu5A.56
 Beling, Andreas - IM2A.2
 Bellanca, Gaetano - IW3C.5, NTu4D.5
 Ben Rayana, Souha - SpW2B.3
 Benabid, Fetah - NTu3D.1
 Bencheikh, Kamel - NW1C.2
 Bendahmane, Abdelkrim - NM2C.6
 Ben-Ezra, Shalva - AW4A.3
 Bennett, Kevin - SW1E.2
 Benoit Heroux, Jean - ITu3B
 Benson, Trevor - SM3E.3
 Benterou, Jerry - BTu3E.1
 Beresna, M. - SM2E.1
 Berghmans, Francis - JTu5A.50
 Bernard, François - NTh1A.5
 Bernhardt, Edward H. - BM3D.1
 Bernier, Martin - BM2D.2, BM4D.7
 Bersch, Christoph - NTu3D.5, NTu4D.3
 Bertarini, Pedro L. - JTu5A.34
 Besbes, Hichem - SpW2B.3
 Bessette, Jonathan T. - IM3A.4, IM3A.5
 Beugnot, Jean Charles - JTu5A.36
 Bhamber, Ranjeet S. - BTu2E.7
 Bialiyayev, Alexander - BW2E.1
 Biancalana, Fabio - NTu3D.2
 Bianco, Federica - JM5A.46
 Bienstman, Peter - IM2B.3
 Bigot, Laurent - SM3E.5, SW4E.2
 Bigourd, Damien - NTh2A.5
 Binet, Laurent - BM4D.5
 Blas, Martin - IM4A.4
 Bloemer, Mark - JTu5A.20
 Blumenthal, Daniel - ITu2B.2
 Boetti, Nadia G. - JM5A.6, SM3E.3
 Bogaerts, Wim - ITu2B.1
 Boguslawski, Martin - JM5A.24, JM5A.31, JM5A.35
 Bohn, M. - SpW2B.4
 Boller, Klaus J. - JM5A.14
 Boltasseva, Alexandra - IW1B, ITu4C.1
 Bongiovanni, Domenico - NTu3D.4
 Borges, Ben-Hur V. - JTu5A.34
 Bornhorst, Kirstin - IM4A.4
 Bosco, Gabriella - SpW3B.1, SpW3B.6
 Bostani, Ameneh - JM5A.17
 Bottomley, Adam - BW2E.1
 Bourhis, Kevin - BM1D.2, BM4D.1, BM4D.5
 Bouwmans, Geraud - NW3D.3, SM3E.5, SW4E.2
 Bowers, John E. - IM2A.2, ITu4B.1, ITu2B.2
 Bradford, Joshua D. - STu4F.1
 Brahim, Guizal - JTu5A.11
 Brambila, Danilo - JM5A.52
 Bree, Carsten - NM2C.1
 Brenot, Romain - IM2A.3
 Bres, Camille-Sophie - JM5A.8, JM5A.20
 Brochu, Guillaume - BW4E.1
 Broderick, Neil - JTu5A.32, NM4C.2, NW1C
 Broeng, Jes - SM3E.4, SW2F.3
 Brunstein, Maia - NW1C.2
 Buckley, Brandon - JM5A.20
 Buczynski, Ryszard - JTu5A.14
 Buelow, Henning - JW1A.2
 Buethe, Lars - BTu2E.6
 Bugaychuk, Svitlana - JTu5A.30, JM5A.37
 Busch, Kurt - IM2B, IM3B.1
 Butrie, Tim - IM2A.4
 Büttner, Thomas - JTu5A.17
 Byrnes, Adam - ITu3C.2
 Cabriales, Lucia - ITu4C.5
 Cai, Yan - IM3A.4, IM3A.5
 Calabrò, Stefano - SpTu3A.6
 Callender, Claire - ITu4B.3, JTu5A.10, SpTu4A.3
 Calvet, Pierre - SW4E.2
 Camacho, Ryan M. - NM3C.4, NM3C.5
 Camacho-Aguilera, Rodolfo E. - IM3A.4, IM3A.5
 Camatel, S. - SpW2B.4
 Campbell, Joe C. - IM2A.2
 Canagasabay, Albert - BW3E.1
 Canciamilla, Antonio - IW4C.5
 Candiani, Alessandro - BTu2E.2, SW1E.3
 Canioni, Lionel - BW1D, BW1D.2, BM4D.1, BM4D.5
 Canning, John - BM4D, BTu1C.1, BTu3E.3, BTu4E.2, BW1D.5, ITu4C.7
 Cano, Iván - AW4A.4
 Carballar, Alejandro - BW4E.3
 Cardinal, Thierry - BM4D.1, BM4D.5, BW1D.2, BW1D.3, BW1D.4
 Carena, Andrea - SpW3B.6
 Carrara, David - IM2A.3
 Carrier, Julien - BM2D.2
 Cartaxo, Adolfo - AW4A.2, AW4A.5, JTu5A.1
 Casas Bedoya, Alvaro - JTu5A.17
 Caspani, Lucia - JM5A.9, NW1C.3
 Caucheteur, Christophe - BTu2E.1
 Caurant, Daniel - BM4D.5
 Cazzanelli, Massimo - JM5A.46
 Cestier, Isabelle - ITu2C.3
 Cha, Myoungsik - JTu5A.37
 Chagnon, Mathieu - SpTu2A.4
 Chandrasekhar, Sethumadhavan - SpTu2A.1
 Chandroth, Jisha P. - NM4C.7
 Chang, Gee-Kung - SpTu3A.2
 Chang, Wonkeun - NM2C.3, NTu2D.2, NTu3D.2
 Charrier, Joel - ITu2B.7
 Chavez Cerda, Sabino - JM5A.54
 Chazov, Andrew I. - SM2E.3, STu3F.3

- Cheben, Pavel - ITu3B.1, ITu3B.4
 Chen, Jian - SpTh1B.1
 Chen, Jocelyn S. - NM4C.2
 Chen, Kevin P. - BTu4E.2
 Chen, Rongzhang - BTu4E.2
 Chen, Tong - BTu4E.2
 Chen, Xianfeng - JTu5A.51
 Chen, Xiaochi - IM4A.3
 Chen, Yaohui - ITu2C.4, ITu3C.5
 Chen, Young-Kai - SpTu1A.1
 Chen, Zhigang - NTu3D.4
 Chen, Zhangyuan - SpTh1B.2
 Chenard, Francois - SW3F.2
 Cheng, Tonglei - JM5A.1
 Cheng, Xianfeng - BW2E.7
 Chiang, Kin S. - BTu1C.5
 Childs, Paul - BM3D.2
 Chiuchiarelli, Andrea - AW4A.7
 Cho, Yongkwon - BW1D.4
 Cho, Lok-Hin - SW1E.1
 Choi, Dawoon - JTu5A.54
 Choi, Duk-Yong - ITu3C.2
 Choi, Jiyeon - BW1D.4
 Chong, Andy - NM4C.4
 Choudhury, Pallab - AW4A.7
 Chow, Desmond M. - SM2E.4
 Chow, Hungkei - AW2A.1
 Christensen, Scott - STu4F, SW3F.3
 Chu, Sai T. - JM5A.10, NW1C.3
 Chung, Yun - JW1A.1
 Churbanov, Mikhail - JM5A.3
 Churkin, Dmitriy V. - JM5A.50, JTu4A.43, NW1C.4
 Ciaramella, Ernesto - AW4A.7
 Ciblat, Philippe - SpTu3A.5
 Clader, David - NM3C.5
 Clarke, Chris F. - SpTu4A.5
 Claudon, Julien - JM5A.16
 Claussen, Stephanie - IM4A.3
 Cleff, Carsten - JM5A.14, NW1C.1
 Clerici, Matteo - JM5A.9, NW1C.3
 Coelho, L. - JM5A.56
 Coen, Stephane - NTu2D.5
 Coillet, Aurélien - JTu5A.23
 Colet, Pere - NTu2D.3
 Colman, Pierre - IM3B.4, ITu4C.2
 Combrié, Sylvain - IM3B.4, ITu2C.2, ITu2C.3, ITu4C.2, IW3C.5, NTu4D.5
 Conforti, Matteo - NW2D.5
 Conte, Robert - JTu5A.30
 Conti, Claudio - JM5A.44, NTu3D.6, NW3D.1
 Cook, Kevin - BTu1C.1, BTu4E.2, BW1D.5
 Cooke, David - JM5A.9
 Copeland, Joshua - JM5A.26
 Corbari, Costantino - BW3E.1
 Cormier, Eric - SW2F.2
 Corsini, Raffaele - AW4A.7
 Corteselli, Stephen - SpTu1A.1
 Corzine, Scott - IM2A.4
 Costa, Nelson - JTu5A.1
 Costache, Florenta - IM4A.4
 Couairon, Arnaud - JM5A.9
 Couderc, Vincent - NTh2A.4
 Cranch, Geoffrey A. - BTu3E.2
 Creeden, Daniel J. - SW3F, SW2F.4
 Crémoux, Tatiana - BW1D.3
 Crivellaro, Antonino - AW3A.2
 Cross, Allen - IM2A.2
 Crossley, Maxwell - ITu4C.7
 Crosta, Matteo - NW2D.4
 Croussore, Kevin - SpTu4A.4
 Cuando-Espitia, Natanael B. - IW1B.5
 Cunningham, Brian T. - IW4C.1
 Curri, Vittorio - SpW3B.6
 Dadap, Jerry I. - IM4B.3
 Dagli, Nadir - IM4A.5
 D'Aguanno, Giuseppe - JTu5A.20
 Dai, Daoxin - ITu2B.2
 Dajani, Iyad - STu4F.3, SW3F.1, SW4F
 Dambre, Joni - IM2B.3
 Damle, Amod - IM2A.4
 Dantus, Marcos - NM4C.4
 Davis, Stanley C. - IW2C.4
 Day, Todd D. - NTu3D.3, SM4E.3, STu1D.1
 De Heyn, Peter - ITu2B.1
 De La Rue, Richard M. - ITu4C.3
 de Miguel, Ignacio - AW2A.2
 de Ridder, René - BM3D.1
 De Rossi, Alfredo - IM3B.4, ITu2C.2, ITu2C.3, ITu4C.2, IW3C.5, NTu4D.5
 Debregas, Helene - IM2A.3
 Decobert, Jean - IM2A.3
 Del Re, Eugenio - NTu3D.6, NW3D.1
 Delage, Andre - ITu3B.4
 Delaporte, Philippe - BM4D.5
 Delesques, Pierre - SpTu3A.5
 Delfyett, Peter - NTh2C.6
 Demircan, Ayhan - NM2C.1
 Denisov, Alexander N. - STu1D.4
 Dentai, Andrew - IM2A.4
 Denz, Cornelia - BM2D.6, JM5A.24, JM5A.30, JM5A.31, JM4A.35, NTu4D.4
 Deparis, Olivier G. - ITu2C.5
 Deppner, Marcus - IM4B.1
 Desfarges-Bertheleot, Agnes - SW4F.3
 DeSimone, Anthony - NTh1A.2
 Dewtler, Thomas F. - SpTu3A.2, SpTu3A.3
 Deutsch, Miriam - JTu5A.24
 DeVore, Peter - NM2C.4, SpTu4A.2
 Di, Liu - SpTh1B.2
 Di Bin, Philippe - NTh2A.4
 Dianov, Evgeny - BM4D.2, BM4D.3, BM4D.6, JM5A.3, STu1D.4
 Dias, Frederic - NW3D.5
 Diebel, Falko - JM5A.24, JM5A.31
 Dinda, Patrice T. - JM5A.45
 Ding, Edwin - JTu5A.26
 Djordjevic, Ivan B. - SpTu2A.6
 Dobner, Sven - JM5A.14, NW1C.1
 Doerr, Christopher - ITu4B
 Dogru, Selim - IM4A.5
 Dong, Liang - SM4E, SM3E.1
 Dorofeev, Vitaly - JM5A.3, STu3F.2
 Douay, Marc - SW4F.2
 Drezet, Aurélien - BW1D.2
 Dridi, Kais - IM4B.7
 Driscoll, Jeffrey B. - IM4B.3, IW3C.6
 Droques, Maxime - NW3D.3
 Droulias, Sotiris - JM5A.32, JM5A.53
 Duarte, Ulysses - JTu5A.3
 Ducci, Sara - JM5A.16
 Duchesne, David - NW1C.3
 Dudley, Eric - IW4C.7
 Dudley, John M. - JTu5A.22, NM3C, NW3D.2, NW3D.5
 Dumais, Patrick - ITu4B.3, SpTu4A.3
 Dumeige, Yannick - NW1C.2
 Durán, Ramón J. - AW2A.2
 Durfee, Charles G. - NM2C.7
 Durkin, Michael K. - BM3D.6
 Dussauze, Marc - BM4D.1, BM4D.5, BW1D.2, BW1D.3
 Dvoyrin, Vladislav - SM2E.5
 Ebendorff-Heidepriem, Heike - BM3D.3
 Ecke, Wolfgang - BTu4E.1
 Edwards, Elizabeth - IM4A.3
 Eggleton, Benjamin J. - ITu3C.2, JTu5A.17
 Egorov, Oleg - JM5A.49, JTu5A.27, NTu4D.1
 Eich, Manfred - NTh1A.1
 Eilenberger, Falk - NTu4D.2
 Eisenstein, Gadi - ITu2C.2, ITu2C.3
 Ek, Sara - ITu3C.5, IW3C.4
 El Daif, Ounsi - ITu2C.5
 El-Amraoui, Mohammed - BM4D.7
 Elesin, Yuriy - IM2B.4
 Ellis, Bryan - IW3C.1
 Elsahn, Ziad - SpTu2A.4
 El-Taher, Atalla - JM5A.43, NW1C.4
 Engelbrecht, Rainer - BTu2E.6
 Ensley, Trenton R. - NTh1A.4
 Erkontalo, Miro - NW3D.2
 Esbensen, Bo - NW3D.4
 Escayola, Xavier - AW4A.4
 Essiambre, R. J. - SpW3B.4
 Ettabib, Mohamed A. - JM5A.11
 Evans, Peter - IM2A.4, SpTu4A.4
 Faccio, Daniele - JM5A.9
 Fallnich, Carsten - JM5A.14, JM5A.41, NW1C.1
 Fan, Jiahua - STu3F.4
 Fang, Ye - BTu4E.3
 Fanjoux, Gil - JTu5A.38, NTu2D.8
 Fard, Ali - JM5A.20
 Fargin, Evelyne - BM4D.5, BW1D.3
 Farsi, Alessandro - ITu3C.1
 Fatome, Julien - JM5A.15, JM5A.39, NM3C.3, NTh2C.8, NTu2D.7, NW3D.5
 Faucher, Mathieu - SM2E.2
 Favero, Ivan - JM5A.16
 Fedotov, Yuri - JM5A.25
 Fehenberger, Tobias - SpTu1A.3
 Fei, Edward - IM4A.3
 Fejer, Martin M. - NM3C.6
 Feng, Dazeng - IM4A.1
 Feng, Xian - JM5A.11
 Ferdinandus, Manuel R. - NTh1A.4
 Fernández, Patricia - AW2A.2
 Fernández-Ruiz, María R. - BW4E.3
 Ferrera, Marcello - NW1C.3
 Ferrero, Valter - AW4A.6
 Fiers, Martin - IM2B.3
 Finkenbusch, Martin - SpW3B.2, SpW3B.3
 Finot, Christophe - JM5A.38, JM5A.39, NM3C.3, NTh2C.8, NTu2D.7, NW3D.5
 Firth, William - NTu2D.3
 Fisher, Matthe - IM2A.4
 Fishman, Dmitry A. - JM5A.36, NTh1A.4
 Fishteyn, Michael - BW3E.4
 Fleischer, Jason W. - NTu4D.7
 Flores, Angel - SW3F.1
 Folli, Viola - JM5A.44
 Fonjallaz, Pierre-Yves - BM3D.5
 Fonseca, Daniel - JTu5A.1
 Fontaine, Nicolas K. - SpTu4A.1
 Forestieri, Enrico - SpTh1B.3
 Forghieri, Fabrizio - AW4A.6, SpW3B.6
 Forsyaciak, Wlodek - SpTu4A.5
 Foster, Amy C. - IW4C.3
 Foster, Mark A. - IW4C.3, NM3C.7
 Foy, Paul - JTu5A.16, SM3E.1, STu1D.2, STu1D.6, STu3F.4, SW4F.7
 Franke, Bulent - ITu2B.6
 Franson, Jim - NM3C.4
 Fratilocchi, Andrea - JM5A.52, NW2D.4
 Frazão, O. - JM5A.56
 Freppon, Daniel J. - STu1D.3
 Freude, Wolfgang - AW4A.1, AW4A.3, IM3A.3, SpTu2A.2
 Fridman, Moti - ITu3C.1
 Froc, Gwillerm - SpTu3A.5
 Frumin, Leonid L. - IM3B.5
 Fu, Yang - IM2A.2
 Fu, Dan - NTh2A.1

- Fuerbach, Alexander - BM3D.3
 Fujiyoshi, Tsubasa - JTu5A.49
 Fukuda, Hiroshi - ITu4B.2
- Gaburro, Zeno - IW1B.1, IW2C
 Gaeta, Alexander L. - ITu3C.1, NM3C.7, NTh1A.2
 Gaete, Oscar - SpTu2A.3
 Galili, Michael - IW4C.4, SpTu4A.6
 Gangopadhyay, Palash - IW2C.2
 Gao, Weiqing - JM5A.2
 Garbovskiy, Yuriy - JM5A.37
 Garcia-Segundo, Crescencio - IW1B.5
 Garnier, Josselin - NW2D.3
 Gaudino, Roberto - AW3A.2, AW3A.5, AW4A.6
 Gauvreau, Bertrand - SM2E.2
 Gdula, Pawel - JTu5A.14
 Gecevicius, M. - SM2E.1
 Gee, Caroline - SpTu4A.2
 Geernaert, Thomas - JTu5A.50
 Geisler, David J. - SpTu4A.1
 Genevet, P. - IW1B.1
 Genty, Goëry - NW3D.2, NW3D.5
 Gerard, Jean-Michel - JM5A.16
 Ghazisaidi, Navid - JTu5A.2
 Ghiglieno, Filippo - JM5A.16
 Ghofraniha, Neda - JM5A.44
 Ghulinyan, Mher - JM5A.46
 Gibson, Brant - ITu4C.7
 Giguere, Alexandre - ITu3B.3
 Gladush, Maxim G. - JTu5A.45
 Gladyshev, Alexey V. - BW3E.1
 Gnusin, Pavel - BM4D.2, BM4D.3
 Goldfarb, Gilad - SpTu4A.4
 Goldstein, Noam - JTu5A.55
 Gorbатов, Nahum - JTu5A.55
 Gorbunov, Oleg - JTu5A.43
 Gorshtein, Albert (Alik) - SpW3B.5
 Govan, Donald S. - SpTu4A.5
 Goyal, Abhishek - JTu5A.13
 Gräfe, Markus - NW2D.2
 Grattan, Kenneth - IM4B.2, SW4F.6
 Greco, Michael - NM2C.7, JTu5A.23, NM4C, NM4C.3, NM4C.5, NW3D.7
 Grether, Marcela - ITu4C.5
 Grillanda, Stefano - IW4C.5
 Grinberg, Patricio - NW1C.2
 Grobnc, Dan - BM2D.5, BTh4E.2, BW3E.2, JTu5A.48
 Grojo, David - BM4D.5
 Gross, Petra - JM5A.14, JM5A.41, NW1C.1
 Gross, Simon - BM3D.3
 Grot, Didier - SpTu1A.2
 Grote, Richard R. - IM4B.3, IW3C.6
 Grubb, Steve - SpTu4A.4
 Gu, T. - ITu2C.1
 Gubin, Mikhail Y. - JTu5A.45
 Guerrero, Neil G. - SpTh2B.2, SpTh2B.5
 Guillamet, Ronan - IM2A.3
 Guillossou, Thierry - SpTu1A.2
 Guillot, Julien - SW4F.3
 Gupta, Nishant - STu1D.2
- Hagan, David J. - JM5A.36, NTh1A.4
 Hage, Charles-Henri - NTh2C.8
 Hales, Joel M. - NTh1A.2, NTh2A.2
 Hall, Trevor - IM4B.7
 Haller, Eugene - IW3C.1
 Hamel, Philippe - NW1C.2
 Hammani, Kamal - JM5A.38
 Han, Young-Geun - BTh1C.2, BTh1C.3, BTh1C.4
 Hansen, Kristian R. - SM3E.4
 Harper, Paul - JM5A.43, NW1C.4
 Harris, James - IM4A.3, IW3C.1
 Harstead, Ed - AW2A.1, AW2A.4
 Hartwig, Haldor - IM4A.4
 Harvey, John - NTh2A
- Hashimoto, Takashi - IM3B.6
 Hatanaka, Koji - ITu3B.7
 Hatem, ELAMINE - JTu5A.11
 Hatori, Nobuaki - ITu4B.5
 Hause, Alexander - JTu5A.39, NTh2D.1
 Hauske, Fabian N. - SpTh2B.1, SpTh2B.2, SpTh2B.5, SpTu3A.4
 Hautefeuille, Mathieu - ITu4C.5
 Hawkins, Thomas - JTu5A.16, SM3E.1, STu1D.2, STu1D.6, STu3F.4, SW4F.7
 He, Jianjun - IM3A.6
 Healy, Noel - NTh3D.3, NW1C.6, SM4E.3, STu1D.1
 Heck, Martijn J. - ITu2B.2, ITu4B.1
 Heidt, Alexander M. - STu3F.6
 Hendrickson, Scott M. - NM3C.4, NM3C.5
 Herda, Robert - NTh2A.1
 Herek, Jennifer L. - JM5A.14
 Hernández-Cordero, Juan - ITu4C.5, ITu4C.6, IW1B.5
 Héroux, Jean Benoit - IM3A.2
 Herrmann, Harald - NM3C.2
 Herrmann, M. - SpW2B.4
 Hesketh, Graham D. - NTh2D.6
 Heuck, Mikkel - IM3B.3, IW3C.4, IW3C.5
 Hillerkuss, David - AW4A.1, AW4A.3, SpTu2A.2
 Hirao, Kazuyuki - BW1D.1
 Hiroyuki, Tsuda - ITu3B.5
 Hizanidis, Kyriakos - JM5A.32, JM5A.53
 Hochberg, Michael - IM2B.1, IM4B
 Hoelzer, Philipp - NTh2D.2, NTh3D.2
 Hofer, C. - SpW2B.4
 Hofmann, Peter - SW4F.5
 Holehouse, Nigel - SM2E.2
 Holtom, Gary R. - NTh2A.1
 Horn, Wolfgang - BM2D.6
 Horowitz, Moshe - BTh1C.6, JTu5A.58
 Hou, Taige - NTh1A.2
 Houtsma, Vincent - AW2A.1
 Hranisavljevic, Jasmina - IW2C.3
 Hsieh, P. - ITu2C.1
 Hsueh, Yu-Ting - SpTu3A.2, SpTu3A.3
 Hu, Hao - IW4C.4
 Hu, Yi - NTh3D.4
 Huang, Serge - BW1D.2
 Huber, Robert - BW4E.1
 Hudson, Darren D. - JTu5A.17
 Hughes, Stephen - ITu2C.6
 Hugonnot, Emmanuel - JM5A.18, NTh2A.5, SW4F.2
 Huo, Yijie - IM4A.3
 Huynh, Tam - SpW2B.2
 Hvam, Jørn M. - IW4C.4
- Ianoul, Anatoli - BTh2E.1, BW2E.1
 Ibsen, Morten - BTh4E, BW3E.1, BW3E.6, BW3E.7, JM1B
 Iitsuka, Hisao - ITu3B.5
 Ilday, F. Oemer - NM2C, NM4C.1
 Imbrock, Jörg - JM5A.30, NTh4D.4
 Inan, Beril - SpTu2A.3
 Ingvarsson, Snorri - JTu5A.6
 Inoue, Junichi - ITu3B.7
 Ishigure, Takaaki - JTu5A.29
 Ishikawa, Yasuhiko - ITu4B.2
 Ishizaka, Masashige - ITu4B.5
 Iturbe-Castillo, Marcelo D. - JM5A.54, JM5A.55
 Ivanenko, Alexey V. - JM5A.28
- Jackson, Stuart D. - SW4F.1
 Jacob, Sarkis - JTu5A.10
 Jacobs, Bryan C. - NM3C.4, NM3C.5
 Jager, Roland - JM5A.34
 Jain, Siddharth - ITu4B.1
 Jalali, Bahram - JM5A.20, NM2C.4
 James, Adam - IM2A.4
 Jamshidi, Kambiz - ITu2B.6, ITu3C.3
 Jang, Jae K. - NTh2D.5
- Jansen, Sander L. - SpTu2A.3, SpTu3A.6
 Janyani, Vijay - JTu5A.13
 Janz, Siegfried - ITu3B.4
 Jaouën, Yves - SpTu1A.2, SpTu2A.5, SpTu3A.5, SpW2B.3
 Jauregui, Cesar - STu4F.5
 Jen, Alex - NTh1A.2
 Jensen, Jakob S. - IM2B.4
 Jeppesen, Palle - IW4C.4
 Jeux, François - SW4F.3
 Jewart, Charles - BTh4E.2
 Jeyaseelan, Hari - ITu4C.7
 Ji, Hua - IW4C.4
 Jiang, Jia - ITu4B.3, JTu5A.10
 Jiang, Shibin - STu1D, STu2F.2
 Jianjun, wang - STu4F.2
 Jimenez, Y. Tamara - AW2A.2
 John, Demis D. - ITu2B.2
 Johnson, Benjamin R. - SW2F.4
 Johnson, Eric G. - ITu3B.2, STu3F.1
 Jollivet Salvin, Clemence - SW4F.5
 Joly, Nicolas - NTh3D.2
 Jones, Liam - JM5A.11, JM5A.19
 Jorgensen, Mette - SM3E.4
 Jovanovic, Nemanja - BW2E.6
- Kaatzian, Hassan - IM4B.5
 Kabakova, Irina V. - BM3D.5
 Kaboko, MONGA J. - JTu5A.47
 Kadkhodazadeh, Shima - JTu5A.12
 Kadwani, Pankaj - STu4F.1, SW2F.3
 Kahl, Oliver - JM5A.36
 Kakande, Joseph - JM5A.11, JM5A.19, NM3C.1
 Kalashnikov, Vladimir - SM2E.5
 Kalinowski, Ksawery K. - JM5A.29, NTh4D.4
 Kam, Pooi-Yuen - SpTh1B.1
 Kammer, Ido - NTh3D.7
 Kamins, Theodore - IM4A.3
 Kamp, Martin - JM5A.16
 Kamysiak, Keith - ITu4B.4
 Kaneda, Noriaki - SpTu1A.1, SpTu2A
 Kang, Cheolju - BTh1C.3
 Kang, Myeongsoo - NM4C.6
 Kannari, Fumihiko - JM5A.12, JM5A.48, JTu5A.21, JTu5A.25
 Karaki, Julie - SpTu1A.2
 Kashyap, Raman - BTh2E.4, JM5A.17, JTu5A.37
 Kato, Masaki - IM2A.4, SpTu4A.4
 Kats, M. A. - IW1B.1
 Kaufman, Joshua J. - STu2F.6
 Kawaguchi, Yuki - JTu5A.9
 Kawashima, Hiroyasu - JM5A.2
 Kawashima, Hitoshi - ITu3B.5
 Kazansky, Peter G. - BW1D.1, BW3E.1, SM2E.1
 Kazmierski, Christophe - IM2A.3
 Kedziora, David J. - NW3D.6
 Keil, Robert - NW2D.2
 Kelberer, Andreas - JM5A.35
 Kermene, Vincent - SW4F.3
 Khayam, Omer - IM2A.4
 Khorasaninejad, Mohammadreza - IW2C.7
 Kibler, Bertrand - JM5A.38, JM5A.45, NM2C.5, NTh2C.8, NTh2D.7, NW2D.3, NW3D.5
 Kieu, Khanh - NTh2A.2
 Killey, Robert - SpTu1A.3
 Kilmurray, Sean - SpTu1A.3
 Kim, Hyun-Joo - BTh1C.2, BTh1C.3, BTh1C.4
 Kim, Hyeongeun - NTh1A.2
 Kim, Kyuho - JTu5A.54
 Kimerling, Lionel C. - IM3A.4, IM3A.5, ITu2B.3, IW4C.5
 Kintaka, Kenji - ITu3B.7
 Kirk, Andrew G. - ITu3B.3
 Kirkendall, Clay - BTh3E.2
 Kish, Fred - IM2A.4, SpTu4A.4
 Kivshar, Yuri S. - NTh4C.7, NTh4D.2, NW2D.2
 Klein, Jackson - IM2B.2, IM3B

- Klimentov, Dmitry S. - SM2E.5
 Klimusheva, Gerturda - JM5A.37
 Knight, Jonathan C. - SM3E.2
 Koba, Marcin - JTu5A.35
 Kobtsev, Sergey M. - JM5A.25, JM5A.28
 Kocaman, S. - ITu2C.1
 Kojou, Junichiro - JTu5A.21
 Komatsu, Masa-aki - IW1B.2
 Kominis, Yannis - JM5A.32, JM5A.53
 Kondo, Shohei - JM5A.12, JTu5A.25
 Kong, Fanting - SM3E.1
 Kong, Lingjie - NTh2A.1
 Konidakis, Ioannis - SM3E.6
 Konstantaki, Maria - BM3D.2, BTu2E.2
 Koonath, Prakash - NM2C.4
 Koonen, Ton - AW3A.2
 Koos, Christian - AW4A.1, AW4A.3, IM3A.3, SpTu2A.2
 Korn, Dietmar - IM3A.3
 Korsakov, Alexandr S. - SM2E.3, STu3F.3
 Korsakov, Viktor S. - SM2E.3, STu3F.3
 Kortov, Sergey - STu3F.3
 Koshiba, Masanori - IW1B.2, JTu5A.9, STu2F.5
 Kosolapov, Alexey F. - JM5A.3, STu3E.2
 Kou, Rai - ITu4B.2
 Kourtessis, Pandelis - AW2A.5
 Kozlov, Victor V. - JM5A.46, NTh2A.4, NW2D.6
 Kozlov, Valery - SW1E.2
 Kraev, Igor - JM5A.3, STu3F.2
 Krause, David - IM2A.4
 Krauss, Thomas - ITu2C, ITu3C
 Kremp, Tristan - BW3E.3, BW3E.4, BW3E.5
 Kriesch, Arian - JM5A.47
 Krishnamurthy, Pradeep Kumar - JM5A.27
 Kristensen, Martin - BTu1C.1
 Kristensen, Philip T. - IM3B.3, IW3C.5
 Kristensen, Poul - SW1E.4
 Kroesen, Sebastian - BM2D.6
 Krolkowski, Wieslaw Z. - JM5A.29, NTu4D.4, NW2D.7, NW3D.4, JTu1B
 Kruglov, Vladimir - JTu5A.32, NM4C.2
 Krummrich, Peter - SpW3B.2, SpW3B.3
 Krupa, Katarzyna - NTh2A.4
 Kruse, Kai - JM5A.14
 Kudlinski, Alexandre - JM5A.18, NM2C.5, NM2C.6, NTh2A.5, NW3D.3, SM4E.2
 Kudryavtseva, Anna - ITu4C.4
 Kuebler, Stephen M. - STu1D.3
 Kues, Michael - JM5A.41, NW1C.1
 Kuga, Takahiro - JTu5A.29
 Kukarin, Sergey V. - JM5A.28
 Kumar, Saurabh - SpTu4A.4
 Kuntz, Matthias - IM2A.4
 Kuo, Paulina S. - NM3C.6
 Kupec, Jan - IM4B.1
 Kupijai, Sebastian - ITu2B.6
 Kuschnerov, Maxim - SpTu2A.3, SpTu3A.6, SpW2B.4
 Kutz, J. Nathan - JM5A.42, JTu5A.26
 Kuznetsova, Nadezda - JTu5A.12
 Kwon, Oh-Jang - BTu1C.2, BTu1C.3
 Kwon, Min-Suk - IW1B.3
- Labat, Damien - SM4E.2
 Lægsgaard, Jesper - SM3E.4
 Lagay, Nadine - IM2A.3
 Lago, Laure - NTh2A.5, SW4F.2
 Lal, Vikrant - IM2A.4, SpTu4A.4
 Lambert, Damien - IM2A.4, SpTu4A.4
 Lancaster, David G. - BM3D.3
 Lancry, Matthieu - BW1D.5
 Lankl, Berthold - SpTu3A.6
 Lantz, Eric - JTu5A.38
 Lanzillotti-Kimura, Noberto D. - IW4C.2
 LaRochelle, Sophie - BM3D.7, BTu3E, BW4E
 Latrasse, Christine - BW2E.3
 Lau, Alan P. - SpTh2B.1, SpW2B
- Laude, Vincent - JTu5A.36
 Lauermann, Matthias - IM3A.3
 Laurila, Marko - SM3E.4
 Le Bidan, Raphaël - SpTu1A.2
 Le Drogoff, Boris - ITu3B.3
 Leburton, Jean Pierre - IM4B.5
 Lecaplain, caroline - NW3D.7
 Ledderhof, Christopher J. - ITu4B.3
 Lederer, Falk - JM5A.49, JTu5A.27, NM4C.3, NTu4D.1, NW3D
 Lee, Byoung-ho - JTu5A.54
 Lee, Chris J. - JM5A.14
 Lee, Min - NTh2A.5
 Lee, Po-Tsung - IM4B.6
 Lee, Ray-Kuang - NM4C.7, JM5A.22
 Lee, Tsin-Dong - NM4C.7
 Lefrancois, Simon - NTh2A.1
 Lehoucq, Gaëlle - IM3B.4, ITu4C.2, IW3C.5
 Lei, Gordon K. P. - IW4C.6
 Lei, Zhao - JTu5A.57
 Leick, Lasse - SW2F.3
 Leitgeb, Erich - AW3A.4
 Leksin, Andrey Y. - JTu5A.45
 Lentine, Anthony L. - IM2A.5
 Leo, Giuseppe - JM5A.16
 Leoni, Paolo - SpTu3A.6
 Leon-Saval, Sergio - SW1E.3
 Lepage, Guy - ITu2B.1
 Leuthold, Juerg - AW4A.1, AW4A.3, IM3A.3, SpTu1A.4, SpTu2A.2, SpW3B
 Leven, Andreas - SpTu1A.1
 Levenson, Juan A. - NW1C.2
 Levy, Jacob S. - NM3C.7
 Lhermite, Jerome - SW2F.2
- Li, Enbang - ITu3C.2
 Li, Feng - JTu5A.26
 Li, Jianheng - Im4A.6
 Li, Juhao - SpTh1B.2
 Li, Ming - BTu2E.3
 Li, Qian - JTu5A.40
 Li, Wangzhe - BTu2E.3
 Li, X. - ITu2C.1
 Li, Yuan - ITu3B.2, STu3F.1
 Li, Zhi - IM2A.2
 Liang, Guanquan - ITu3B.6
 Liao, Meisong - JM5A.2
 Lim, Wansu - AW2A.5
 Lim, Christina - AW3A.3, JTu5A.5
 Limberger, Hans G. - BM4D.4, BM4D.6, BTu1C
 Limpert, Jens - STu4F.5
 Lin, Pin-Tso - IM4B.6
 Lin, Pao-Tai - ITu2B.3
 Lin, YuanYao - JM5A.22, NM4C.7
 Lipson, Michal - NM3C.7, NTh1A.2
 Little, Brent - JM5A.10, NW1C.3
 Liu, Xiaoping - BW3E.3
 Liu, Xi - IM4A.3
 Liu, Zhifu - Im4A.6
 Liu, Yuxiang - IW2C.5
 Liu, Weici - JM5A.23
 Liu, Hui - NM4C.4
 Liu, Xiang - SpTu2A.1
 Liu, Cheng - SpTu3A.2, SpTu3A.3
 Llorente, Roberto - AW4A.5
 Lloyd, G. - BTu2E.7
 Lo, Stanley M. G. - IW4C.6
 Lobato, Adriana - SpTu2A.3
 Loh, Wei H. - JM5A.11
 López-Moreno, Enrique - ITu4C.5
 Lorences Riesgo, Abel - SpTu4A.6
 Lorenzo, Rubén M. - AW2A.2
 Löschnigg, Markus - AW3A.4
 Lotti, Antonio - JM5A.9
 Lou, Cibo - NTu3D.4
- Lousteau, Joris - JM5A.6, SM3E.3
 Lu, Ya Yan - IM2B.5
 Lu, Chao - JW1A, SpTh2B, SpTh2B.1, SW1E.1
 Luff, Jonathan - IM4A.1
 Lumer, Yaakov - NTu4D.6
 Luther-Davies, Barry - ITu3C.2
 Lwin, Richard - SW1E.3
- Ma, Lijun - NM3C.6
 Ma, Ren-Min - IW4C.2
 Madden, Steve J. - ITu3C.2
 Mafi, Arash - SW4F.5
 Magalhães, Eduardo - SpTh2B.3
 Mägi, Eric - JTu5A.17
 Magri, Roberto - SpTh1B.3
 Mahamd Adikan, Faisal Rafiq - SM2E.4
 Mahnke, Christoph - NM2C.2
 Mailis, Sakellaris - STu1D.1
 Maillotte, Herve - JM5A.15
 Majima, Tatsuya - JTu3B.7
 Majumdar, Arka - IW3C.1
 Mak, Ka Fai - NM2C.3
 Makino, Shuntaro - JTu5A.9
 Malacarne, Antonio - SpTu4A.3
 Malaguti, Stefania - IW3C.5, NTu4D.5
 Malcata, F. X. - JM5A.56
 Maleki, Lute - JM5A.13
 Malendevich, Roman - IM2A.4, SpTu4A.4
 Malouin, Christian - SpTh2B.4
 Marder, Seth - NTh1A.2
 Margulis, Walter - BM3D.5, BTu2E.2
 Mariani, Silvia - JM5A.16
 Marko, M. - ITu2C.1
 Marom, Dan M. - JTu5A.55, NM3C.2
 Marquestaut, Nicolas - BM4D.1, BW1D.2
 Marsella, Domenico - SpTh1B.3
 Marshall, Graham - BW2E.6
 Martin, Steve - JTu5A.16
 Martinelli, Gilbert - NW3D.3
 Martinez, Amos - JTu5A.29
 Martinez, Rodolfo - JTu5A.47
 Martins, Emiliano R. - JTu5A.34
 Mashanovitch, Milan - IM2A
 Mashinsky, Valery M. - BM4D.6
 Mathur, Atul - SpTu4A.4
 Matsko, Andrey B. - JM5A.13
 Matsuo, Shinji - IW3C.2
 Matsuo, Shoichiro - STu2F.5
 Mattiucci, Nadia - JTu5A.20
 Maucher, Fabian - NW2D.7
 Mayer, Marie - IW3C.1
 Maze, Gwenael - STu3F.7
 McClane, Devon - SM3E.1
 McIntyre, Craig - NTu2D.3
 McKinstrie, Colin J. - JTu5A.18
 Mcleod, Robert - ITu2B.4, ITu4B.4
 McMillan, J. F. - ITu2C.1
 McMillen, Colin - STu1D.2, STu1D.6, STu3F.4, SW4F.7
 McNicol, John - IM2A.4
 Medvedkov, Oleg - BM4D.2, BM4D.3
 Meherzi, Oueslati - JTu5A.11
 Mehta, Priyanth - NTu3D.3, NW1C.6, SM4E.3
 Meister, Stefan - ITu2B.6
 Mejling, Lasse - JTu5A.18
 Meledina, Pedro S. - JM5A.5
 Mélin, Gilles - SM4E.2
 Melloni, Andrea - IW4C.5
 Melnik, Daria - JM5A.37
 Mendez Otero, Marcela M. - JM5A.54, JM5A.55
 Merayo, Noemí - AW2A.2
 Mergo, Pawel - JTu5A.50
 Mertz, Pierre - SpTu4A.4
 Merzlyak, Yegeniy - NTh2A.2
 Messaddeq, Younes - BM4D.7
 Messerly, Mike - SW4F.4

- Mestre, Miguel A. - SpW3B.4
Meyer, Johan - JTu5A.47
Miao, Houxun - IW2C.5
Michel, Jurgen - IM3A.4, IM3A.5, ITu2B.3, IW4C.5
Michel, Claire - JM5A.38, NM2C.5, NW2D.3
Mihailov, Stephen J. - BM2D.5, BTu4E.2, BW3E.2, JTu5A.48
Milanese, Daniel - JM5A.6, SM3E.3
Miller, Gary A. - BTu3E.2
Miller, David - IM4A.3
Miller, David A. B. - JM1A.2
Millot, Guy - JM5A.39, NM2C.5, NM3C.3, NW3D.5
Milosavljevic, Milos - AW2A.5, AW4A
Mirnaya, Tatiana - JM5A.37
Missey, Mark - IM2A.4
Mitchell, Matthew - SpTu4A.4
Mitschke, Fedor - JTu5A.39, NM2C.1, NM2C.2, NTu2D.1
Miura, Kiyotaka - BW1D.1
Miyoshi, Shohei - JM5A.4
Mizunami, Toru - JTu5A.49
Modotto, Daniele - JM5A.46
Moiseev, Alexander - JM5A.3
Moiseev, Alexander - STu3F.2
Mokhtari, Arash - ITu3C.3
Mollet, Oriane - BW1D.2
Monro, Tanya M. - BM3D.3
Monroy, Idelfonso T. - SpTh2B.2, SpTh2B.5, SpTu3A.4
Moore, Eric - ITu2B.4
Morandotti, Roberto - JM5A.10, JM5A.9, NTu3D.4, NW1C.3, NW1C.5
Morant, Maria - AW4A.5
Morgado, José - AW4A.2
Mori, Mashiko - ITu4B.5
Mori, Toshihiro - JTu5A.49
Morichetti, Francesco - IW4C.5
Morin, Michel - BW2E.3, BW4E.1
Morin, Philippe - JM5A.15, NM3C.3
Mork, Jesper - IM3B.3, ITu2C.4, ITu3C.5, IW3C.4, IW3C.5
Morris, Stephanie - JTu5A.16, STu1D.2, STu3F.4, SW4E.7
Morsy-Osman, Mohamed - SpTu2A.4
Moss, David J. - JM5A.10, NW1C.3, NW1C.5
Motorin, Sergey - JM5A.3, STu3E.2
Mou, Chengbo - JM5A.25, NTu2D.4
Mountfort, Francesca H. - JTu5A.56, SM2E.6
Mousa-Pasandi, Mohammad E. - SpTu2A.4
Mundus, Markus - BM2D.4
Munsch, Mathieu - JM5A.16
Mura, Emanuele - JM5A.6, SM3E.3
Murdoch, Stuart G. - NTu2D.5
Muriel, Miguel A. - JTu5A.52
Mussot, Arnaud - JM5A.18, NM2C.6, NTh2A.5, NW3D.3, SM4E.2, SW4F.2
Muthiah, Ranjani - IM2A.4
Myslivets, Sergey A. - JTu5A.44
- Nagarajan, Radhakrishnan - IM2A.4, SpTu4A.4
Nakabayasi, Miki - BW1D.1
Nakagawa, Shigeru - IM3A.2
Nakagawa, Tadao - SpTh1B.4
Nakamura, Takahiro - ITu4B.5
Nakano, Hisamatsu - IM2B.6, IM3B.6
Nakkeeran, K. - JTu5A.40
Naqshbandi, Masood - ITu4C.7
Nascimento, Vitor - SpTh2B.3
Nash, Melissa - ITu4C.7
Nasser, Nour - JTu5A.38
Nazarathy, Moshe - AW4A.3, SpTu3A, SpW2B.1
Nebendahl, Bernd - SpTu2A.2
Negro, Davide - JM5A.6
Neshev, Dragomir - NTh4C.7, NTu4D.2
Nespolo, Antonino - AW3A.5
Ngabireng, Claude M. - JM5A.45
Nguyen, Dat - NTh2C.6
Nguyen, Duc minh - JM5A.15
- Nguyen, Lim - SpW2B.2
Nicholson, Jeffrey W. - BW3E.3
Nie, Bai - NM4C.4
Niesler, Fabian - JM5A.36
Nilsson, Alan - SpTu4A.4
Nilsson, Johan - STu4F.4
Nirmalathas, Ampalavanapilla - AW2A, AW3A.1, AW3A.3, JTu5A.5
Nishi, Hidetaka - ITu4B.2
Nishiyama, Nobuhiko - ITu3B.4
Noblet, Yoann - JM5A.34, NTu2D.3
Nolte, Stefan - BM2D.3, BM2D.4, NW2D.2
Norris, David - IW2C.1, IW3C
Norwood, Robert A. - IW2C.2, NTh2A.2
Nossek, Josef A. - SpTh2B.2, SpTh2B.5, SpTu3A.4
Notomi, Masaya - IW3C.2
Nozaki, Kengo - IW3C.2
Nuno, Javier - NW2D.6
Nuño del Campo, Javier - JM5A.7
- O'Brien, John - IM4B.4
Odori, Junya - ITu3B.5
Offerhaus, Herman L. - JM5A.14
Ohishi, Yasutake - JM5A.1, JM5A.2, JM5A.4
Oishi, Yu - JM5A.12, JTu5A.25
Okano, Makoto - ITu4B.5
Okawachi, Yoshitomo - ITu3C.1, NM3C.7
Okonkwo, Chigo - AW3A.2
Olausson, Christina - SM3E.4
Oliveira, Júlio - SpTh2B.3
Olivero, Massimo - SM3E.3
Omura, Mika - JTu5A.29
O'Neil, Jason - SpTh2B.4
Onishchukov, Georgy - NTu3D.5, NTu4D.3
Oppo, Gian-Luca - NTu2D.3
Orcutt, Jason - IM4A.2, ITu2B
Osgood, Richard M. - IM4B.3, IW3C.6
Oxenlowe, Leif K. - IW4C.4
Ozaki, Tsuneyuki - JM5A.9
- Painchaud, Yves - BM3D.7, BW2E.3, BW3E, BW4E.1
Pan, Huapu - IM2A.2
Pan, Jie - SpTu3A.2, SpTu3A.3
Panajotov, Krassimir - JTu5A.31
Pandiyan, Krishnamoorthy - JTu5A.37
Pang, Wei - ITu3C.4
Panoiu, Nicolae C. - IM4B.3, IW3C.6
Pant, Ravi - ITu3C.2
Pantouvaki, Marianna - ITu2B.1
Papagiannis, Panagiotis - JM5A.32, JM5A.53
Papon, Gautier - BM4D.1, BM4D.5, BW1D.2
Park, Wounghang - IW4C.7
Parmigiani, Francesca - JM5A.11, JM5A.19, NM3C.1
Parravicini, Jacopo - NTu3D.6
Pasquazi, Alessia - JM5A.10, NW1C.3, NW1C.5
Patard, Olivier - IM2A.3
Patel, Neil - IM3A.4
Paulau, Pavel - NTu2D.3
Pavesi, Lorenzo - JM5A.46
Peacock, Anna C. - NTu3D, NTu3D.3, NW1C.6, SM4E.3, STu1D.1
Peccianti, Marco - JM5A.10, JM5A.9, NTu3D.4, NW1C.3, NW1C.5
Peckerar, Marty - IM2A.5
Pelc, Jason S. - NM3C.6
Pelicano, Telmo - JTu5A.4
Perminov, Serge V. - IM3B.5
Perry, Joseph W. - NTh1A.2, NTh2A.2
Pertsch, Thomas - NTu4D.2
Peschel, Ulf - JM5A.47, NTu3D.5, NTu4D.3
Petermann, Klaus - ITu2B.5
Peters, Jon - IM2A.2
Petersen, Sidsel - SM3E.4
Petit, Yannick - BM4D.1, BM4D.5, BW1D.2
Petrillo, Keith G. - IW4C.3
- Petropoulos, Periklis - JM5A.11, JM5A.19, NM3C.1
Petrovich, Marco N. - JM5A.11
Petykiewicz, Jan - IW3C.1
Peucheret, Christophe - IW4C.4, Sptu4A.6
Peyghambarian, N. - NTh2A.2, SW4E.5
Pfauf, Timo - SpTu1A.1
Pfeiffer, Thomas - JW1A
Philippovskiy, Denis - JM5A.3, STu3E.2
Phillips, Mark W. - SW3E.4
Picard, Marie-Josée - BW2E.3
Picozzi, Antonio - JM5A.38, JTu5A.41, NM2C.5, NW2D.3
Piels, Molly - IM2A.2
Pimentel, Reinher - ITu4C.5
Pimentel-Domínguez, Reinher - ITu4C.6
Pincemin, Erwan - SpTu1A.2
Pinguet, Thierry J. - IM2B.1
Pinto, João - JTu5A.4
Piracha, Mohammad U. - NTh2C.6
Piramidowicz, Ryszard - JTu5A.14
Pishvai Bazargani, Hamed - SpTu4A.3
Pissadakis, Stavros - BM3D.2, BM3D.4, BTu2E.2, BW2E, SM3E.6, SW1E.3
Pitois, Stéphane - JM5A.15, NM3C.3
Pittalà, Fabio - SpTh1B, SpTh2B.2, SpTh2B.5, SpTu3A.4
Pittman, Todd - NM3C.4
Plank, Thomas - AW3A.4
Plant, David - SpTu2A.4
Ploss, Daniel - JM5A.47
Plotnichenko, Victor - JM5A.3, STu3E.2
Podila, Ramakrishna - STu1D.2
Podivilov, Eugeny - NW1C.4
Poggiolini, Pierluigi - SpW3B.6
Poletti, Francesco - JM5A.11, STu3F.6
Pollnau, Markus - BM3D.1
Polo, Victor - AW4A.4
Pond, James - IM2B.2
Ponomarenko, Sergey A. - JTu5A.42
Ponzo, Giorgio M. - JM5A.11
Poole, Kelvin - STu1D.2
Popov, Alexander K. - JTu5A.44
Porque, Jerome - BW3E.3, BW3E.4
Poulain, Marcel - STu3F.7
Poulin, Michel - BW2E.3
Poulton, Christopher G. - ITu3C.2
Poumellec, Bertrand - BW1D.5
Poutous, Menelaos - ITu3B.2, STu3F.1
Prat, Josep - AW4A.4
Preciado, Miguel A. - JTu5A.52
Presi, Marco - AW4A.7
Preussler, Stefan - ITu3C.3
Prezgot, Daniel - BW2E.1
Price, Jonathan - STu3F.6
Prokhorov, Alexey - JTu5A.45
Pu, Minhao - ITu3C.5, IW4C.4
Pucker, Georg - JM5A.46
Pung, Aaron - ITu3B.2
- Qian, Li - SM4E.1, STu2F
Quélène, Jean-Baptiste - SpTu4A.3
Quiquempois, Yves - SM3E.5, SW4F.2
- Radic, Stojan - JM5A.20, SM3E, SM4E.4
Radwell, Neal - JM5A.34
Raghu, Indumathi - ITu3B.2, STu3F.1
Raghunathan, Vivek - IW4C.5
Rahman, B.M.Azizur - IM4B.2, SW4F.6
Rahn, Jefferey - IM2A.4, SpTu4A.4
Raineri, Fabrice - IW1B.4, IW3C.3
Raj, Rama - IW1B.4, IW3C.3
Rakich, Peter - NM3C.4
Ralph, Stephen E. - SpTu3A.2, SpTu3A.3
Ramachandran, Siddharth - SW1E.4
Ramirez Garcia, Emma V. - JM5A.54
Ramirez Martinez, Daisi - JM5A.55

- Randel, Sebastian - SpW3B.4
 Randoux, Stephane - JM5A.40, JTu5A.41
 Ranzini, Stenio - SpTh2B.3
 Rao, Apparao - STu1D.2
 Raymer, Michael G. - JTu5A.18
 Razzari, Luca - NW1C.3
 Rechtsman, Mikael C. - NTu4D.6
 Reffle, Mike - IM2A.4
 Regensburger, Alois - NTu3D.5
 Reichert, Matthew - NTh1A.4
 Rekaya-Ben Othman, Ghaya - SpTu2A.5, SpW2B.3
 Renninger, William - NM4C.4
 Reynoso Lara, Edmundo - JM5A.54
 Ribeiro, Vitor - SpTh2B.3
 Rice, Robert - JTu5A.16, STu1D.2, STu3F.4, SW4F.7
 Richardson, David J. - JM5A.11, JM5A.19, NM3C.1, STu3F.6
 Richardson, Martin - STu4F.1, SW2F.3
 Richter, Daniel - BM2D.3
 Ricken, Raimund - NM3C.2
 Rieck, Andreas - IM4A.4
 Rieger, T. - SpW2B.4
 Rigneault, Hervé - NTu2D.7
 Rizzelli, Giuseppe - AW4A.6
 Roberts, Kim - SpTu4A, SpW2B.5
 Robin, Craig - STu4F.3, SW3F.1
 Rodriguez, Vincent - BM4D.5, BW1D.2, BW1D.3
 Roedig, Philip - JM5A.30, NTu4D.4
 Roemer, Friedhard - IM4B.1
 Roh, Sookyoung - JTu5A.54
 Rohrmann, Philipp - JTu5A.39, NTu2D.1
 Romagnoli, Marco - IM3A.4
 Romero, Murilo - JTu5A.3
 Rong, Yiwen - IM4A.3
 Ropers, Claus - NM2C.4
 Rosa, Eduardo - SpTh2B.3
 Rose, Patrick - JM5A.24, JM5A.31, JM5A.35
 Rosenkranz, Werner - SpTu2A.3
 Rosolem, Joao - JTu5A.3
 Rothhardt, Manfred - BM2D, BTu4E.1, JM5A.56, JTu5A.50
 Rottwitz, Karsten K. - JTu5A.18, JTu5A.28, NTu5D
 Roy, Sourabh - ITu2C.2
 Royon, Arnaud - BM4D.1, BM4D.5, BW1D.2
 Royon, Romain - SW2F.2
 Rozhin, Aleksey - JM5A.25, NTu2D.4
 Rumpf, Raymond C. - STu1D.3
 Russell, Philip - JM1B.2, NM2C.3, NM4C.6, NTu2D.2, NTu3D.2
 Ryf, Roland - SpW3B.4
- Saad, Mohammed - STu3E.5
 Sadot, Dan - SpW3B.5
 Saffari, Pouneh - BM4D.6
 Saha, Kasturi - NM3C.7
 Sahu, Jayanta K. - JTu5A.56, SM2E.6
 Saini, Simarjeet S. - IW2C.7
 Saitoh, Kunimasa - IW1B.2, JTu5A.9, SM3E.1, STu2F.5
 Saleh, Mohammed F. - NTu3D.2
 Salvatore, Randal - IM2A.4
 Samra, Parmijit - SpTu4A.4
 Samson, Bryce - SW2F
 Sanatinia, Reza - NTh1A.3
 Sánchez-Arévalo, Francisco - ITu4C.6
 Sandhage, Kenneth H. - IW2C.4
 Sandoghchi, Seyed Reza - SM2E.4
 Santagiustina, Marco - ITu2C.2
 Santos, María C. - AW4A.4
 Saoudi, Bachir - BTu2E.4
 Sarger, Laurent - SW2F.2
 Sarmiento, Tomas - IW3C.1
 Sato, Tomonari - IW3C.2
 Savchenkov, Anatoliy - JM5A.13
 Savio, Paolo - AW3A.5
 Sawai, Shota - JM5A.48
- Sayeh, Mohammad R. - JTu5A.8
 Sazio, Pier J. - SM4E.3, STu1D.1, NTu3D.3
 Scarpignato, Gerardo - JM5A.6, SM3E.3
 Schindler, Philipp C. - AW4A.1, AW4A.3
 Schmauss, Bernhard - BTu2E.6
 Schmid, Jens - ITu3B.4
 Schmidt, Christian - SpW3B.4
 Schmidt, Ted - SpTh2B.4
 Schmogrow, Rene - AW3A, AW4A.1, AW4A.3, SpTu2A.2
 Schneebeli, Lukas - NTh2A.2
 Schneider, Patrick - NTh2A.1
 Schneider, Thomas - ITu2B.6, ITu3C.3
 Schubert, Martin - JTu5A.12
 Schulzgen, Axel - SW4F.5
 Schuster, Kay - JTu5A.50
 Sciamanna, Marc - JTu5A.31
 Scott, Ryan P. - SpTu4A.1
 Secondini, Marco - SpTh1B.3
 Sedgwick, Forrest - IM2A.4
 Sedov, Eugene S. - JM5A.22
 Sefler, George - SpTu4A.2
 Segawa, Toru - IW3C.2
 Segev, Mordechai - JTu1B.2, NTu3D.7, NTu4D.6
 Selleri, Stefano - SW1E.3
 Semenova, Elizaveta - JTu5A.12
 Semjonov, Sergey - STu1D.4
 Senior, John - AW2A.5
 Sergeev, Sergey - JM5A.43, JTu5A.19, NTu2D.4
 Setzler, Scott D. - SW2F.4
 Setzpfandt, Frank - NTu4D.2
 Shabahang, Soroush - JTu5A.15, NTh2C.6, STu1D.5, STu2F.6
 Shah, Lawrence - STu4F.1, SW2F.3
 Shahin, Shiva - IW2C.2
 Shahoei, Hiva - BW2E.4, BW4E.2
 Shalaby, Mostafa - JM5A.9
 Shalae, Vladimir M. - JM1A.1
 Shambat, Gary - IW3C.1
 Shaner, Eric - IM2A.5
 Shao, Li-Yang - BTu2E.1
 Shapira, Yuval P. - BTu1C.6, JTu5A.58
 Shapiro, David A. - IM3B.5
 Shaw, Mike - NM3C.4
 Shayovitz, Dror - NM3C.2
 She, Shichang - IM2B.5
 Sheng, Yan - JM5A.29, NTu4D.4
 Shepard, Scott - JM5A.26
 Shi, Jindan - BW3E.6, BW3E.7, JM5A.11
 Shihab, Rubena - JM5A.21
 Shim, Bonggu - NM3C.7
 Shimizu, Takanori - ITu4B.5
 Shimotsuna, Yasuhiko - BW1D.1
 Shin, Dongsik - BW1D.4
 Shin, Jin-Soo - IW1B.3
 Shin, Sang-Yung - IW1B.3
 Shinojima, Hiroyuki - ITu4B.2
 Shinya, Akihiko - IW3C.2
 Shlizerman, Eli - JM5A.42
 Shlyagin, Mikhail G. - JTu5A.47
 Shori, Ramesh - STu3F.1
 Shu, Chester - IW4C.6
 Shu, Xuewen - JTu5A.52, JTu5A.53
 Siekiera, Alexander - BTu2E.6
 Sigmund, Ole - IM2B.4
 Silberhorn, Christine - NM3C.2
 Silva, Susana - JM5A.56
 Simard, Alexandre D. - BM3D.7
 Sims, Andrew - STu4F.1, SW2F.3
 Sinefeld, David - JTu5A.55
 Singh, Ghanshyam - JTu5A.13
 Singh, Rajendra - STu1D.2
 Singh, Vivek - ITu2B.3, IW4C.5
 Sirtori, Carlo - JM5A.16
 Situ, Guohai - NTu4D.7
 Skafidas, Efstratios - AW3A.3, JTu5A.5
- Skryabin, Dmitry V. - NTu2D, NW2D.1
 Skupin, Stefan - JM5A.23, NW2D.7
 Slattery, Oliver - NM3C.6
 Slavík, Radan - JM5A.11, NM3C.1
 Sleiffer, Vincent - SpTu3A.6
 Slovak, J. - SpW2B.4
 Smelser, Christopher W. - BM2D.5, BW3E.2, JTu5A.48
 Smirnov, Sergey - JM5A.28, JTu5A.43
 Smit, Meint K. - IM2A.1
 Smulakovski, Vladimir - BTu1C.6
 Soares de Lima Filho, Elton - BTu2E.4
 Sohler, Wolfgang - NM3C.2
 Solli, Daniel R. - NM2C.4
 Solntsev, Alexander S. - NTh4C.7, NTu4D.2, NW2D.2
 Song, Daohong - NTu3D.4
 Sørensen, Simon Toft - JTu5A.22
 Sorger, Volker J. - IW4C.2
 Sorimoto, Keisuke - ITu3B.5
 Sorokin, Evgeni - SM2E.5
 Sorokina, Irina - SM2E.5
 Soto-Crespo, Jose-Maria - NM4C.5, NW3D.7
 Sousa, Ana - AW2A.3
 Sozzi, Michele - BM3D.2
 Sparks, Justin - SM4E.3
 Spektor, Boris - BTu1C.6
 Spinnler, Bernhard - SpTu3A.6
 Srinivasan, Kartik - IW2C.5
 Stafsudd, Oscar - STu1D.6
 Stark, Andrew J. - SpTu3A.2, SpTu3A.3
 Steel, M. J. - BW2E.6
 Stepanov, Dmitrii - BW2E.5
 Sterke, Martijn de C. - BM3D.5
 Stiller, Birgit - JM5A.15
 Stolen, Roger - STu3F.4, SW4F.7
 Straullu, Stefano - AW3A.5, AW4A.6
 Strzelecka, Eva - IM2A.4
 Studenkov, Pavel - IM2A.4
 Su, Zhang - SpTh1B.2
 Sugden, Kate - JTu5A.52
 Suh, Jeong - BW1D.4
 Sukhorukov, Andrey A. - NTh4C.7, NTu4D.2, NW2D.2
 Sullivan, Amy - ITu4B.4
 Summers, Joseph - IM2A.4
 Sun, Han - IM2A.4, SpTu4A.4
 Sun, Tingting - BTu2E.5
 Sun, Zhe - NTu3D.4
 Suret, Pierre - JM5A.40, JTu5A.41
 Suvakovic, Dusan - AW2A.1
 Suzuki, Yasumasa - IW3C.2
 Suzuki, Takenobu - JM5A.2, JM5A.4
 Svane, Ask S. - JTu5A.28
 Swenson, N. - SpW2B.4
 Swillo, Marc - NTh1A.3
 Syed, Azeemuddin - JTu5A.8
 Sylvestre, Thibaut - JM5A.15, NTh1A, NTh2A.3, NTh2A.5, NTu2D.8
 Szameit, Alexander - NW2D.2
 Szczepanski, Pawel - JTu5A.14, JTu5A.35
- Taghavi, Iman - IM4B.5
 Takahashi, Ryo - IW3C.2
 Takenaga, Katsuhiko - STu2F.5
 Takiguchi, Masato - JTu5A.29
 Tam, Hwa Yaw - SW1E.1
 Tang, Jie - IM2A.4
 Tang, Yongbo - ITu4B.1
 Tang, Xiao - NM3C.6
 Tang, Zhiyuan - SM4E.1
 Tangdiongga, Eduward - AW3A.2
 Tani, Francesco - NM2C.3
 Tanvir, Huda M. - IM4B.2
 Tao, Guangming - JTu5A.15, NTh2C.6, STu1D.5, STu2F.6
 Tarasenko, Oleksandr - BM3D.5
 Taunay, Thierry - BW3E.4, JTu5A.17
 Taylor, Brian - SpTu4A.4

- Tcherniega, Nickolay V. - ITu4C.4
 Tee, Din Chai - SM2E.4
 Tehranchi, Amirhossein - JM5A.17, JTu5A.37
 Tenopala-Carmona, Francisco - IW1B.5
 Terlyga, Nadezhda - SM2E.3
 Thiel, Markus - JM5A.57
 Thienpont, Hugo - JTu5A.50
 Thomas, Jens U. - BM2D.3, BM2D.4
 Thomas, Philip - SpTh2B.4
 Tijani, Gharbi - JTu5A.11
 Todorov, Yanko - JM5A.16
 Tokmenko, Inna - JM5A.37
 Tolmachev, Alex - SpW2B.1
 Tolochko, Anatoliy - JM5A.37
 Tolstik, Nikolai - SM2E.5
 Tonello, Alessandro - NTh2A.4
 Tong, Limin - STu2F.1
 Travers, John C. - NM2C.3, NTu2D.2, NTu3D.2
 Trepanier, Francois - BW4E.1
 Trillo, Stefano - IW3C.5, JM5A.39, NTu4D.5, NW2D.4, NW2D.5
 Trotter, Doug C. - IM2A.5
 Tsai, Huan-Shang - IM2A.4, SpTu4A.4
 Tsang, Hon K. - IW4C.6
 Tse, Ming-Leung Vincent - SW1E.1
 Tsuchizawa, Tai - ITu4B.2
 Tsukerman, Igor - IM3B.2
 Tu, Jiajing - STu2F.5
 Tünnermann, Andreas - BM2D.3, BM2D.4, NW2D.2
 Tur, Moshe - JTu5A.55
 Turduev, Mirbek - IW2C.6
 Turitsyn, Sergei K. - JM5A.25, JM5A.43, NTu2D.4, NW1C.4
 Turitsyna, Elena G. - JM5A.43

 Udd, Eric - BTu3E.1, JM1B.1
 Ura, Shogo - ITu3B.7
 Urino, Yutaka - ITu4B.5
 Urness, Adam - ITu2B.4
 Uteza, Olivier - BM4D.5

 Vachon, Martin - ITu3B.4
 Valentin, Constance - SW4F.2
 Vallaitis, Thomas - IM2A.4
 Vallee, Real - BM2D.1, BM2D.2, BM4D.7
 Valley, George - SpTu4A.2
 Van Campenhout, Joris - IM3A, ITu2B.1
 Van Stryland, Eric W. - JM5A.36, NTh1A.4
 Van Vaerenbergh, Thomas - IM2B.3
 van Veen, Doutje - AW2A.1
 van Wolfereen, Henk - BM3D.1
 Vanvincq, Olivier - NM2C.6
 Vasile, Gabriel - JTu5A.6
 Vasiliev, Sergei - BM4D.2, BM4D.3
 Vatnik, Ilya - JM5A.50, NW1C.4
 Vedadi, Armand A. - JM5A.8
 Veerasubramanian, Venkatakrishnan - ITu3B.3
 Velazquez, Victor - ITu4C.5
 Veljanovski, V. - SpW2B.4
 Venkitesh, Deepa - JM5A.21
 Verheyen, Peter - ITu2B.1
 Vetter, Peter - AW2A.1
 Violakis, Georgios - BM4D.4, BM4D.6
 Virte, Martin - JTu5A.31
 Voigtländer, Christian - BM2D.3, BM2D.4
 Voois, P. - SpW2B.4
 Vrublevsky, Dmitry S. - SM2E.3, STu3F.3
 Vuckovic, Jelena - IW3C.1
 Vukovic, Natasha - NW1C.6

 Wabnitz, Stefan - JM5A.46, NM4C.4, NTh2A.4, NW2D.6
 Wada, Kazumi - IM3A.1, ITu4B.2
 Wadsworth, William J. - NTh2A.1, SM3E.2
 Wai, Alex P. K. A. - JTu5A.26
 Wai, Ping Kong A. - JTu5A.40

 Wakabayashi, Yuu - IM2B.6, IM3B.6
 Wale, Michael J. - JTu1B.1
 Walia, Jaspreet - IW2C.7
 Walker, Robert B. - BM2D.5, BW3E.2, JTu5A.48
 Wang, Fengwen - IM2B.4
 Wang, Hong - SpTu4A.4
 Wang, Ke - AW3A.3, JTu5A.5
 Wang, Ke-Yao - IW4C.3
 Wang, Lei - IM3A.6
 Wang, Qingqing - BTu4E.2
 Ware, Cédric - SpTu3A.5
 Watts, Michael R. - IM2A.5, IM4A
 Webb, David J. - BTu2E.7, BTu3E.4
 Webster, Scott - JM5A.36, NTh1A.4
 Wegener, Martin - JM5A.36
 Weiler, Chad - NM3C.4
 Welch, David - IM2A.4, SpTu4A.4
 Welikow, Katrin - JTu5A.14
 Wen, Jing - JM5A.47
 Wen, Henry - NTh1A.2
 Werner, Albrecht - JTu5A.27
 Wertheimer, Michel - BTu2E.4
 Wessels, Bruce W. - Im4A.6
 Westbrook, Paul - BM3D, BW3E.3, BW3E.4, BW3E.5
 Westhäuser, Matthias - SpW3B.2, SpW3B.3
 Wetzel, Benjamin - JTu5A.22, NW3D.5
 Whittaker, Edward A. - JM5A.5
 Wiederrecht, Gary - IW2C.3, IW4C
 Wieser, Wolfgang - BW4E.1
 Williams, Robert J. - BW2E.6
 Williams, Henry E. - STu1D.3
 Willinger, Amnon - ITu2C.2
 Willis, Christina C. - STu4F.1
 Willsch, Reinhardt - BTu4E.1
 Winzer, Peter J. - AW2A.1
 Winzer, Peter J. - SpW3B.4
 Wise, Frank W. - JM1A, NM4C.4, NTh2A.1
 Withford, Michael J. - BM3D.3, BW2E.6
 Witzigmann, Bernd - IM4B.1
 Wlotzka, Alex - NW3D.4
 Wohlfeil, Benjamin - ITu2B.5
 Wong, Chee Wei - ITu2C.1
 Woodward, Ryan - ITu3B.2, STu3F.1
 Wörhoff, Kerstin - BM3D.1
 Wright, Jeremy - IM2A.5
 Wu, Che-Yao - IM4B.6
 Wu, Che W. - NTu4D.2
 Wu, Kuang-Tsan - IM2A.4, SpTu4A.4

 Xavier, Stephane - IW3C.5
 Xia, Zhixuan - IW2C.4
 Xiao-Li, Yinying - IM4B.4
 Xie, Sunney X. - NTh2A.1
 Xu, Bo - JTu5A.29
 Xu, Dan-Xia - JTu1B, ITu3B.4
 Xu, Jingjun - NTu3D.4
 Xu, Ke - IW4C.6
 Xu, Xian - SpTu2A.4

 Yacomotti, Alejandro M. - NW1C.2
 Yamada, Koji - ITu4B.2
 Yamamoto, Tsuyoshi - ITu4B.5
 Yamashita, Shinji - JTu5A.29, SW2F.5
 Yamauchi, Junji - IM2B.6, IM3B.6
 Yan, Zhijun - BW2E.2, BW2E.7
 Yan, Xin - JM5A.4
 Yang, Qi - SpTu1A.1
 Yao, Jianping - BTu2E.3, BW2E.4, BW4E.2
 Yao, Tianfu - STu4F.4
 Ye, Chunfang - ITu4B.4
 Ye, Yabin - SpTh2B.2, SpTh2B.5, SpTu3A.4
 Ye, Zhuoyi - NTu3D.4
 Yoo, S.J. Ben - SpTu4A.1
 Yoon, Min-Seok - BTu1C.4
 Yoshida, Takemasa - ITu3B.5

 Yoshikiyo, Kenta - JM5A.12, JTu5A.25
 Young, Ian - NM3C.4
 Yu, Changyuan - SpTh1B.1
 Yu, Fei - SM3E.2
 Yu, Hui - ITu2B.1
 Yu, N. - IW1B.1
 Yu, Shuqing - IM4B.1
 Yu, Song - SpTu4A.4
 Yu, Tingting - IM3A.6
 Yu, Yi - IW3C.4
 Yu, Xia - STu2F.3
 Yu, Zhangwei - BM3D.5
 Yvind, Kresten - ITu3C.5, IW3C.4, IW4C.4, JTu5A.12

 Zach, Armin - NTh2A.1
 Zadok, Avinoam - ITu3C.3
 Zaviyalov, Alexandr - NM4C.3
 Zayats, Anatoly - ITu4C, JM1A
 Zektzer, Roy - JTu5A.55
 Zeng, Yong - JTu5A.7
 Zeringue, Clint - STu4F.3
 Zervas, Michalis N. - BM3D.6, SW1E, SW2F.1
 Zhang, Bo - SpTh2B.4
 Zhang, Botao - BTu4E.2
 Zhang, Fan - SpTh1B.2
 Zhang, Hao - ITu3C.4
 Zhang, Jiaming - IM2A.4
 Zhang, Lin - ITu2B.3, ITu3C.4, JTu5A.51, BW2E.2, BW2E.7
 Zhang, Shaoliang - SpTh1B.1
 Zhang, Shuyan - STu2F.3
 Zhang, Yang - BTu2E.5
 Zhang, Ying - STu2F.3
 Zhang, Xiang - IW4C.2
 Zhao, Chunxu - SpTh1B.2
 Zhao, Xiangjun - SpTu4A.4
 Zhou, Kaiming - BW2E.2, BW2E.7, JTu5A.51
 Zhou, Qiugui - IM2A.2
 Zhou, Xiang - SpTu1A, SpTu3A.1
 Zhou, Xiaoyan - ITu3C.4
 Zhu, Benyuan - BW3E.3
 Zhu, Eric Y. - SM4E.1
 Zhu, Lin - STu1D.2, STu1D.6, STu3E.4
 Zhuge, Qunbi - SpTu2A.4
 Zhukov, Vladislav V. - SM2E.3, STu3F.3
 Zhukova, Liya V. - SM2E.3, STu3F.3
 Zilio, Sérgio C. - JTu5A.34
 Zimmermann, Lars - ITu2B.5
 Zito, Gianluigi - BM3D.4, SM3E.6
 Zlatanovic, Sanja - JM5A.20
 Zortman, William - IM2A.5
 Zou, Bing - BTu1C.5
 Zou, Ding - SpTu2A.6
 Zou, Li - IM3A.6

Advanced Photonics: OSA Optics and Photonics Congress Update Sheet 2012

Online Access to Technical Digest

In addition to the Technical Digest CD, full Technical Attendees now have an alternate way to access the digest papers at the meeting. Access the papers through Optics InfoBase: <http://www.opticsinfobase.org/browseconferences.cfm?congress=12Photonics>. You will use the same login email address and password provided during the meeting registration process. Access is currently limited to Advanced Photonics Full Technical Attendees only. If you need assistance with your login information, please use the "forgot password" utility or "Contact Help" link.

Session Changes

The BGPP session JM1B will begin on Monday, 18 June at 08:00 in White River. The session will be preceded by opening comments beginning at 07:50.

Presentations NW1C.4 and NW1C.5 are reversed in the program. NW1C.4, **Longitudinal Power Distribution in a Random DFB Fiber Laser**, will be presented by Dmitriy Churkin from 09:15-09:30 on Wednesday, 20 June. NW1C.5, **A Novel Extraction Algorithm for Spectral Phase Interferometry**, presented by Alessia Pasquazi will be from 09:30 - 09:45.

The NP and BGPP Postdeadline sessions have merged and will now be held on Wednesday, 20 June from 16:00 – 17:36 in Colorado I as session JW4D. Postdeadline books will be available at the registration desk.

SPPCom will not be having a Postdeadline Session. Instead, they will host a workshop in Platte from 16:00-18:00. Details of the workshop appear below in the New Events section.

An additional poster presentation has been added during Monday's Joint Poster session:

JM5A.58

Optically-induced, Bandwidth-tunable, Chirped Volume Bragg Gratings, Sebastian Kroesen^{1,2}, Wolfgang Horn^{1,2}, Cornelia Denz^{1,2}; ¹*Westfälische Wilhelms-Universität, Institut für Angewandte Physik, Germany*; ²*Westfälische Wilhelms-Universität, Center for Nonlinear Science (CeNoS), Germany*. We demonstrate reconfigurable chirped volume Bragg gratings centered at $\lambda=1542$ nm in photorefractive lithium niobate. The reflection bandwidth and chirp rate can be controlled by an adaptive lens system. The dispersion characteristics are obtained by the modulation phase shift method.

Presenter Changes

Sebastian Jakobs will be presenting the invited talk NTH1A.1, entitled **Four Wave Mixing in Silicon-Organic Hybrid Waveguides**.

Alex Clark will be presenting the postdeadline paper NW4D.6 entitled **Ultra-low Raman Noise Correlated Photon-Pair Generation in a Dispersion Engineered As₂S₃ Waveguide**.

New Events

Networking Cookout

Wednesday, 20 June
18:30 – 20:30, *The Courtyard*

Ticketed event – This event is not included in the Congress registration fees. Join us at this great event! Come meet with leaders of the optics and photonics community in a great informal and fun setting. Enjoy the sunset as you grab dinner, drinks and lively conversation! For \$20 USD for full technical registrants, \$10 USD for students.

SPPCom Workshop: Trends in Linear and Non-linear Digital Signal Processing for Communication Over all Degrees of Freedom of Light

Wednesday, 20 June
16:00-18:00, *Platte*

This workshop will consist of one hour of invited talks, followed by an open-forum discussion. Attendees are invited to converse with the speakers, make comments or ask questions. Speakers will include the following individuals:

- **Trends in High Spectral Efficiency Transmission**, Gabriella Bosco, *Politecnico di Torino, Italy*
- **Trends in High-speed Digital Signal Processing for Optical Communications**, Maxim Kuschnerov, *Univ. of Melbourne, Australia*
- **What Does the Future Hold for All-optical OFDM?**, Jeurg Leuthold, *Karlsruhe Institute of Technology, Germany*
- **Trends in Photonic Integrated Circuits for Coherent Optical Communications**, Jeff Rahn, *Infinera Corp., USA*
- **Trends in High-speed Optical Transport**, Kim Roberts, *Ciena Corporation, Canada*

Other speakers and topics will also be presented during the Workshop.

Withdrawn

Title: Widely and Continuously Tunable Narrow-band Photonic Filters with MEMS Integration
Contact: Guanquan Liang
Abstract ID: ITu3B.6

Title: Observation of all-optical Berezinskii-Kosterlitz-Thouless crossover in a photonic lattice
Contact: Guohai Situ
Abstract ID: NTu4D.7

Title: High Power Passive Components for kW Lasers
Contact: Bertrand Gauvreau
Abstract ID: SM2E.2

Presider Changes

Igor Tsukerman will now be presiding over session **IM4B: Theory, Modeling & Simulations III**, on Monday, 18 June.

Advanced Photonics: OSA Optics and Photonics Congress Exhibit 2012

Exhibit: 18-19 June 2012

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