## Winter Topicals 2009 Program-at-a-Glance

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<th>Nonlinear Dynamics in Photonic Systems</th>
<th>Nonlinear Processing in Optical Fibers</th>
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### Monday, 12 January 2009

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<td>10.30-12.30</td>
<td>MA2: Applications of Nanophotonics I</td>
<td>MB1: Innovative Light Sources &amp; All-Optical Generation</td>
<td>MC2: Parametric Amplification I</td>
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<td>16.00-18.00</td>
<td>MA4: Silicon Photonics (ends at 17.45)</td>
<td>MB3: Chaotic Optical Behavior</td>
<td>MC4: Telecom Applications (ends at 17.45)</td>
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### Tuesday, 13 January 2009

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<td>08.30-10.00</td>
<td>TuA1: Plasmonics I</td>
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<td>10.30-12.30</td>
<td>TuA2: Plasmonics II</td>
<td>TuB2: VCSELs</td>
<td>TuC2: Emerging Topics</td>
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<td>16.00-18.00</td>
<td>TuA4: Applications of Nanophotonics II (ends at 17.45)</td>
<td>TuB4: Slow Light &amp; QWs/QD</td>
<td>TuC4: Fibers I (ends at 17.45)</td>
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### Wednesday, 14 January 2009

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<tr>
<td>08.30-10.00</td>
<td>WA1: Nanostructures I</td>
<td>WB1: Ultra-Fast Optical Pulse Dynamics</td>
<td>WC1: Fibers II (ends at 09.45)</td>
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<td>10.30-12.30</td>
<td>WA2: Metamaterials</td>
<td>WB2: Regular &amp; Random Structures</td>
<td>WC2: Regeneration</td>
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<td>14.00-15.30</td>
<td>WA3: Resonators</td>
<td>WB3: Mode Switching Dynamics</td>
<td>WC3: Parametric Amplification III (ends at 15.15)</td>
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<tr>
<td>16.00-18.00</td>
<td>WA4: Nanostructures II (ends at 17.15)</td>
<td>WB4: Solitons</td>
<td>WC4: Nonlinear Processing II (ends at 17.45)</td>
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### End of Conference

Coffee Breaks are 10.00-10.30 & 15.30-16.00 each day
Lunch Break is 12.30-14.00 each day in the Restaurant Guggeryllis. Lunch is included for all attendees.
Final Program
Nanophotonics

Monday, 12 January 2009

ALL SESSIONS TO BE HELD IN KUFSTEIN

08.30 - 10.00
Session MA1: PHOTONIC CRYSTAL I
Session Chair: Min Qiu, Royal Institute of Technology, Stockholm, Sweden

MA1.1 08.30 - 09.15 (Plenary)
Photonic Band Gap Materials: Light Trapping Crystals, S. John, University of Toronto, Toronto, ON, Canada
We describe recent progress in the fabrication of 3D photonic band gap materials and the applications of their light-trapping capabilities.

MA1.2 09.15 - 09.45 (Invited)
Plane-Wave Transfer-Matrix Method and Its Application to Photonic Crystal Devices, Z.-Y. Li, Chinese Academy of Sciences, Beijing, China
Plane-wave transfer-matrix method can handle band diagrams of photonic crystal and its surface, optical spectra for dielectric and metallic crystals, and scattering and coupling of Bloch modes and guided modes at surface and interface.

MA1.3 09.45 - 10.00
Low-threshold lasing is experimentally achieved for the first time in semiconductor photonic-crystal nanocavities embedding site-controlled quantum wires. The effect is established via direct observation of the stimulated emission in the time domain.

10.00 - 10.30 COFFEE BREAK

10.30 - 12.30
Session MA2: APPLICATIONS OF NANOPHOTONICS I
Session Chair: Ali Adibi, Georgia Institute of Technology, Atlanta, GA, USA

MA2.1 10.30 - 11.00 (Invited)
Nanophotonic Interconnection Networks in Multicore Embedded Computing, K. Bergman, Columbia University, New York, NY, USA
We develop a multilayer optical network simulation environment that uniquely captures physical nanoscale silicon photonic device models. The network-on-chip scalability and performance are evaluated in the context of device characteristics and associated energy consumption.

MA2.2 11.00 - 11.30 (Invited)
Scalable Coarse WDM Transceiver Modules for Satellite Applications, P. S. Guilfoyle, M. T. Harris, U. Retnasingham, S. Mahnkopf, T. J. Eustis, D. Kumar, and D. A. Louderback, OptiComp Corporation, Zephyr Cove, NV, USA
A scalable coarse WDM optical transceiver specifically designed for satellite applications will be presented. The transceiver can be upgraded in both data rate and number of wavelengths, giving the transceiver the potential of achieving 120 Gbit/s in a single fiber.

MA2.3 11.30 - 12.00 (Invited)
Nanostructured LED’s for Solid-State Lighting, R. Windisch, N. Linder, C. Wiesmann and K. Streubel, Osram Opto Semiconductors GmbH, Regensburg, Germany
Nanostructures are often applied to LEDs for enhanced performance, but they have to compete with conventional light extraction technologies. The paper compares the obtainable results and classifies the technologies with respect to solid-state lighting applications.

MA2.4 12.00 - 12.15
We report the simulation, fabrication and characterization of a new architecture of a 90° phase shifter of QAM-QPSK photonic vectorial modulators/demodulators based on RR. The structure was fabricated with SOI technology and the RR parameters were optimized for WDM.
Numerical Investigation of a SiGe HBT Electro-Optic Modulator, S. Deng, Z. Huang, J.-R. Guo, J. McDonald and R. Kraft, Rensselaer Polytechnic Institute, Troy, NY, USA

We analyzed an electro-optic modulator consisting of a heterojunction bipolar transistor (HBT) with graded SiGe composition in the base. Simulation shows single mode operation is attainable with an interaction length $L_p$ of 40.8$\mu$m.

12.30 – 14.00 LUNCH BREAK - Restaurant Guggeryllis

MA3.1 14.00 - 14.15

We present a photonic-crystal microcavity with a sharp asymmetric Fano resonance. The obtained intrinsic Q of the cavity is around 700000.

MA3.2 14.15 - 14.30
Broad Resonance for Improving Imaging Quality of a Photonic Crystal Lens, W. Jiang, Rutgers University, Piscataway, NJ, USA

We employ a semi-analytic theory to compute the modulation transfer function and optimize the design of a photonic crystal lens. With a unique broad resonance, the isotropy of the image field is significantly enhanced.

MA3.3 14.30 - 14.45
Discrimination of Higher-Order Modes in Photonic-Crystal VCSEL, T. G. Czyszanowski, Technical University of Lodz, Lodz, Poland

Self-consistent modeling of threshold characteristics of an InP-based 1300-nm AlInGaAs photonic-crystal vertical-cavity surface-emitting diode laser is presented. It shows that a shallow photonic crystal deteriorates the VCSEL characteristics, however deeper, optimized etching assures low threshold.

MA3.4 14.45 - 15.00
High-Q Optical Filter Based on Photonic Crystal Surface-Mode Microcavity, J. Wang, Royal Institute of Technology, Stockholm, Sweden

An optical filter based on a side-coupled two-dimensional photonic crystal surface mode cavity on crystalline silicon-on-insulator (SOI) structure is presented. The measured system Q and intrinsic Q factor are 6900 and 13700, respectively.

MA3.5 15.00 - 15.15
Vertically Stacked Square Lattice Photonic Crystals for Large Angle Optical Beam Steering, R. T. Chen, X. Dou, X. Chen, University of Texas at Austin, Austin, TX, USA, M. Y. Chen, X. Wang and W. Jiang, Omega Optics Inc., Austin, TX, USA

In this paper, we reported the fabrication of 2-D square lattice photonic crystals structures targeted at beam steering application using double exposure holographic interference method. Computer simulation gives the electric field distribution patterns and SEM images show the developed photonic crystals on the glass substrate.

MA3.6 15.15 - 15.30
Enhancement of Nonlinearity in Nonlinear Photonic Crystal Ring Resonators for All-Optical Switching, T. Ahmadi Tameh, B. Memarzadeh Isfahani, A. R. Maleki Javan and N. Granpayeh, K.N.Toosi University of Technology, Tehran, Iran

In this paper three different structures of all optical switches based on nonlinear photonic crystal ring resonators are proposed and compared. The procedure of enhancement of nonlinearity is shown and the optimal structure is proposed.

15.30 – 16.00 COFFEE BREAK

MA4.1 16.00 - 16.30 (Invited)
Efficient Wavelength Conversion via Four-Wave Mixing in Sub-Micron Silicon Rib Waveguides, H. Rong, W. A. Mathlouthi, I. Hsieh and M. Paniccia, Intel Corporation, Santa Clara, CA, USA

We report a wavelength conversion efficiency of -5.5 dB via four-wave-mixing in a low-loss 2.5 cm long sub-micron silicon-on-insulator rib waveguide. The impact of non-linear absorption and waveguide dimensions on the conversion efficiency is studied.

MA4.2 16.30 - 16.45
All Optical Switching in Silicon-On-Insulator Photonic Wire Nano-Cavities, M. Belotti, M. Galli, D. Gerace, L. C. Andreani, University of Pavia, Pavia, Italy, A. R. Md Zain, N. P. Johnson, M. Sorel and R. M. De La Rue, University of Glasgow, Glasgow, Scotland, UK
All-optical switching with a very low power is demonstrated on photonic crystal wire nano-cavities on silicon-on-insulator with large quality factors and high transmission in the telecom range.

MA4.3 16.45 - 17.00
Silicon Cross-Slot Waveguides Insensitive to Polarization, J. V. Galan Conejos, P. Sanchís Kilders, J. Garcia, A. Martinez, J. Blasco, J. M. Martínez, A. Brimont, and J. Martí, Universidad Politécnica de Valencia, Valencia, Spain

We present a slot waveguide configuration which simultaneously works for TE and TM polarizations. Simulation results are reported to achieve single-mode propagation and insensitivity to polarization. Dispersion is also analyzed by calculating the GVD parameter.

MA4.4 17.00 - 17.15
Nonlinearity of Optimized Horizontal Slot Waveguides, R. Hainberger and P. Muellner, Austrian Research Centers GmbH - ARC, Vienna, Austria

In this theoretical study, we show that the use of optimized horizontal silicon photonic slot waveguide structures could enable the realization of devices with a nonlinearity coefficient of more than $2 \times 10^7 \text{1/(W\cdot km)}$.

MA4.5 17.15 - 17.30
Low Loss, Small Crosstalk Offset Crossing Structure of Si Wire Waveguide, D. Tanaka, Keio University, Yokohama, Kanagawa, Japan

Low loss, small crosstalk offset crossing structure of Si wire waveguide is proposed. The transmission loss of 0.018 dB, and the crosstalk of -49.1 dB are achieved with a crossing angle of 20 degrees.

MA4.6 17.30 - 17.45
All Optical Switch Using Stimulated Raman Scattering and Free Carrier Absorption in Silicon, M. Khorasaninejad and S. S. Saini, University of Waterloo, Waterloo, ON, Canada

In this paper we propose an all optical switch in Silicon on Insulator (SOI) waveguides based on two nonlinear phenomena, Stimulated Raman Scattering (SRS), and Free Carrier Absorption (FCA). About 13 dB extinction ratio is achieved.

18.30 – 20.00
WELCOME RECEPTION - CASINEUM

Tuesday, 13 January 2009

08.30 - 10.00
Session TuA1: PLASMONICS I
Session Chair: Ray T. Chen, University of Texas at Austin, Austin, TX, USA

TuA1.1 08.30 - 09.15 (Plenary)
Nanophotonic Functionalities through Plasmonics, A. V. Zayats, Queens University of Belfast, Belfast, UK

Plasmonic waveguides, crystals and metamaterials will be overviewed and their applications discussed. Coupling light to plasmonic excitations on nanostructured metal films and surfaces allows passive and active functionalities to be achieved on the sub-wavelength scale.

TuA1.2 09.15 - 09.45 (Invited)
Plasmonic Nanoguides, S. I. Bozhevolnyi, University of Southern Denmark, Odense, Denmark

Surface-plasmon (SP) based waveguiding configurations are considered, and subwavelength photonic components utilizing SP modes propagating along channels cut into and dielectric ridges deposited onto gold films are overviewed, demonstrating first examples of ultra-compact plasmonic components.

TuA1.3 09.45 - 10.00
Active Components for Integrated Plasmonic Circuits, A. Krasavin, P. Bolger, A. V. Zayats, Queens University of Belfast, Belfast, UK, T. Holmgaard, Z. Chen, Aalborg University, Aalborg, Denmark, S. I. Bozhevolnyi, University of Southern Denmark, Odense, Denmark, L. Markey and A. Dereux, Université de Bourgogne, Dijon, France

We present a comprehensive study of highly efficient and compact passive and active components for integrated plasmonic circuit based on dielectric-loaded surface plasmon polariton waveguides.

10.00 – 10.30 COFFEE BREAK

10.30 - 12.30
Session TuA2: PLASMONICS II
Session Chair: Sergey I. Bozhevolnyi, University of Southern Denmark, Odense, Denmark
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<td>TuA2.1</td>
<td>10.30 - 11.00</td>
<td>Surface Plasmons for Micro- and Nano-Optical Manipulation</td>
<td>R. Quidant and M. Righini, Institut de Ciencies Fotoniques, Barcelona, Spain</td>
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<td>TuA2.2</td>
<td>11.00 - 11.30</td>
<td>Fabricating Plasmonic Components for Nanophotonics</td>
<td>A. Boltasseva, R. Bakker, Z. Liu, H.-K. K. Yuan, A. V. Kildishev, V. M. Shalaev, Purdue University, West Lafayette, IN, USA, R. B. Nielsen, C. Jeppesen, and A. Kristensen, Technical University of Denmark, Lyngby, Denmark</td>
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<td>TuA2.3</td>
<td>11.30 - 11.45</td>
<td>Silver Nanoparticle Impregnated Polycarbonate Substrates for Plasmonic Applications</td>
<td>A. Peacock, L. Lagonigro, University of Southampton, Southampton, Hampshire, UK, T. Hasell, University of Nottingham, Nottingham, UK, S. Rohmoser, University of Southampton, Southampton, UK, S. Howdle, University of Nottingham, Nottingham, UK, P. J. A. Sazio and P. Lagoudakis, University of Southampton, Southampton, UK</td>
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<td>TuA2.4</td>
<td>11.45 - 12.00</td>
<td>Polarization Independent Lensing and Superbeaming in Plasmonic Crystals and Applications to Focal Plane Arrays</td>
<td>D. Crouse, City College of New York/CUNY, New York, NY, USA</td>
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<td>TuA2.5</td>
<td>12.00 - 12.15</td>
<td>Investigation of Coupling Parameters and the Effect of Edges in Nano-plasmonic Waveguides</td>
<td>M. Rasouli Disfani and M. S. Abrishamian, K.N. Toosi University of Technology, Tehran, Iran</td>
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<td>12.30 – 14.00</td>
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**Session TuA3: PHOTONIC CRYSTAL III**

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<td>TuA3.2</td>
<td>14.15 - 14.30</td>
<td>Spurious-Free Dynamic Range (SFDR) Improvement in a True-Time-Delay System based on Highly Dispersive Photonic Crystal Fiber</td>
<td>H. Subbaraman, University of Texas at Austin, Austin, TX, USA, M. Y. Chen, Omega Optics Inc., Austin, TX, USA and R. T. Chen, University of Texas at Austin, Austin, TX, USA</td>
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<td>TuA3.3</td>
<td>14.30 - 14.45</td>
<td>Nested Photonic Crystal Cavity for On-Chip Wavelength Conversion</td>
<td>A. Khorshidahmad and A. G. Kirk, McGill University, Montréal, QC, Canada</td>
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TuA3.4     14.45 - 15.00
Lateral Current Injection Photonic Crystal Emitters, C. Long, A. V. Giannopoulos and K. D. Choquette, University of Illinois at Urbana-Champaign, Urbana, IL, USA

We report the first lateral current injected photonic crystal light emitting diodes. The devices utilize a transverse junction that is created using selective ion implantation. Electrical and spectral properties showing the influence of the photonic crystal are reported.

TuA3.5     15.00 - 15.15

A photonic crystal defect waveguide fabricated in a freestanding LiNbO3 membrane is presented. The three dimensional patterning was done by means of ion-beam enhanced etching.

TuA3.6     15.15 - 15.30
Hybrid Photonic Crystal Fiber Coupler Infiltrated with Liquid Crystals, D. J. J. Hu, P. Shum, Nanyang Technological University, Singapore, C. Lu, Hong Kong Polytechnic University, Hong Kong, X. Sun, Beijing Institute of Remote Sensing Equipment, Beijing, China, G. Ren, X. Yu and G. Wang, Nanyang Technological University, Singapore

We theoretically investigate the thermally tunable photonic crystal fiber (PCF) coupler infiltrated with nematic liquid crystals. The thermo-optical responsive NLC offers thermal tunability of the fiber coupler. The proposed design can find promising sensor applications.

15.30 – 16.00     COFFEE BREAK

16.00 - 17.45

Session TuA4: APPLICATIONS OF NANOPHOTONICS II
Session Chair: Frederick B. McCormick, Sandia National Laboratory, Albuquerque, NM, USA

TuA4.1     16.00 - 16.30 (Invited)
Nanophotonics for Life, M. Gu, Swinburne University of Technology, Hawthorn, VIC, Australia

We report on our recent nanophotonics developments with gold nanorods, medically-safe two-photon-induced cancer therapy and multi-dimensional optical data storage.

TuA4.2     16.30 - 17.00 (Invited)
Lab-on-a-Chip Sensing using Ultra-Compact Si Nanophotonic Structures, A. Adibi, A. A. Eftekhar, B. Momeni, M. Soltani and S. Yegnanarayanan, Georgia Institute of Technology, Atlanta, GA, USA

The combination of Si-based ultra-high Q micro-resonators and ultra-compact photonic crystal on-chip spectrometers has enabled highly-sensitive lab-on-a-chip sensing structures with orders-of-magnitude smaller size compared to conventional bulk sensing systems. Details of the design along with their experimental demonstrations will be presented.

TuA4.3     17.00 - 17.15
Annular Holes and Their Arrays for Light Extraction from High Refractive Index Substrates, J.-S. Bouillard, W. Dickson, J. Einsle, Queens University of Belfast, Belfast, UK, S. Gutiérrez Rodrigo, S. Carretero, L. Martin-Moreno, Universidad De Zaragoza, Zaragoza, Spain, F. Garcia-Vidal, Universidad Autónoma de Madrid, Madrid, Spain and A. V. Zayats, Queens University of Belfast, Belfast, UK

Transmission through Annular Aperture Arrays has been studied in detail on glass and high refractive index GaP substrate. The optimisation of the geometry of annular apertures and the nature of the transmission enhancement will be discussed.

TuA4.4     17.15 - 17.30
Domain-Inversion-Equivalent EO Polymer based Y-fed Directional Coupler Modulator with High Linearity, B. Lee, C. Lin, University of Texas at Austin, Austin, TX, USA, J. Luo, and A. K.-Y. Y. Jen, University of Washington, Seattle, WA, USA

A novel Y-branch directional coupler modulator (YDCM) with high linearity based on domain-inverted modulation was fabricated and tested. A two-tone test was performed to demonstrate the improvement of linearity of four-domain YDCM over two-domain YDCM.

TuA4.5     17.30 - 17.45
Multi-Point In-Line Refractometry Using Tilted Fiber Bragg Gratings, C. Caucheteur, Faculté Polytechnique de Mons, Mons, Belgium

Tilted fiber Bragg gratings (TFBGs) are cascaded along optical fibers but they are badly suited for quasi-distributed refractive index sensing when TFBGs are cascaded along optical fibers. We demonstrate here that a commercial OTDR can be used for this purpose.

CANCELLED
WTM 2009 The IEEE/LEOS Winter Topical Meeting Series on Nanophotonics

Wednesday, 14 January 2009

08.30 - 10.00
Session WA1: NANOSTRUCTURES I
Session Chair: Kent Choquette, University of Illinois at Urbana-Champaign, Urbana, IL, USA

WA1.1 08.30 - 09.15 (Plenary)
Nanoscale Nonlinear Optics, R. M. Osgood, Columbia University, New York, NY, USA
This talk will review and describe new advances in nonlinear optics in nanostructured materials in a variety of material media and optical structures.

WA1.2 09.15 - 09.45 (Invited)
Subwavelength-Diameter Optical Fibers: Connecting Fiber Optics with Near-Field Optics, Nonlinear Optics and Quantum Optics on the Micro/Nanoscale, L. Tong, Zhejiang University, Hangzhou, Zhejiang, China
ABSTRACT NOT AVAILABLE

WA1.3 09.45 - 10.00
We introduce NanoPen, a novel technique for flexible, real-time reconfigurable, and large-scale light-actuated patterning of single or multiple nanoparticles such as metallic spherical nanoparticles, semiconducting and metallic nanowires, and carbon nanotubes.

10.00 – 10.30 COFFEE BREAK

10.30 - 12.00
Session WA2: METAMATERIALS
Session Chair: Richard M. Osgood, Columbia University, New York, NY, USA

WA2.1 10.30 - 11.00 (Invited)
Photonic Metamaterials: Recent Progress, M. Wegener and S. Linden, University of Karlsruhe, Karlsruhe, Germany
After briefly reviewing the tremendous progress in the emerging field of (e.g., magnetic or negative-index) photonic metamaterials, we focus on the remaining two major challenges: Fabrication of truly three-dimensional structures and reduction of losses.

WA2.2 11.00 - 11.30 (Invited)
Nanophotonics at Sandia National Laboratories, F. B. McCormick, Sandia National Laboratories, Albuquerque, NM, USA
Sandia National Laboratories is leveraging the extensive CMOS, MEMS, compound semiconductor, and nanotechnology fabrication and test resources at Sandia National Laboratories to explore new science and technology in photonic crystals, plasmonics, metamaterials, and silicon photonics.

WA2.3 11.30 - 11.45
We present a fishnet metamaterial design whose dimensions have been engineered to enhance a second-order magnetic resonance appearing at visible wavelengths. Both negative permittivity and permeability are achieved in this spectral range.

WA2.4 11.45 - 12.00
Negative Index Metamaterial through High-Order Plasmon Resonances on U-Shaped Nanowires, F. Rodriguez-Fortuño, C. Garcia-Meca, R. Ortuño, Universidad J. Martí and A. Martínez, Universidad Politécnica de Valencia, Valencia, Spain
Second- and third-order standing-wave slow-plasmon resonances on gold u-shaped nanowires are modelled and used to achieve a negative index metamaterial at far infrared frequencies which can be stacked showing backward phase propagation.

12.30 – 14.00 LUNCH BREAK - Restaurant Guggeryllis

14.00 - 15.30
Session WA3: RESONATORS
Session Chair: Frederick B. McCormick, Sandia National Laboratories, Albuquerque, NM, USA
Ultra-high quality factor silicon nitride planar microdisk resonators for integrated photonics in the visible range: A new coupling scheme, E. Shah Hosseini and A. Adibi, Georgia Institute of Technology, Atlanta, GA, USA

Ultra-high quality (Q>4E6) microdisk resonators are demonstrated in a silicon nitride platform in visible with integrated in-plane coupling waveguides. Critical coupling to the microdisk mode is demonstrated using a pedestal and also a curved waveguide.

Interferometrically-coupled traveling-wave resonators for nonlinear optics applications, A. H. Atabaki, Q. Li, S. Yegnanarayanan, M. Chamanzar, E. Shah Hosseini, A. A. Eftekhar, M. Soltani, B. Momeni and A. Adibi, Georgia Institute of Technology, Atlanta, GA, USA

A traveling-wave resonator structure with interferometric-coupling scheme is shown to have the capability of supporting both over-coupled and critically-coupled modes, simultaneously. This device is demonstrated in SOI with an integrated microheater to tune its coupling. The application of this device for nonlinear optics is discussed.


We fabricate and optically investigate metal nanoantennas and pillar microresonators for efficient coupling of light from the far field into single nanomitters, such as semiconductor quantum dots, diamond nanocrystals, or molecules.

Sub-wavelength imaging of optical modes in silicon microdisk cavities using a near-field probing technique, A. A. Eftekhar, M. Soltani, S. Yegnanarayanan and A. Adibi, Georgia Institute of Technology, Atlanta, GA, USA

We demonstrate sub-wavelength near-field imaging of the optical modes in high Q silicon microdisks. Mode profiles with a spatial resolution of ~20nm are obtained by characterizing the perturbative effects of a small scanning AFM tip.

Spectral characteristics of coupled silica disc microresonators, C. Schmidt, A. Chipouline, T. Käsebier, Friedrich-Schiller University- Jena, Jena, Germany, L. Deych, City University of New York, New York, NY, USA, E. B. Kley, Friedrich-Schiller University- Jena, Jena, Germany, A. Tuennemann, Fraunhofer-Institut, Jena, Germany and T. Pertsch, Friedrich-Schiller University- Jena, Jena, Germany

A spectral response of coupled silica disc microresonators is investigated and light intensity distribution among the coupled discs is measured. The latter depends on the resonance frequencies of each of the resonators and excitation condition.


An optical switch based on the Mach-Zehnder interferometer (MZI) with a micro-ring resonator as the two-beam interferometer is proposed. The improved MZI can always obtain a low crosstalk, even with seriously unbalanced interfering beams.

Dense (1010 cm-2) arrays of ordered quantum dots with narrow (< 10 meV) photoluminescence spectra, A. Surrente, M. Felici, P. Gallo, B. Dwir, A. Rudra and E. Kapon, École Polytechnique Fédérale de Lausanne, Lausanne, Switzerland

Dense currently looks like (1010 cm-2) quantum dots (QDs) were grown in inverted pyramidal recesses by OMCVD. The high uniformity of the QD array is demonstrated by macro-photoluminescence spectra having linewidth as small as 6.5 meV and AFM measurements.


A novel class of optically anisotropic materials is presented. Layers of semiconductor nanowires fabricated in a bottom-up process exhibit a large in-plane birefringence and show quarter-wavelength retardation for a wavelength of 690 nm. These nanowire metamaterials are promising materials for optical gas- and biosensing.


Control on the degree of valence band mixing is experimentally achieved in the particular GaAs/AlGaAs quantum Dot-in-Dot (DiD) structure. The effect is reflected by the tunable polarization of the emitted photons.
WA4.4  16.45 - 17.00
Silicon Nano-Membranes for Efficient Large Angle Optical Beam Steering, A. Hosseini, University of Texas at Austin, Austin, TX, USA
In this paper, we present a silicon nano-membrane-based phased array structure for large angle optical beam steering. The new array structure allows for over ±60° optical beam scanning with minimal degradation in the side-lobe-level and diffraction efficiency.

WA4.5  17.00 - 17.15
Analysis of Scattering in Photonics Polymer Doped with Optically Anisotropic Cylinder Particles, Y. Kato, Keio University, Yokohama, Kanagawa, Japan, A. Tagaya, Japan Science and Technology Agency, Kawasaki, Japan and Y. Koike, Keio University, Kawasaki, Japan
Using a polymer film doped with optically anisotropic particles, angular distribution difference of the scattering light is demonstrated depending on the oscillating direction of incident light. Analysis on particle size difference was studied as well.

End of Program
WTM 2009 The IEEE/LEOS Winter Topical Meeting Series on Nonlinear Dynamics in Photonic Systems

Final Program

Nonlinear Dynamics in Photonic Systems

Monday, 12 January 2009

ALL SESSIONS TO BE HELD IN SEEFELD

08.30 - 10.00
Session MC1: JOINT PLENARY SESSION
Session Chair: Göery N. Genty, Tampere University of Technology, Tampere, Finland

MC1.1 08.30 - 09.15 (Plenary)
10 Years of Nonlinear Optics in Photonic Crystal Fiber: Progress and Perspectives, J. M. Dudley, University of Franche-Comte, Besancon, France
2009 marks ten years since the first report of supercontinuum generation in photonic crystal fiber. These results have had wide-reaching impact, and continue to stimulate new research directions in nonlinear dynamics and nonlinear optics.

MC1.2 09.15 - 10.00 (Plenary)
Octave Spanning High Quality Super Continuum Generation using Ultrashort Pulse Fiber Laser –Highly Functional Optical Control using Ultrafast Nonlinear Effects in Optical Fibers–, N. Nishizawa, Osaka University, Suita, Osaka, Japan
Ultrafast nonlinear phenomena in optical fibers have a lot of applications and exciting possibilities. In this talk, the achievements and recent results, such as high quality super continuum generation, pulse trapping, etc, are presented.

10.00 – 10.30 COFFEE BREAK

10.30 - 12.30
Session MB1: INNOVATIVE LIGHT SOURCES & ALL-OPTICAL GENERATION
Session Chair: Yuri S. Kivshar, Australian National University, Canberra, ACT, Australia

MB1.1 10.30 - 11.00 (Invited)
Dynamics of Optical Modes in Modulated Photonic Structures, S. Fan, Z. Yu, C. Otey and M. Povinelli, Stanford University, Stanford, CA, USA
The introduction of dynamics in nanophotonic structures creates new opportunities for controlling light. Here we show that one can use just two dynamically tuned cavities to capture a light pulse. We also introduce the use of dynamic modulation to create complete optical isolation.

MB1.2 11.00 - 11.30 (Invited)
Parabolic Pulse Generation and Applications, C. Finot, Université de Bourgogne, Dijon, France, J. M. Dudley, University of Franche-Comte, Besancon, France, D. J. Richardson, University of Southampton, Southampton, UK and G. Millot, Université de Bourgogne, Dijon, France
Parabolic pulses in optical fibers have stimulated an increasing number of applications. We review here the physics underlying the generation of such pulses as well as the results obtained in a wide-range of experimental configurations.

MB1.3 11.30 - 12.00 (Invited)
Harmonic Generation with Transverse and Longitudinal Phase-Matching, S. M. Saltiel, University of Sofia, Sofia, Bulgaria
Second harmonic nonlinear diffraction including Cerenkov SH radiation and generation of conical and toroidal second harmonic waves in 1D and 2D nonlinear photonic structures with modulation of the sign of quadratic nonlinearity are reported.

MB1.4 12.00 - 12.30 (Invited)
Dynamics of 2D Photonic Crystal Lasers, F. Raineri, A. Yacomotti, R. Hostein, R. Braive, A. Beveratos, I. Sagnes and R. Raj, Laboratoire de Photonique et de Nanostructures, Marcoussis, France
Band-edge photonic crystal lasers were fabricated and their temporal characteristics were minutely analyzed using a high resolution up-conversion system. The InGaAs/InP 2D photonic crystal laser operates at room temperature at 1.55 µm showing possibility of modulating faster than 25GHz.

12.30 – 14.00 LUNCH BREAK - Restaurant Guggeryllis
<table>
<thead>
<tr>
<th>Time</th>
<th>Session MB2:</th>
<th>Speaker(s)</th>
<th>Topic</th>
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<tbody>
<tr>
<td>14.00 - 15.30</td>
<td>Plenary II</td>
<td>Trevor M. Benson, University of Nottingham, Nottingham, UK</td>
<td>WTM 2009 The IEEE/LEOS Winter Topical Meeting Series on Nonlinear Dynamics in Photonic Systems</td>
</tr>
<tr>
<td>MB2.1</td>
<td>14.00 - 14.45</td>
<td>(Plenary) M. Sciamanna, SUPELEC, Metz, France, K. Panajotov, I. Gatare, H. Thienpont, Vrije University Brussels, Brussels, Belgium, A. Valle, Universidad de Cantabria, Santander, Spain, M. Arizaleta, Universidad Pública de Navarra, Pamplona, Spain and A. Uchida, Saitama University, Saitama, Japan</td>
<td>Chaotic Polarization Dynamics and Chaos Synchronization in VCSELs. We review our recent results related to nonlinear polarization dynamics and chaos in VCSELs. The possibility to generate multimode chaos motivates the study of chaos synchronization in coupled VCSELs and its application for secure communications.</td>
</tr>
<tr>
<td>MB2.2</td>
<td>14.45 - 15.00</td>
<td>C. Bersch, G. Onishchukov and U. Peschel, University of Erlangen-Nuremberg, Erlangen, Germany</td>
<td>Experimental Observation of Bloch Oscillations in the Spectral Domain. We have experimentally demonstrated for the first time spectral Bloch oscillations using the interaction between a probe signal and a traveling-wave periodic potential in an optical fiber.</td>
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<tr>
<td>MB2.3</td>
<td>15.00 - 15.15</td>
<td>C. Schmidt, A. Chipouline, T. Kaesebier, G. K. Chowdhury, E. B. Kley, Friedrich-Schiller University- Jena, Jena, Germany, A. Tuennermann, Fraunhofer-Institut, Jena, Germany, L. Deych, City University of New York, New York, NY, USA and T. Pertsch, Friedrich-Schiller University- Jena, Jena, Germany</td>
<td>Nonlinear Effects in Silica and Hybrid Silica-Silicon Disc Micro Resonators. A spectral response of silica and hybrid silica-silicon disc microresonators is investigated and their different nonlinear behavior is discussed in terms of different sources of nonlinearity.</td>
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<tr>
<td>MB2.4</td>
<td>15.15 - 15.30</td>
<td>A. Konyukhov, Saratov State University, Saratov, Russia</td>
<td>Design of Low-Contrast Periodic Structures in Highly Non-Linear Glass for the Ultra-Short Pulse Processing in Mid-Infrared. Functionality of low-contrast 2D periodic guiding structures written by femtosecond laser pulses is studied in the theoretical approach based on classical methods of non-linear optics and direct numerical solution of Maxwell equations.</td>
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<td>15.30 – 16.00</td>
<td>Coffee Break</td>
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<tr>
<td>16.00 - 18.00</td>
<td>Session MB3:</td>
<td>Marc Sciamanna, SUPELEC, Metz, France</td>
<td>WTM 2009 The IEEE/LEOS Winter Topical Meeting Series on Nonlinear Dynamics in Photonic Systems</td>
</tr>
<tr>
<td>MB3.1</td>
<td>16.00 - 16.30</td>
<td>I. Fischer, Heriot-Watt University, Edinburgh, Scotland, UK</td>
<td>Chaos Dynamics in Semiconductor Lasers. ABSTRACT NOT AVAILABLE</td>
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<tr>
<td>MB3.2</td>
<td>16.30 - 17.00</td>
<td>D. Syvridis, University of Athens, Athens, Greece, M. Hamacher, Fraunhofer-Institut, Berlin, Germany, I. Giles, Phoenix Photonics, Wallington, Surrey, UK, A. Bogris, A. Argyris and K. E. Chlouverakis, University of Athens, Athens, Greece</td>
<td>Optical Sources for Chaos based Communications. Two new types of integrated broadband optical sources generating a wide range of nonlinear dynamics are presented. The new sources are compact potential emitters for high-speed optical communication systems employing chaos data encryption.</td>
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<td>MB3.3</td>
<td>17.00 - 17.30</td>
<td>K. Uchida, Saitama University, Saitama, Japan, H. Someya, M. Ozaki, K. Tanaka, S. Yoshimori, Takushoku University, Tokyo, Japan, K. Panajotov, Vrije University Brussels, Brussels, Belgium and M. Sciamanna, SUPELEC, Metz, France</td>
<td>Synchronization of Chaos in Mutually Coupled Vertical-Cavity Surface-Emitting Lasers with Time Delay. We experimentally observe in-phase and anti-phase synchronization of chaos in two mutually-coupled vertical-cavity surface-emitting lasers. We investigate leader-laggard relationship between two chaotic waveforms and find that the laser with longer wavelength becomes the leader.</td>
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<td>MB3.4</td>
<td>17.30 - 17.45</td>
<td>B. Romeira, J. M. L. Figueiredo, Universidade do Algarve, Paro, Algarve, Portugal, T. J. Slight, L. Wang, E. Wasige and C. N. Ironside, University of Glasgow, Glasgow, UK</td>
<td>Wireless to Optical Frequency Locking and Chaos using a Resonant Tunnelling - Laser Diode Circuit. We report experimental and numerical results on frequency locking, quasi-periodic and chaotic outputs induced by wireless signals on a nonlinear photonic interface consisting of a laser diode driven by a resonant tunnelling diode.</td>
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<td>MB3.5</td>
<td>17.45 - 18.00</td>
<td>K. D. Choquette, University of Illinois at Urbana-Champaign, Urbana, IL, USA, A. Lehman Harren, Sandia National Laboratories, Livermore, CA, USA and P. Carney, University of Illinois at Urbana-Champaign, Urbana, IL, USA</td>
<td>Partial Coherence in Coupled Photonic Crystal Vertical Cavity Lasers.</td>
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</table>
A model for the emergence of partial coherence in arrays of VCSELs is presented. The spectra of the uncoupled lasers determine the coherence properties of the coupled system. Predictions the model is verified experimentally.

18.30 – 20.00  
**WELCOME RECEPTION - CASINEUM**

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**Tuesday, 13 January 2009**

08.30 - 10.00  
**Session TuB1:**  
**Chair:**  Ramon Vilaseca, Polytechnic University of Catalonia, Terrassa, Barcelona, Spain

**TuB1.1** 08.30 - 09.15  (Plenary)

Ultrafast Nonlinear Optics in Emerging Waveguide Structures, B. J. Eggleton, CUDOS, University of Sydney, Sydney, NSW, Australia  
**ABSTRACT NOT AVAILABLE**

**TuB1.2** 09.15 - 10.00  (Plenary)

We discuss new propagation effects in semiconductors at frequencies above the absorption including inhibition of linear absorption using phase-locked harmonic pulses, negative refraction, anomalous momentum states, sub-wavelength imaging and ultrathin, nanometer-size guiding channels.

10.00 – 10.30  
**COFFEE BREAK**

10.30 - 12.30  
**Session TuB2:**  
**Chair:**  Kent D. Choquette, University of Illinois at Urbana-Champaign, Urbana, IL, USA

**TuB2.1** 10.30 - 11.00  (Invited)

VCSEL Structures and Applications, M.-C. Amann, Technical University of Munich, Garching b. München, Germany  
Vertical-Cavity Surface-Emitting Lasers (VCSELs) for sensing and communication applications in the 1.3-2.3µm wavelength range are presented. The devices feature low thresholds (~1mA), electronically tunable (4nm) single-mode emission (SMR>30dB) and modulation bandwidths exceeding 10Gb/s.

**TuB2.2** 11.00 - 11.30  (Invited)

Optically Controllable Microlasers and 3D Light Confinement based on Cavity Solitons in Vertical-Cavity Devices, T. Ackermann, N. Radwell, University of Strathclyde, Glasgow, Scotland, UK and R. Jaeger, ULM-Photonics, Ulm, Germany  
Bistable microlasers in a broad-area vertical-cavity semiconductor laser with frequency-selective feedback are demonstrated. It is argued that mode-locking of these lasers provides a route to three-dimensional light confinement.

**TuB2.3** 11.30 - 12.00  (Invited)

Polarization Dynamics in Vertical-Cavity Surface-Emitting Lasers Subject to Optical Injection or Current Modulation, K. Panajotov, I. Gatare, Vrije University Brussels, Brussels, Belgium, M. Nizette, Universite Libre de Bruxelles, Bruxelles, Belgium, M. Sciamanna, SUPELEC, Metz, France, H. Thienpont, Vrije University Brussels, Brussels, Belgium and A. Valle, Universidad de Cantabria, Santander, Spain  
We present experimental and theoretical results on polarization nonlinear dynamics in Vertical-Cavity Surface-Emitting Lasers subject to optical injection or current modulation. We discuss polarization switching, rich nonlinear dynamics, multi-transverse modes and their bifurcation routes.

**TuB2.4** 12.00 - 12.30  (Invited)

All-Optical Flip-Flop Operation in Polarization Bistable VCSELs and Its Application for Photonic Buffer Memory, H. Kawaguchi, Nara Institute of Science and Technology, Ikoma, Nara, Japan  
All-optical flip-flop operation was demonstrated in 1.55 µm VCSELs with square mesa-structure. We achieved 1 Gbps memory operation and shift register function, which show a technical feasibility of multi-bit buffer memory.
14.00 - 15.30

**Session TuB3:** PHOTOIC CRYSTALS & RANDOM MATERIALS

**Session Chair:** Michael Scalora, US Army, Redstone Arsenal, AL, USA

TuB3.1  14.00 - 14.30  (Invited)
**Second Harmonic Generation in Nonlinear Disordered Media,** W. Z. Krolikowski, Australian National University, Canberra, ACT, Australia
We study second-harmonic generation in strontium barium niobate crystal with disordered structures of ferroelectric domains. We show that this effect can be used to realize simple autocorrelator for ultra-short optical pulse characterization.

TuB3.2  14.30 - 15.00  (Invited)
**Nonlinear Control of Light in Periodic Photonic Structures: From Waveguides to Cavities,** D. N. Neshev, Australian National University, Canberra, ACT, Australia, N. Marsal, D. Wolfersberger, M. Sciamanna, G. Montemezzani, SUPELEC, Metz, France, A. A. Sukhorukov, W. Z. Krolikowski and Y. S. Kivshar, Australian National University, Canberra, ACT, Australia
We review the fundamentals of light control in nonlinear periodic photonic lattices. In particular, we demonstrate their ability to control the modulational instability and pattern formation in a nonlinear dissipative feedback system.

TuB3.3  15.00 - 15.30  (Invited)
**Control of Spatial Instabilities with Intracavity Photonic Crystals,** D. Gomila, University of the Balearic Islands, Palma De Mallorca, Spain, M. Moreno and R. Zambrini, University of the Balearic Islands, Palma de Mallorca, Spain
We propose using intracavity photonic crystals to control the spatial instabilities of broad area devices and engineering the transverse profile and quantum fluctuations of the emitted light.

15.30 – 16.00  

**COFFEE BREAK**

16.00 - 18.00

**Session TuB4:** SLOW LIGHT & QWs/QD

**Session Chair:** Hitoshi Kawaguchi, Nara Institute of Science and Technology, Ikoma, Nara, Japan

TuB4.1  16.00 - 16.30  (Invited)
**Four Wave Mixing and Wavelength Conversion in Slow Light Regime,** A. Melloni, Politecnico di Milano, Milano, Italy, M. Torregiani, Politecnico di Milano - CoreCom, Milano, Italy, A. Canciamilla, Politecnico di Milano, Milano, Italy and F. Morichetti, CORECOM, Milano, Italy
In ideal conditions the Four Wave Mixing conversion efficiency is enhanced by the slowing factor to the fourth power. We have investigated FWM in Coupled Resonator Optical Waveguides both numerically and experimentally, also in presence of attenuation and chromatic dispersion.

TuB4.2  16.30 - 17.00  (Invited)
**Exploring Carrier Dynamics in Semiconductors for Slow Light,** J. Moerk, W. Xue, Y. Chen, F. Ohman, P. Nielsen, H. Nielsen and T. R. Nielsen, Technical University of Denmark, Kgs. Lyngby, Denmark
We give an overview of recent results on slow and fast light in active semiconductor waveguides. The cases of coherent population oscillations as well as electromagnetically induced transparency are covered, emphasizing the physics and fundamental limitations.

TuB4.3  17.00 - 17.30  (Invited)
**Nonlinear Dynamics of Quantum Dot Lasers,** K. Luedge, C. Otto, E. Malic and E. Schoell, Technical University Berlin, Berlin, Germany
Nonlinear Auger scattering rates between wetting layer and quantum dot carriers are crucial in modeling the dynamic response of quantum-dot lasers. We show that the response is characterized by decoupled electron- and hole dynamics in the dots.

TuB4.4  17.30 - 18.00  (Invited)
**All-Optical Switch based on Intersubband Transition in Quantum Wells,** R. Akimoto, G. Cong, M. Nagase, T. Mozume, C. G. Lim, S.-I. Gozu, K. Akita, T. Hasama and H. Ishikawa, National Institute of Advanced Industrial Science and Technology, Tsukuba, Ibaraki, Japan
Ultrafast cross-phase modulation in InGaAs/AlAsSb coupled double quantum wells, where interband dispersion is modulated by intersubband excitation, is applied to a MZI switch demonstrating error-free all-optical demultiplexing of 160-Gb/s OTDM signal to 40-Gb/s.
Wednesday, 14 January 2009

<table>
<thead>
<tr>
<th>Time</th>
<th>Session WB1: Ultra-Fast Optical Pulse Dynamics</th>
<th>Session Chair: Krassimir Panajotov, Vrije University Brussels, Brussels, Belgium</th>
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<tbody>
<tr>
<td>08.30 - 09.00</td>
<td>Ultrahigh Speed Nanophotonics, D. Bimberg, G. Fiol, M. Kuntz, S. Liebich, C. Meuer, H. Schmeckebier, Technical University Berlin, Berlin, Germany and A. R. Kovsh, Innolume GmbH, Dortmund, Germany</td>
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<td>Quantum dot monolithic mode locked lasers at 40 GHz show ps pulse generation at room and elevated temperatures with minimum jitter of 190 fs. Semiconductor optical amplifiers show cross gain modulation up to 40 GHz.</td>
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<tr>
<th>Time</th>
<th>Session WB2: Regular &amp; Random Structures</th>
<th>Session Chair: Marian Marciniak, National Institute of Telecommunications, Warsaw, Poland</th>
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<tr>
<td>10.30 - 11.00</td>
<td>Light Shaping in Periodic Photonic Structures, Y. S. Kivshar, Australian National University, Canberra, ACT, Australia</td>
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<td>We review our recent theoretical and experimental results on the tunable control of light beams and generation of polychromatic spatial solitons and optical surface states in nonlinear periodic photonic lattices.</td>
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<td>11.00 - 11.30</td>
<td>Nonlinear Wave Dynamics in 2D Periodically Poled Waveguides, K. Gallo, Royal Institute of Technology, Stockholm, Sweden</td>
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<td>An overview of recent results on spatial solitons in purely nonlinear 2D lattices is presented. Theory and experiments highlight new possibilities for multicolour soliton excitation and control via planar nonlinear structures in periodically poled materials.</td>
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<td>We investigate the dynamics of spatio-temporal nonlinear localization in arrays of evanescently coupled silica fiber arrays. In contrast to continuous systems the formation of stable light bullets becomes possible.</td>
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<td>12.00 - 12.30</td>
<td>Second Harmonic Generation from Multilayer Structures, M. C. Larciprete, University of Rome “La Sapienza”, Rome, Italy, F. A. Bovino, Elisagdatamat, Genova, Italy, M. Centini, A. Belardini, C. Sibilia, M. Bertolotti, University of Rome “La Sapienza”, Rome, Italy, A. Passaseo and V. Tasco, University of Lecce, Lecce, Italy</td>
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<td>We present experimental results on second harmonic generation from multilayer structures obtained in the collinear and noncollinear configuration. The two class of investigated, i.e. metalloidielectric and III-V nitrides, materials, are centrosymmetric and non centrosymmetric, respectively.</td>
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12.30 – 14.00 LUNCH BREAK - Restaurant Guggeryllis
14.00 - 15.30
Session WB3: MODE SWITCHING DYNAMICS
Session Chair: Dieter Bimberg, Technical University Berlin, Berlin, Germany

WB3.1 14.00 - 14.30 (Invited)
Mode Locked Laser Diodes in Integrated Optoelectronics: Some Anticipated Challenges and Possible Solutions, E. A. Avrutin, X. Song, and B. Russell, University of York, York, UK
The effect of electrical (finite absorber response time) and optical (distant reflector) external effects on the performance of monolithic mode-locked lasers in a monolithically integrated environment is discussed and illustrated using numerical modeling. The relation of the findings to the recent experimental results is discussed, and some methods of reducing the feedback effects are assessed.

WB3.2 14.30 - 15.00 (Invited)
Squeezed Light Generation via Spatial Symmetry Breaking, G. J. de Valcarcel, Universitat de València, Burjassot, Spain
The spontaneous spatial symmetry breaking occurring in the transverse section of the light beam emitted by a degenerate optical parametric oscillator is shown to give rise to perfectly squeezed light. Such phenomenon occurs at any operating conditions, unlike conventional squeezing.

WB3.3 15.00 - 15.30 (Invited)
Nonlinear Mode Coupling of Ultra-Short Pulses in Optical Fibers, P. Horak and F. Poletti, University of Southampton, Southampton, UK
A generalized nonlinear Schroedinger equation to model pulse propagation in multimode optical fibers is presented. Fiber symmetries are invoked to significantly reduce computation times. Finally, implications for multimode supercontinuum generation are discussed.

15.30 – 16.00
COFFEE BREAK

16.00 - 18.00
Session WB4: SOLITONS
Session Chair: Katia Gallo, Royal Institute of Technology, Stockholm, Sweden

WB4.1 16.00 - 16.30 (Invited)
Recent Advances in Dissipative Optical Solitons, N. N. Rosanov, Vavilov State Optical Institute, St. Petersburg, Russia
Presented are dissipative optical solitons’ features in the following schemes: coherent excitation of a thin semiconductor layer or a molecular chain, including nanosized solitons; non-driven wide-aperture laser cavity schemes; laser amplifier schemes, including few-cycle solitons.

WB4.2 16.30 - 17.00 (Invited)
Spatial and Discrete Solitons, C. Denz, Wesphalia Wilhems-University at Munster, Münster, Germany
ABSTRACT NOT AVAILABLE

WB4.3 17.00 - 17.30 (Invited)
Spatial Filtering of Light Beams in Chirped Photonic Crystals, K. Staliunas, Universidad Politecnica de Cataluña, Barcelona, Spain
We propose a new method for spatial filtering of light beams by propagating them through 2D (also 3D) longitudinally chirped photonic crystals, and prove the proposed idea by numerical simulations of wave propagation equations.

WB4.4 17.30 - 17.45
Monolithic Cavity Soliton Laser, S. Barbay, T. Elsass, K. Meunier, G. Beaudouin, I. Sagnes and R. Kuszelewicz, Laboratoire de Photonique et de Nanostructures, Marcoussis, France
We propose an original design of a monolithic and integrated vertical cavity laser with saturable absorber and discuss experimental results showing the formation and fast writing/erasure of bistable laser spots.

WB4.5 17.45 - 18.00
Analysis of Polarization States of Broad-Area Vertical-Cavity Surface-Emitting Lasers Below and Above Threshold, M. Schulz-Ruhtenberg, Universität Münster, Muenster, Germany, I. V. Babushkin, Max Born Institute, Berlin, Germany, N. A. Loiko, Academy of Sciences of Belarus, Minsk, Belarus, K. F. Huang, National Chiao Tung University, Hsinchu, Taiwan, R.O.C. and T. Ackemann, University of Strathclyde, Glasgow, Scotland, UK
The polarization direction of broad-area vertical-cavity surface-emitting lasers is found to be parallel to the wavevector below threshold. The characteristics of the transition through threshold are studied.

END OF PROGRAM
Final Program
Nonlinear Processing in Optical Fibers

Monday, 12 January 2009

ALL SESSIONS TO BE HELD IN INNSBRUCK

08.30 - 10.00
Session MC1: JOINT PLENARY SESSION
Session Chair: Göery N. Genty, Tampere University of Technology, Tampere, Finland

MC1.1 08.30 - 09.15 (Plenary)
10 Years of Nonlinear Optics in Photonic Crystal Fiber: Progress and Perspectives, J. M. Dudley, University of Franche-Comte, Besancon, France
2009 marks ten years since the first report of supercontinuum generation in photonic crystal fiber. These results have had wide-reaching impact, and continue to stimulate new research directions in nonlinear dynamics and nonlinear optics.

MC1.2 09.15 - 10.00 (Plenary)
Octave Spanning High Quality Super Continuum Generation using Ultrashort Pulse Fiber Laser –Highly Functional Optical Control using Ultrafast Nonlinear Effects in Optical Fibers–, N. Nishizawa, Osaka University, Suita, Osaka, Japan
Ultrafast nonlinear phenomena in optical fibers have a lot of applications and exciting possibilities. In this talk, the achievements and recent results, such as high quality super continuum generation, pulse trapping, etc, are presented.

10.00 – 10.30     COFFEE BREAK

10.30 - 12.15
Session MC2: PARAMETRIC AMPLIFICATION I
Session Chair: Armand Vedadi, Swansea University, Swansea, UK

MC2.1 10.30 - 11.00 (Invited)
Tunable Optical Delays, N. Alic, University of California - San Diego, La Jolla, CA, USA
Recent record breaking all-optical delay experiments based on fiber parametric wavelength conversion and dispersion are presented and analyzed. Impairment mechanisms and ultimate limits of the delay-generating concept are outlined.

MC2.2 11.00 - 11.30 (Invited)
High Resolution Optical Waveform Sampling, P. A. Andrekson, Chalmers University of Technology, Goteborg, Sweden
Techniques to analyze optical waveforms with high resolution are discussed. Emphasis is on all-optical sampling based on fiber-optic parametric amplifiers that offer high resolution with excellent sensitivity.

MC2.3 11.30 - 11.45
Demonstration of Parametric Amplification at 1µm by use of a Microstructured Optical Fiber, T. Sylvestre, University of Franche-Comte, Besancon, France, A. Mussot, University of Sciences and Technologies of Lille 1, Villeneuve d'Ascq, France and H. Maillotte, University of Franche-Comte, Besancon, France
Highly efficient parametric amplification and wavelength conversion have been demonstrated in the 1040-1090nm band by use of a microstructured optical fiber and Q-switched picosecond pulses.

MC2.4 11.45 - 12.00
BER Estimation of a Long-Haul Transmission System with Phase-Sensitive Amplifiers, A. Bogris, University of Athens, Athens, Greece, T. Kamalakis, Harokopio University, Athens, Attika, Greece, D. Syvridis and T. Sphicopoulos, University of Athens, Athens, Greece
The impact of phase-sensitive amplification on the BER performance of a phase-modulated link is semi-analytically estimated revealing its effectiveness in handling nonlinear phase noise.

MC2.5 12.00 - 12.15
Parametric Multicasting of 320 Gb/s OTDM Data, C.-S. Bres, A. O. Wilberg, J. R. Windmiller, N. Alic and S. Radic, University of California - San Diego, La Jolla, CA, USA
We report, for the first time, simultaneous wavelength conversion for WDM multicasting of an optical time division multiplexed single data channel at 320 Gb/s using a 2-pump fiber optic parametric amplifier.
Polarization-Insensitive 2R-Regenerator based on Two-Pump Fiber Optical Parametric Amplifier, P. Velanas, A. Bogris and D. Syvridis, University of Athens, Athens, Greece

An all optical parametric 2R-regenerator is numerically investigated in terms of its polarization insensitivity. The proposed device is based on the use of a fiber optical parametric amplifier with two pumps at orthogonal polarization states.

12.30 – 14.00  
LUNCH BREAK - Restaurant Guggeryllis

MC3.1  14.00 - 14.30  (Invited)  
Towards a Thermodynamic Description of Supercontinuum Generation, S. Coen, University of Auckland, Auckland, New Zealand, B. Barvieu, B. Kibler and A. Picozzi, Université de Bourgogne, Dijon, France

Based on the kinetic wave theory, we describe continuous-wave supercontinuum generation as a thermalization process, i.e., an irreversible evolution of the optical field towards a state of maximum nonequilibrium entropy.

MC3.2  14.30 - 15.00  (Invited)  
CW Pump Supercontinuum Generation in Dispersion-Tailored Photonic Crystal Fibers, A. Mussot and A. Kudlinski, University of Sciences and Technologies of Lille 1, Villeneuve d'Ascq, France

Recent results concerning the control of the spectral extension of very high power supercontinuum are presented. They are obtained with powerful Ytterbium fiber lasers and dispersion tailored photonic crystal fibers.

MC3.3  15.00 - 15.15  
Route to Coherent Supercontinuum Generation in the Long Pulse Regime, G. N. Genty, Tampere University of Technology, Tampere, Finland and J. M. Dudley, University of Franche-Comte, Besancon, France

We study numerically the possibility of generating supercontinuum with improved stability characteristics through modulation of the input pulse. General guidelines for the choice of modulation parameters leading to coherent supercontinuum generation in the long pulse regime are given.

MC3.4  15.15 - 15.30  
Enhanced Supercontinuum Generation using Multi-Fibre Ultra-Long Raman Cavities, A. El-Taheer, M. Alcon-Camas, Aston University, Birmingham, UK, J. D. Ania-Castanon, Instituto de Optica, Madrid, Spain and P. Harper, Aston University, Birmingham, UK

Supercontinuum generation in a TrueWave and SM fibre based ultra-long Raman fibre laser cavity is investigated experimentally. By including SMF in the ultra-long Raman cavity, bandwidth and flatness can be dramatically improved.

15.30 – 16.00  
COFFEE BREAK

MC4.1  16.00 - 16.30  (Invited)  
Tapered Chalcogenide Fibers, B. J. Eggleton, CUDOS, University of Sydney, Sydney, NSW, Australia

ABSTRACT NOT AVAILABLE

MC4.2  16.30 - 17.00  (Invited)  
Bismuth Oxide Fiber-based Tunable Delay Schemes using Nonlinear Optical Processing Techniques, C. Shu, Chinese University of Hong Kong, Shatin, NT, Hong Kong and M. P. Fok, Princeton University, Princeton, NJ, USA

Different tunable delay schemes are demonstrated using nonlinear approaches for wavelength conversion in a 35-cm highly nonlinear bismuth-oxide fiber together with dispersion in a linearly chirped fiber grating. The compact setup offers a low-latency operation.

MC4.3  17.00 - 17.15  
All-Optical Modulation Format Conversion from NRZ-OOK to RZ-Multilevel APSK based on Fiber Nonlinearity, A. Maruta and S. Kitagawa, Osaka University, Suita, Osaka, Japan

We demonstrate an all-optical modulation format conversion from non-return-to-zero on-off-keying to return-to-zero multilevel amplitude-phase-shift-keying based on parametric amplification and cross-phase modulation in optical fibers.

MC4.4  17.15 - 17.30  

Error-free 640-Gbit/s all-optical time-division add-drop multiplexing is demonstrated using a non-linear optical loop mirror. Both the add- and drop operations are achieved simultaneously by switching.
Reduction of Nonlinear Phase Noise in DPSK Transmission Using a NALM, C. Stephan, K. Sponsel, G. Onishchukov, B. Schmauss and G. Leuchs, University of Erlangen-Nuremberg, Erlangen, Germany

Performance of a NALM as phase-preserving amplitude 2R-regenerator in a DPSK transmission system has been investigated experimentally and numerically. A 3dB improvement of eye opening or alternatively a 3dB increase of fibre-launched power are demonstrated.

Tuesday, 13 January 2009

08.30 - 10.00

Session TuC1: NONLINEAR PROCESSING I
Session Chair: Karsten Rottwitt, Technical University of Denmark, Kgs. Lyngby, Denmark

TuC1.1 08.30 - 09.00  (Invited)
Optical Signal Processing using Nonlinearity in Optical Fibers, F. Futami, Fujitsu Laboratories Ltd., Kawasaki, Kanagawa, Japan

High-speed all-optical signal processing by using nonlinearity in silica-based highly-nonlinear fibers is reviewed. Besides, our development of an optical parametrically amplified fiber switch that suppresses amplitude noise of 160-Gb/s OOK and DPSK data signals is introduced.

TuC1.2 09.00 - 09.30  (Invited)
Ultrafast All-Optical A/D Conversion using NOLMs with Multi-Period Transfer Functions, Y. Miyoshi, S. Takagi, Osaka University, Suita, Osaka, Japan, H. Nagaeda, Trimatiz Limited, Sapporo, Hokkaido, Japan, K.-I. Kitayama, Osaka University, Suita, Osaka, Japan and S. Namiki, National Institute of Advanced Industrial Science and Technology, Tsukuba, Ibaraki, Japan

We will present an ultrafast all-optical A/D conversion using multi-period transfer function of nonlinear optical loop mirrors (NOLMs) to overcome the speed bottleneck of electronic A/D converters.

TuC1.3 09.30 - 10.00  (Invited)
Nonlinear Processing in Bismuth Optical Fibers, J. H. Lee, University of Seoul, Seoul, Korea

Recent research activities on the state-of-the-art Bismuth oxide-based nonlinear optical fiber technology are reviewed from a perspective of practical implementation of all-optical nonlinear signal processing devices.

10.00 – 10.30   COFFEE BREAK

10.30 - 12.30

Session TuC2: EMERGING TOPICS
Session Chair: John D. Harvey, University of Auckland, Auckland, New Zealand

TuC2.1 10.30 - 11.00  (Invited)

The physics at the event horizon resembles the behavior of waves in moving media where the speed of the medium reaches the wave velocity. We use ultrashort pulses in microstructured optical fibers to demonstrate the formation of an artificial event horizon in optics.

TuC2.2 11.00 - 11.30  (Invited)
Nonlinear Optics in Photonics Nanowires, M. Lipson, Cornell University, Ithaca, NY, USA

Nonlinear optical processes benefit from high field intensities and long interaction lengths between light and the media within which it propagates. In bulk media, high optical intensities can be achieved by tightly focusing the light, but this leads to reduced interaction lengths.

TuC2.3 11.30 - 12.00  (Invited)
New Concepts based on Nonlinear Polarization Effects and Raman Amplification in Optical Fibers, S. Pitois, J. Fatome, A. Picozzi and G. Millot, Université de Bourgogne, Dijon, France

We report a theoretical analysis and experimental demonstration of a polarization attraction process at telecommunication wavelengths in isotropic optical fibers. The combined effects of polarization attraction and Raman amplification are also presented.

TuC2.4 12.00 - 12.15
Generation and Detection of Optical Rogue-wave-like Fluctuations in Fiber Raman Amplifiers, K. Hammani, Institut Carnot de Bourgogne, Dijon, France, C. Finot, Université de Bourgogne, Dijon, France, J. M. Dudley, University of Franche-Comte, Besancon, France and G. Millot, Université de Bourgogne, Dijon, France
Rogue wave-like statistics is reported in a fiber Raman amplifier. The pump-signal noise transfer leads to the development of large peak-power fluctuations following a powerlaw probability distribution. Discrimination of the rarest events is demonstrated.

TuC2.5  12.15 - 12.30  
**Convective Instabilities and Optical Rogue Waves in Fibers with CW Pumping**, A. Mussot, *University of Sciences and Technologies of Lille 1, Villeneuve d’Ascq, France*

We have evidenced both experimentally and numerically the occurrence of optical rogue waves with continuous wave pumping. We have also shown that this system exhibit convective instability revealing its extreme sensitivity to initial conditions.

12.30 – 14.00  
**LUNCH BREAK - Restaurant Guggeryllis**

| 14.00 - 15.30 | **Session TuC3:** PARAMETRIC AMPLIFICATION II  
**Session Chair:** Jose M. Boggio, *State University of Campinas, Campinas, São Paulo, Brazil* |

TuC3.1  14.00 - 14.30  (Invited)  

We review different functionalities that can be achieved by the fiber-based parametric wavelength exchange, such as all-optical demultiplexer in optical time-division multiplexing (OTDM) system and as packet-switch in optical networking.

TuC3.2  14.30 - 14.45  
**Continuous-Wave One-Pump Fiber Optical Parametric Amplifier with 230 nm Gain Bandwidth**, A. Vedadi, M. Jamshidifar and M. E. Marhic, *Swansea University, Swansea, Wales, UK*

We report operation of a continuous-wave one-pump fiber OPA with net gain between 1460 nm and 1690 nm. We used a 50 m long step-index highly-nonlinear fiber, and 5 W of pump power.

TuC3.3  14.45 - 15.00  
**RZ Pulse Source for Optical Time Division Multiplexing Based on Self-Phase Modulation and Four Wave Mixing**, A. O. Wiberg, C.-S. Bres, J. R. Windmiller, N. Alic and S. Radic, *University of California - San Diego, La Jolla, CA, USA*

We present an RF-driven two-stage 40 GHz RZ pulse source based on self-phase modulation and a fiber optic parametric amplifier, for generation of 1.1 ps pulses, and demonstrate generation of OTDM data up to 320 Gbi/s.

TuC3.4  15.00 - 15.15  
**Wide-Band Generation of Pico-second Pulse via Idler Generation in Optical Parametric Amplifier**, K. K.-Y. Wong, *University of Hong Kong, Hong Kong*, B. P. P. Kuo, *University of California - San Diego, La Jolla, CA, USA*, K. K. Y. Cheung and Y. Zhou, *University of Hong Kong, Hong Kong*

A wide-band generation of pico-second pulse using optical parametric amplifier (OPA) was demonstrated. High quality pulse was generated at 85-nm away from the pump with pulsewidth narrower than that of the pump.

15.30 – 16.00  
**COFFEE BREAK**

| 16.00 - 17.45 | **Session TuC4:** FIBERS I  
**Session Chair:** TBD |

TuC4.1  16.00 - 16.30  (Invited)  
**Nonlinear Fibers: A Fiber Maker’s Tool Box**, A. Evans, *Corning, Inc., Corning, NY, USA*

Nonlinear fibers for optical signal processing have competing requirements. The main tools of a fiber maker are profile design and composition.

TuC4.2  16.30 - 17.00  (Invited)  
**Polarization Maintaining Highly Nonlinear Fibers and their Applications**, L. Grüner-Nielsen, *OFS Fitel Denmark, Brøndby, Denmark*

Polarization maintaining highly nonlinear fibers based on elliptical core with high birefringence, precise and wide range dispersion control, and good splice performance are presented. Application results including high-speed wavelength conversion and supercontinuum generation are reported.

TuC4.3  17.00 - 17.30  (Invited)  

We review the properties and limitations of conventional and emerging nonlinear fibers. We describe advances in soft glass microstructured fibers, including fabrication, the demonstration of extreme nonlinearity and a generalisation of the underpinning nonlinear theory.
Fiber-Bragg-Grating Writing in Highly Nonlinear PM Fibers for Raman Fiber Lasers, A. Siekiera, R. Engelbrecht, E. Mueller and B. Schmauss, University of Erlangen-Nuremberg, Erlangen, Germany

We describe the fabrication of fiber-Bragg-gratings (FBG) in highly nonlinear polarization maintaining (PM) fibers with tight constraints concerning their spectral bandwidth and maximum reflectivity. The experimental setup for the inscription and writing results are presented.

**Wednesday, 14 January 2009**

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<td>08.30 - 09.45</td>
<td>FIBERS II</td>
<td>Lars Grüner-Nielsen, OFS Laboratories, Murray Hill, NJ, USA</td>
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**WC1.1** 08.30 - 09.00 (Invited)
Recent Advances in Highly Nonlinear Fiber, T. Sasaki, Sumitomo Electric Industries Ltd., Yokohama, Kanagawa, Japan

Recent advances on silica-based highly nonlinear fibers of their enhanced nonlinear coefficient and ultra uniform longitudinal chromatic dispersion uniformity are described. Practical applications utilizing these fibers such as enhanced wavelength conversion efficiency and supercontinuum generation are demonstrated.

**WC1.2** 09.00 - 09.30 (Invited)
Anomalous Dispersion in All-Silica Fibers, S. Ramachandran, OFS Laboratories, Somerset, NJ, USA

Recent demonstrations of anomalous dispersion in the visible and NIR wavelengths with conventional all-silica fibers, previously considered feasible primarily with small-$A_{	ext{eff}}$ microstructured fibers, has opened the door to a variety of linear and nonlinear applications.

**WC1.3** 09.30 - 09.45
SBS Shaping and Suppression by Arbitrary Strain Distributions Realized by a Fiber Coiling Machine, R. Engelbrecht, M. Mueller and B. Schmauss, University of Erlangen-Nuremberg, Erlangen, Germany

Experimental results of coiled fibers with a permanent arbitrary distribution of longitudinal strain along the fiber in order to shape or to suppress significantly the gain spectrum of Stimulated Brillouin Scattering (SBS) are presented.

10.00 – 10.30 COFFEE BREAK

<table>
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<tr>
<th>Time</th>
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<td>10.30 - 12.30</td>
<td>REGENERATION</td>
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**WC2.1** 10.30 - 11.00 (Invited)
All-Optical Signal Regeneration using Fiber Nonlinearity, M. Matsumoto, Osaka University, Suita, Osaka, Japan

Signal regeneration schemes using fiber nonlinearity are reviewed. Phase-preserving noise reduction of PSK signals using saturation of fiber-optic parametric amplifier is described in detail. Multi-channel reshaping by a single nonlinear medium is also discussed.

**WC2.2** 11.00 - 11.30 (Invited)
Simultaneous 2R Regeneration of WDM Signals in a Single Optical Fibre, P. Petropoulos, L. Provost, F. Parmigiani, University of Southampton, Southampton, UK, C. H. Koukoumentas, Athens Information Technology Center, Peania, Athens, Greece, C. Finot, Université de Bourgogne, Dijon, France, K. Mukasa, Furukawa Electric Co. Ltd, Ichihara, Chiba, Japan, P. Vooraeu, University of Karlsruhe, Karlsruhe, Germany, I. Tomkos, Athens Information Technology Center, Peania, Athens, Greece, S. Sygletos, W. Freude, J. Leuthold, University of Karlsruhe, Karlsruhe, Germany, A. D. Ellis, University College, Cork, Cork, Ireland and D. J. Richardson, University of Southampton, Southampton, UK

Two experimental implementations of amplitude regeneration of WDM signals based on self-phase modulation (SPM) in optical fibres are discussed. The two examples differ in their approach of mitigation of inter-channel nonlinearities.

**WC2.3** 11.30 - 12.00 (Invited)
All-Optical Regeneration of Multi-Wavelength Signals, M. Vasilyev, P. G. Patki, University of Texas at Arlington, Arlington, TX, USA and T. Lakoba, University of Vermont, Burlington, VT, USA

We discuss our experimental results on 8x10 Gb/s all-optical 2R regeneration, enabled by the innovative dispersion management scheme in Mamyshev regenerator based on off-center filtering of self-phase-modulation-broadened signal spectrum.

**WC2.4** 12.00 - 12.15
All-Optical Arbitrary Wavelength Conversion with Signal Regeneration based on Slicing of Supercontinuum Spectrum, S. Oshiba and R. Moritomo, Kyoto Institute of Technology, Kyoto, Japan
Signal regeneration was demonstrated with a wavelength conversion in a wide wavelength range (±20 nm from an input signal) using a highly nonlinear fiber (HNLF) at normal dispersion. At the optimum pumping condition, Q-factor of converted signals can be increased up to 15.

**WC2.5 12.15 - 12.30**

The adaptation and optimization of a dispersion-imbalance loop mirror for phase-preserving amplitude 2R regeneration is shown by numerical simulations. Its performance has been evaluated for DPSK transmission. A 4.5dB Q-factor improvement has been demonstrated.

**WC3.1 14.00 - 14.30** (Invited)

Parametric devices based on four-wave mixing in fibers can generate, frequency convert and delay photons. I will review the quantum optics of parametric devices and recent quantum communication experiments done with them.

**WC3.2 14.30 - 14.45**
**Fiber Optical Parametric Amplifiers with Alternating Fiber Twists**, C. Braimiotis, *Swansea University, Swansea, Wales, UK, P. Kylemark, Sweden and M. E. Marhic, Swansea University, Swansea, Wales, UK*

We show that the impact of PMD on the gain spectrum of fiber OPAs can be reduced by imposing twists along the fiber axis. Alternating twists are used in order to cancel the induced circular birefringence.

**WC3.3 14.45 - 15.00**
**Tunable 2.5W Continuous-Wave Optical Source Based on Efficient Parametric Conversion in Highly Nonlinear Fiber**, J. M. Chavez Boggio, S. Moro, J. R. Windmillier, A. J. Anderson, J. X. Zhao, N. Alic and S. Radic, *University of California - San Diego, La Jolla, CA, USA*

An S-band tunable optical source based on highly-efficient parametric conversion is investigated. Generation of a continuous-wave 2.5W source that is tunable over 1470-1520nm is demonstrated.

**WC3.4 15.00 - 15.15**
**Widely-Tunable Triply-Resonant Optical Parametric Ring Oscillator**, Y. Q. Xu, S. G. Murdoch, R. Leonhardt and J. D. Harvey, *University of Auckland, Auckland, New Zealand*

We present a widely-tunable low-threshold all-fiber optical parametric ring oscillator that is resonant for the pump wavelength and the two sidebands. For some detunings, threshold can be achieved with as little as 0.7W peak power.

**WC4.1 16.00 - 16.30** (Invited)
**Optical Pulse Compression based on Fiber Nonlinearity and Dispersion**, Y. Mimura, T. Inoue and T. Yagi, *Furukawa Electric Co. Ltd, Ichihara, Chiba, Japan*

Pulse compression technique based on fiber nonlinearity and dispersion is discussed, where we focus on comb-like profiled fiber (CPF). CPF is a practical pulse compressor owing to its systematic and flexible compression design scheme.

**WC4.2 16.30 - 17.00** (Invited)
**High Performance Optical Processing Systems Incorporating Grating Based Pulse Shaping**, D. J. Richardson, F. Parmigiani, M. Ibsen and P. Petropoulos, *University of Southampton, Southampton, UK*

We review the operating principles and performance of optical pulse processing systems which exploit the powerful combination of Kerr-nonlinearity based optical switches and tailored optical pulses (e.g. square, triangular and parabolic) produced using superstructured fiber Bragg gratings.

**WC4.3 17.00 - 17.30** (Invited)

A stabilized frequency comb provides a broadband array of highly resolved comb lines. Using a multiheterodyne technique, we measure the amplitude and phase of every comb line, allowing for massively parallel, high-resolution optical sampling.

This paper reports on the generation of a 1.6 ps FWHM flat-top pulse using the optical Fourier transform technique. The pulse is validated in a 320 Gbit/s demultiplexing experiment.

End of Program
CALL FOR PAPERS

22nd ANNUAL MEETING OF THE
IEEE LASERS & ELECTRO-OPTICS SOCIETY

2009

4-8 OCTOBER
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Registration will be held in the Foyer during the following times:
Monday, 12 January 2009 - 07.00 - 17.30
Tuesday, 13 January 2009 - 07.30 - 17.30
Wednesday, 14 January 2009 - 08.00 - 16.00

Hilton Innsbruck Floorplan