

Advance 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: TBD

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

14.00 - 15.30**Session MB2: PLENARY II****Session Chair:** Trevor M. Benson, *University of Nottingham, Nottingham, UK***MB2.1 14.00 - 14.45 (Plenary)**

Chaotic Polarization Dynamics and Chaos Synchronization in VCSELs, 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*

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.

MB2.2 14.45 - 15.00

Experimental Observation of Bloch Oscillations in the Spectral Domain, C. Bersch, G. Onishchukov and U. Peschel, *University of Erlangen-Nuremberg, Erlangen, Germany*

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.

MB2.3 15.00 - 15.15

Nonlinear Effects in Silica and Hybrid Silica-Silicon Disc Micro Resonators, 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*

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.

MB2.4 15.15 - 15.30

Design of Low-Contrast Periodic Structures in Highly Non-Linear Glass for the Ultra-Short Pulse Processing in Mid-Infrared, A. Konyukhov, *Saratov State University, Saratov, Russia*

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.

15.30 – 16.00**COFFEE BREAK****16.00 - 18.00****Session MB3: CHAOTIC OPTICAL BEHAVIOR****Session Chair:** Marc Sciamanna, *SUPELEC, Metz, France***MB3.1 16.00 - 16.30 (Invited)**

Chaos Dynamics in Semiconductor Lasers, I. Fischer, *Heriot-Watt University, Edinburgh, Scotland, UK*

ABSTRACT NOT AVAILABLE

MB3.2 16.30 - 17.00 (Invited)

Optical Sources for Chaos based Communications, D. Syrydis, *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*

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.

MB3.3 17.00 - 17.30 (Invited)

Synchronization of Chaos in Mutually Coupled Vertical-Cavity Surface-Emitting Lasers with Time Delay, A. 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*

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.

MB3.4 17.30 - 17.45

Wireless to Optical Frequency Locking and Chaos using a Resonant Tunnelling - Laser Diode Circuit, B. Romeira, J. M. L. Figueiredo, *Universidade do Algarve, Faro, Algarve, Portugal*, T. J. Slight, L. Wang, E. Wasige, and C. N. Ironside, *University of Glasgow, Glasgow, UK*

We report experimental and numerical results on frequency locking, quasi-periodic and chaotic outputs induced by wireless signals on a nonlinear photonics interface consisting of a laser diode driven by a resonant tunnelling diode.

MB3.5 17.45 - 18.00

Partial Coherence in Coupled Photonic Crystal Vertical Cavity Lasers, 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*

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

Tuesday, 13 January 2009

08.30 - 10.00

Session TuB1: PLENARY III**Session 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)

New Propagation Effects in Semiconductors in the UV Range: Inhibition of Absorption, Negative Refraction, Anomalous Momentum States, Sub-Wavelength Imaging, and Non-Plasmonic Nanometer-size Guided Waves, M. Scalora, *US Army, Redstone Arsenal, AL, USA*, M. A. Vincenti, *Politecnico di Bari, Bari, Italy*, V. Roppo, *Polytechnical University of Catalunya, Terrassa, Spain*, J. V. Foreman, *Duke University, Durham, NC, USA*, J. W. Haus, *University of Dayton, Dayton, OH, USA*, N. Akozbek and M. J. Bloemer, *US Army, Redstone Arsenal, AL, USA*

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: VCSELS**Session 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 1.3-2.3 μm wavelength range are presented. The devices feature low thresholds ($\sim 1\text{mA}$), electronically tunable (4nm) single-mode emission (SMSR $>30\text{dB}$) 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. Ackemann, 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.

12.30 – 14.00

LUNCH BREAK - Restaurant Guggeryllis

14.00 - 15.30

Session TuB3: PHOTONIC 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**08.30 - 10.00****Session WB1: ULTRA-FAST OPTICAL PULSE DYNAMICS****Session Chair:** Krassimir Panajotov, *Vrije University Brussels, Brussels, Belgium***WB1.1 08.30 - 09.00 (Invited)****Ultrahigh Speed Nanophotonics**, D. Bimberg, G. Fiol, M. Kuntz, S. Liebich, C. Meuer, H. Schmeckeber, *Technical University Berlin, Berlin, Germany* and A. R. Kovsh, *Innolume GmbH, Dortmund, Germany*

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.

WB1.2 09.00 - 09.30 (Invited)**Dynamics in Isolator-Free Injection-Locked Lasers**, W. W. Chow, *Sandia National Laboratories, Albuquerque, NM, USA*

Dynamical behavior in injection-locked lasers without optical isolation between master and slave lasers is investigated. A uniquely new laser theory, that treats the two lasers on equal footing, predicts considerable modification to modulation response.

WB1.3 09.30 - 10.00 (Invited)**High-Speed Signal Processing using Silicon Nanophotonics**, A. L. Gaeta, *Cornell University, Ithaca, NY, USA*

We demonstrate various all-optical processing functions via broadband ultralow-power four-wave mixing on a Silicon-chip.

10.00 – 10.30**COFFEE BREAK****10.30 - 12.30****Session WB2: REGULAR & RANDOM STRUCTURES****Session Chair:** Marian Marciniak, *National Institute of Telecommunications, Warsaw, Poland***WB2.1 10.30 - 11.00 (Invited)****Light Shaping in Periodic Photonic Structures**, Y. S. Kivshar, *Australian National University, Canberra, ACT, Australia*

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.

WB2.2 11.00 - 11.30 (Invited)**Nonlinear Wave Dynamics in 2D Periodically Poled Waveguides**, K. Gallo, *Royal Institute of Technology, Stockholm, Sweden*

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.

WB2.3 11.30 - 12.00 (Invited)**Spatio-Temporal Light Propagation in Complex Two-Dimensional Waveguide Lattices**, T. Pertsch, F. Eilenberger, S. Minardi, S. Nolte, F. Lederer, A. Tunnermann, *Friedrich-Schiller University- Jena, Jena, Germany*, U. Ropke, J. Kobelke, K. Schuster, H. Bartelt, *Institute of Photonic Technology, Jena, Germany*, Y. V. Kartashov and L. Torner, *Institut de Ciències Fotoniques, Barcelona, Spain*

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.

WB2.4 12.00 - 12.30 (Invited)**Second Harmonic Generation from Multilayer Structures**, M. C. Larciprete, *University of Rome "La Sapienza", Rome, Italy*, F. A. Bovino, *Elsagdatamat, 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*

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. metallo/dielectric and III-V nitrides, materials, are centrosymmetric and non centrosymmetric, respectively.

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