

Advance Program

Joint Plenary Session

Monday, 14 January 2008

NETTUNO 4

08.30 - 10.00

Session PLE: JOINT PLENARY SESSION

Session Chair: TBD

PLE1 08.30 - 09.15

Photonic Crystal Fibers: A New Era in the Control of Light, P. St. J. Russell, *University of Erlangen-Nuremberg, Erlangen, Germany*



BIO: Philip Russell is Director of the Max-Planck Research Group for Optics, Information and Photonics and Professor of Physics at the University of Erlangen-Nuremberg, Germany. From 1996 to 2005 he was professor in the Department of Physics at the University of Bath, where he founded and led the Photonics & Photonic Materials Group. He obtained his M.A. (1976) and D.Phil. (1979) degrees at the University of Oxford and subsequently worked in research laboratories and universities in France, Germany and the USA. Since 1980 he has worked on the behaviour of light in periodically structured materials as well as on nonlinear optics, waveguides and optical fibres. He was the founder of the start-up company BlazePhotonics Ltd (April 2001 to August 2004), whose aim was the development and commercial exploitation of photonic crystal fibre. He has over 600 publications and is inventor on 37 patents covering in many aspects of photonics. He is a Fellow of the Royal Society, the Optical Society of America and the Institute of Physics (London) and has won several awards for his research.

ABSTRACT: Through their unique properties – often offering orders of magnitude improvement over previous technologies – photonic crystal fibres are giving rise to numerous new applications spanning many areas of science.

PLE2 09.15 - 10.00

Dispersion Control via Light Confinement for Efficient Nonlinear Optical Devices, A. L. Gaeta, *Cornell University, Ithaca, NY, USA*

ABSTRACT: The high effective nonlinearity and dispersion engineering associated with photonic nanowires made from glasses and semiconductors can be used for a wide variety of nonlinear optical applications ranging from ultralow power devices to the generation of single-cycle optical pulses.

10.00 – 10.30

COFFEE BREAK

Advance Program

Fiber Optical Parametric Amplifiers and Related Devices

Monday, 14 January 2008

ALL SESSIONS WILL BE HELD IN NETTUNO 2

10.30 - 12.00

Session MB1: PHASE-SENSITIVE FIBER AMPLIFIERS

Session Chair: Michel E. Marhic, *Swansea University, Swansea, Wales, UK*

MB1.1 10.30 - 11.00 (Invited)

Phase-Sensitive Amplification in Optical Fiber, M. Vasilyev, *University of Texas at Arlington, Arlington, TX, USA*

We describe the advantages of phase-sensitive parametric amplifiers based on frequency-nondegenerate four-wave mixing in optical fiber and discuss the recent progress in this field.

MB1.2 11.00 - 11.15

Near-Noiseless Amplification for Analog Optical Signals, O.-K. Lim, V. S. Grigoryan, *Northwestern University, Evanston, IL, USA*, M. Shin, *Samsung Corporation, Seoul, Korea* and P. Kumar, *Northwestern University, Evanston, IL, USA*

We demonstrate an ultra-low-noise fiber-optic phase-sensitive amplification scheme that is capable of providing more than 10 dB of gain on a 40 MHz analog signal.

MB1.3 11.15 - 11.45 (Invited)

BPSK Phase and Amplitude Regeneration Using a Traveling-Wave Phase-Sensitive Amplifier, K. Croussore and G. Li, *University of Central Florida, Orlando, FL, USA*

Phase and amplitude regeneration is demonstrated for NRZ-BPSK signals degraded by both phase and amplitude distortions using a symmetric-pump phase-sensitive amplifier, implemented in 5.64 meters of bismuth-oxide highly nonlinear fiber.

MB1.4 11.45 - 12.00

Transformation of Nonlinear Phase Noise Statistics in a Phase-Sensitive Amplifier, A. Bogris, T. Kamalakis, D. Syvridis and T. Sphicopoulos, *University of Athens, Athens, Greece*

The nonlinear phase noise statistics of a phase modulated signal coming through a phase-sensitive amplifier are semi-analytically analyzed.

12.00 – 14.00

LUNCH BREAK

14.00 - 15.30

Session MB2: PERFORMANCE

Session Chair: Jacob Lasri, *EIOp Ltd., Rehovot, Israel*

MB2.1 14.00 - 14.30 (Invited)

Impact of Pump Quality on the Performances of Fibre Optical Parametric Amplifiers, T. Sylvestre, *University of Franche-Comte, Besancon, France*, A. Mussot, *University of Sciences and Technologies of Lille 1, Villeneuve d'Ascq, France*, E. Lantz and H. Maillotte, *University of Franche-Comte, Besancon cedex, France*

The principle of operation of fibre optical parametric amplifiers is revisited with a special attention to the pump wave characteristics ranging from the monochromatic coherent case to the incoherent one.

MB2.2 14.30 - 15.00 (Invited)

Reduction of Nonlinear Crosstalk in Fiber OPAs, K. K.-Y. Wong, B. P. P. Kuo, *University of Hong Kong, Hong Kong*, G.-W. Lu, *National Institute of Information and Communications Technology, Tokyo, Japan*, P. C. Chui, *University of Hong Kong, Hong Kong* and L.-K. Chen, *Chinese University of Hong Kong, Shatin, NT, Hong Kong*

We review different techniques to suppress nonlinear crosstalks due to four-wave mixing (FWM) and cross-gain modulation (XGM) experienced after fiber OPA in WDM system. These techniques should help design high-performance OPAs for use in WDM communication systems.

MB2.3 15.00 - 15.30 (Invited)

High-Speed Polarization Independent Demultiplexing Using Birefringent Nonlinear Fiber, A. Lenihan, *University of Maryland Baltimore County, Baltimore, MD, USA*, R. Salem, *University of Maryland, Silver Spring, MD, USA*, W. Astar, *University of Maryland Baltimore County, Baltimore, MD, USA*, T. E. Murphy, *University of Maryland, College Park, MD, USA* and G. Carter, *University of Maryland Baltimore County, Baltimore, MD, USA*

We describe a technique for achieving polarization-independent nonlinear interactions in a short nonlinear fiber, through the residual birefringence of the fiber. We apply this method to all-optical demultiplexing of high data rate signals.

15.30 – 16.00**COFFEE BREAK****16.00 - 17.30****Session MB3: APPLICATIONS I**

Session Chair: Kenneth K. Wong, *University of Hong Kong, Hong Kong*

MB3.1 16.00 - 16.30 (Invited)

High-Resolution All-Optical Waveform Sampling Using Fiber Optic Parametric Amplifiers, P. A. Andrekson, M. Westlund, and H. Sunnerud, *Chalmers University of Technology, Göteborg, Sweden*

Techniques to analyze optical waveforms with high resolution are discussed. Emphasis is on all-optical sampling using FOPAs that offer high resolution with excellent sensitivity.

MB3.2 16.30 - 17.00 (Invited)

Two-Pump Fiber OPAs with Flat Gain Over 100 nm Bandwidth, J. M. C. Boggio, J. D. Marconi and H. L. Fragnito, *State University of Campinas, Campinas, SP, Brazil*

We review recent experimental and numerical results demonstrating two-pump fiber OPAs with flat gain over 100 nm bandwidth.

MB3.3 17.00 - 17.15

Receiver Sensitivity Improvement for ON-OFF Keying Format by using Optical Parametric Amplifier and Balanced Detection, B. P. P. Kuo, *University of Hong Kong, Hong Kong*, K. Shimizu, *Mitsubishi Electric Corporation, Kamakura, Kanagawa, Japan*, P. C. Chui and K. K.-Y. Wong, *University of Hong Kong, Hong Kong*

We demonstrated a novel technique to improve receiver sensitivity for ON-OFF Keying format by adopting balanced detection with optical parametric amplifier as pre-amplifier. Receiver sensitivity was improved by 1.9dB as compare to single-ended detection scheme.

MB3.4 17.15 - 17.30

1-to-40 Channel Multicasting in Wideband Parametric Amplifier, C.-S. Bres, *University of California - San Diego, La Jolla, CA, USA*, J. M. Chavez Boggio, *State University of Campinas, Campinas, SP, Brazil*, N. Alic and S. Radic, *University of California - San Diego, La Jolla, CA, USA*

All optical multicasting using one-pump modulated parametric optical amplifier is reported. For a 10Gb/s NRZ system, 1:40 multicasting is demonstrated with less than 0.5dB power penalty and minimum 12.5dB conversion efficiency.

18.30 – 20.00**WELCOME RECEPTION****Tuesday, 15 January 2008****SESSION IN NETTUNO 4****09.00 - 10.00****Session TuD1: JOINT SESSION WITH PCF AND FOPA**

Session Chair: Kunimasa Saitoh, *Hokkaido University, Sapporo, Japan*

TuD1.1 09.00 - 09.30 (Invited)

Parametric Amplification in Photonic Crystal Fibres, J. D. Harvey, S. Murdoch, J. Chen, R. Leonhardt and G. K. L. Wong, *University of Auckland, Auckland, New Zealand*

Photonic crystal fibres have reinvigorated the study of parametric amplification in optical fibres through their special properties. Experimental results are presented for a range scalar and vector four wave mixing processes in photonic crystal fibres.

TuD1.2 09.30 - 10.00 (Invited)

Parametric Generation of Entangled Photon Pairs in Fibers, J. G. Rarity, *University of Bristol, Bristol, UK*

Four-wave mixing in micro-structured fibres can be a versatile source of time correlated and entangled photon pairs. Here we review the prospect of using these sources to develop all optical quantum logic functions.

10.00 – 10.30**COFFEE BREAK****10.30 - 12.00**

Session TuB1: THEORY

Session Chair: Michael Vasilyev, *University of Texas at Arlington, Arlington, TX, USA*

TuB1.1 10.30 - 11.00 (Invited)

Quantum Noise in Pure Third-Order Fiber Parametric Amplifiers, D. Chapron and P. Voss, *Georgia Tech Lorraine, Metz, France*

We discuss the potential for novel quantum devices in third-order parametric amplifiers, which utilize the inverse of the pure third harmonic process. We review the potential for novel quantum and classical devices, and discuss the design and construction of such a parametric amplifier in a waveguide.

TuB1.2 11.00 - 11.15

Gain Oscillations in Two-Pump Fiber Optical Parametric Amplifiers, A. Vedadi and T. Sylvestre, *University of Franche-Comte, Besancon, France*

Using the four sidebands theory, we analyse a recent experimental demonstration of a broadband and flat two-pump fiber optical parametric amplifier and predict gain oscillations near the pump wavelength due to interferences with the modulation instability.

TuB1.3 11.15 - 11.30

Impact of Fiber Loss in Pump Resonators for Fiber Optical Parametric Amplifiers, M. E. Marhic, *Swansea University, Swansea, Wales, UK*

We show that the ratio of fiber loss to fiber nonlinearity is an important parameter for the design of pump resonators for fiber OPAs. Silica-based HNLF have advantages over other nonlinear fibers for making such resonators, and can exhibit power enhancement ratios of over 100.

TuB1.4 11.30 - 11.45

Exact Solutions for Four-Wave Mixing Crosstalk in One-Pump Fiber Optical Parametric Amplifiers, M. E. Marhic, *Swansea University, Swansea, Wales, UK* and J. M. Chavez Boggio, *State University of Campinas, Campinas, SP, Brazil*

The exact solution of the two coupled differential equations governing a FWM component and its associated idler in a one-pump fiber OPA consist of a sum of exponentials. First- and second-order crosstalk terms scale like the corresponding powers of the signal power.

TuB1.5 11.45 - 12.00

Fundamental Limit of the Achievable Time Delay in Slow-Light NB-OPA, C. G. Smeda, L. Schenato and M. Santagiustina, *University of Padova, Padova, Italy*

A novel analytical expression for the induced time delay in scalar narrowband fiber-optic parametric amplifiers is here presented.

12.00 – 14.00**LUNCH BREAK****14.00 - 15.30**

Session TuB2: QUANTUM OPTICS IN FIBERS

Session Chair: Paul Voss, *Georgia Tech Lorraine, Metz, France*

TuB2.1 14.00 - 14.30 (Invited)

Characterization of Correlated Photons in Optical Fibers, X. Li, L. Yang, L. Cui and X. Ma, *Tianjin University, Tianjin, China*

The spectral properties of the photon-pairs generated in optical fiber with a pulsed pump are characterized. The results show the fiber based sources of the photon-pairs with single spatial and temporal mode are realizable.

TuB2.2 14.30 - 15.00 (Invited)

Quantum Communication Experiments Using Entangled Photons Generated in Dispersion Shifted Fiber, H. Takesue, *NTT Corporation, Atsugi, Kanagawa, Japan*

I present entanglement generation using spontaneous four-wave mixing in a cooled dispersion shifted fiber. Quantum communication experiments using fiber-based entanglement sources, including quantum key distribution and quantum interference with two independent sources, are also described.

TuB2.3 15.00 - 15.30 (Invited)

Testing Realism Using Entangled or Hyper-Entangled States Made with a Fiber-Based Two-Photon Source, J. Fan and A. Migdall, *National Institute of Standards and Technology, Gaithersburg, MD, USA*

We describe the creation and characterization of entangled or hyper-entangled quantum states using a fiber-based two-photon source. We use these entangled states to study local- and non-local realism.

15.30 – 16.00

COFFEE BREAK

16.00 - 17.30

Session TuB3: APPLICATIONS II

Session Chair: Jose M. Chavez Boggio, *State University of Campinas, Campinas, SP, Brazil*

TuB3.1 16.00 - 16.30 (Invited)

Slow and Fast Light Propagation in Narrow Band Fiber Optics Parametric Amplifiers, G. Eisenstein, *Technion, Haifa, Israel*

We describe the properties of narrow band parametrics amplifiers in the context of slow and fast light propagation.

TuB3.2 16.30 - 17.00 (Invited)

Femtosecond Fiber Optical Parametric Oscillators, J. E. Sharping and J. R. Sanborn, *University of California - Merced, Merced, CA, USA*

We report on the generation of <100-fs pulses using a microstructure-fiber-based optical parametric oscillator. We highlight our latest studies of oscillator stability, fiber dispersion optimization, and pump power depletion for these systems.

TuB3.3 17.00 - 17.30 (Invited)

Applications of Bragg Scattering in High-Speed Optical Telecommunication Systems, D. Mechin, R. Provo and J. D. Harvey, *University of Auckland, Auckland, New Zealand*

We present recent theoretical and experimental results concerning transparent ultra-fast switches, and potentially noise-free wavelength converters using schemes based on the Bragg scattering four-wave mixing process in highly nonlinear fibers.

Wednesday, 16 January 2008

10.30 - 12.00

Session WB1: NONLINEAR FIBERS AND TECHNIQUES

Session Chair: Prem Kumar, *Northwestern University, Evanston, IL, USA*

WB1.1 10.30 - 11.00 (Invited)

Evolution of Silica-Based Highly Nonlinear Fibers for FWM-Based Wavelength Conversion Application, M. Hirano, *Sumitomo Electric Industries, Yokohama, Japan*

Recent progresses on silica-based highly nonlinear fibers for practical FWM-based applications such as wavelength conversion efficiency enhancement and chromatic dispersion design are described, and then functional wavelength conversions using the fibers are demonstrated.

WB1.2 11.00 - 11.30 (Invited)

Optical Signal Processing in Highly-Nonlinear Chalcogenide Planar Waveguides, M. D. Pelusi, V. G. Ta'eed, M. R. E. Lamont, B. J. Eggleton, *CUDOS, University of Sydney, Sydney, NSW, Australia*, S. Madden, D.-Y. Choi, D. Bulla and B. Luther-Davies, *Australian National University, Canberra, ACT, Australia*

Bit-error rate performance of newly developed As₂S₃ planar waveguides in applications of high-speed all-optical time-division demultiplexing and wavelength conversion of 40-160 Gb/s optical signals through the use of four-wave mixing and cross-phase modulation is investigated.

WB1.3 11.30 - 11.45

Resonant Optical Nonlinearity of PbSe Quantum Dots Doped Optical Fiber, P. R. Watekar and W.-T. Han, *Gwangju Institute of Science and Technology, Gwangju, Korea*

The optical fiber doped with PbSe quantum dots was experimentally developed using MCVD process. A strong absorption peak was observed at 1100 nm and the resonant optical nonlinearity was measured to be $9.94 \times 10^{-16} \text{ m}^2/\text{W}$.

WB1.4 11.45 - 12.00

Ultrawide-band Pulse Generation based on Cross Phase Modulation in Fibers, P. Velanas, A. Bogris, A. Argyris and D. Syvridis,
University of Athens, Athens, Greece

An ultrawide-band impulse signal's generator based on the cross-phase modulation effect (XPM) in optical fibers performed by optical filtering is experimentally demonstrated. Electrical monocycle pulses have been obtained at the output of the photodetector (PD).

END OF PROGRAM