OAA/IPR

Optical Amplifiers and Their Applications

July 14–17, 2002

Integrated Photonics Research

July 17–19, 2002

Collocated Topical Meetings and Tabletop Exhibits

The Fairmont Hotel Vancouver
Vancouver, Canada

Technical Co-Sponsor: IEEE / Lasers and Electro-Optics Society

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About OAA

July 14–17, 2002

This topical meeting will provide an international forum for the most recent and advanced issues concerning optical amplifiers, including principles of operation, practical realization, design, photonic integration, and the optical systems and networks they enable. All aspects of optical amplifier implementation from research to manufacturing will be discussed.

Meeting Scope

Topics to be Covered

- **Fiber and Active Waveguides**
  planar waveguide amplifiers and sources, rare-earth doped fibers, Raman amplifiers, new fiber amplifiers and sources, materials and structures, design and fabrication, amplifier modeling and characterization, noise and linearity, active fiber-based integration.

- **Semiconductor Devices and Functional Circuits**
  wavelength converters, optical switches and processing elements, semiconductor photonic integrated circuits, planar elements and subsystems, sensors, semiconductor amplifiers, semiconductor pump lasers.

- **Networks and Systems**
  multi-wavelength network applications; switched optical network applications, video and analog transport, subscriber-access networks, upgrade of existing systems, terrestrial and undersea transmission, soliton transmission, system-related analysis; nonlinear effects, field demonstrations/deployment experience.

About IPR

July 17–19, 2002

The Integrated Photonics Research topical meeting will cover all aspects of research in integrated and/or guided-wave photonics. Original papers will be solicited from the international guided-wave community in the general areas listed under the scope.

Meeting Scope

Topics to be Covered

- **Active and Compound Semiconductor Devices**
  active III-V semiconductor devices, compound semiconductor modulators, integrated amplifiers, filters, switches, photonic integrated circuits and optoelectronic integrated circuits, compound semiconductor WDM components, novel III-V quantum optoelectronic devices, III-V materials and processing for photonics, novel and emerging packaging technologies.

- **Dielectric Waveguides and Waveguide Devices**
  active and passive waveguide components, modulators and switches, materials and fabrication technology for integrated photonic circuits, characterization of linear and nonlinear optical waveguide devices, micro-machines and micro-optic components, integrated planar waveguide, silicon-based photonics, photonic assembly and manufacturing issues, parallel optical interconnects.

- **Modeling, Numerical Simulation and Theory**
  optical system and network modeling. Numerical and semi-analytical methods for guided-wave optics, active, passive and non-linear component modeling, and WDM component design. Advances in computational algorithms, physics and coupled models for integrated photonic circuits.

- **Photonic Nanostructure and Microstructures**
  simulation, modeling, fabrication and characterization of photonic crystals and microstructures, microcavity, photonic wire and other high-confinement structures. Waveguides, filters, resonators,

LEDs, compact lasers and novel III-V quantum devices using photonic bandgap and band-structure behavior. Photonic microstructures, optical MEMS (MOEMS), and hybrid approaches based on microstructuring/nanostructuring.

OAA Speakers

Plenary Speaker

- Undersea fiberoptic cable systems: high-tech telecommunications tempered by a century of ocean cable experience
  Neal Bergano, *TyCom, Inc., USA.* [OMA1]

Invited Speakers

The list of invited speakers during the main program includes a session code for easy reference:

- Raman amplification in unrepeatered submarine systems pushes the limits of distance and bandwidth
  Francois Boubal, *Alcatel Submarine Networks, France* [OMA2]
- Transient effects and their control in Raman optical amplifiers
  Chien-Jen Chen, *Onetta, USA* [OWA1]
- MZ-SOA interferometers for optical signal processing: from device to systems
  Beatrice Dagens, *Alcatel/OPTO+, France* [OtuD1]
- Overview of developments in ultra-long haul transmission systems
  Noboru Edagawa, *KDD R&D Labs, Japan* [OtuA1]
- TDFA and ultra-wide band amplifiers
  Hiroji Masuda, *NTT, Japan* [OTuC1]
- Hybrid integration
  Graeme Douglas Maxwell, *Corning, Inc., U.K.* [OWC1]
- InGaAs broad area laser diodes for telecom application
  Yasuo Oeda, *Mitsui Chemicals, Japan* [OMB1]
- Advances in bi-directional transmission
  Stojan Radic, *Lucent/Bell Labs, USA* [OWB1]
- Highly nonlinear holey fibers and their applications
  David Richardson, *Univ. of Southampton, UK* [OMD1]
- OCDM techniques for improved spectral efficiency
  Hideyuki Sotobayashi, *Comm. Res. Lab., Japan* [OTuB1]
- Linear optical amplifier
  Gerlas van den Hoven, *Genoa, The Netherlands* [JW1]

- Novel fibers for Raman amplifiers
  Takeshi Yagi, *Furukawa Elec. Co, Ltd., Japan* [OMC1]

IPR Speakers

Plenary Speakers

- Optoelectronic components for advanced transport networks
  Thomas L. Koch, *Agere Systems, USA* [IWA1]
- Market prospects and opportunities for optical components
  Karen Liu, *RHK, USA* [IWA2]
- Integrated devices for wavelength agile all-optical networks
  Daniel J. Blumenthal, *Univ. of California-Santa Barbara, USA* [IWB1]

Special Symposium on Systems

- Issues in simulating amplified transmission
  Dirk Breuer, *T-Nova, Germany* [IThB2]
- Polarization dependent loss and its effect in WDM systems
  Antonio Mecozzi, *Univ. of L'Aquila, Italy* [IThB3]
- New advances in modeling optical fiber communication systems
  John Zweck, *Univ. of Maryland-Baltimore, USA* [IThB1]

Invited Speakers

The list of invited speakers during the main program includes a session code for easy reference:

- Large-scale production techniques for photonic nanostructures using excimer laser replication
  Wim Bogaerts, *Ghent Univ. /IMEC, Belgium* [IFH4]
- Low-noise, high-speed avalanche photodiodes
  Joe C. Campbell, *Univ. of Texas, USA* [IThE3]
- Active microresonators for WDM photonic integrated circuits
  P. Daniel Dapkus, *Univ. of Southern California, USA* [IFG1]
- Realizing optical frequency 3D photonic crystals through advanced VLSI techniques
  James Fleming, *Sandia Natl. Labs, USA* [IFH1]

- GaAs based lasers for telecommunications
  Alfred Forchel, *Univ. of Würzburg, Germany* [IThC2]
- Lithium niobate modulators for high speed transport: A status report
  Douglas M. Gill, *Lucent Tech., USA* [IFA1]
- High-density and low-loss arrayed waveguide gratings composed of high index difference PLCs
  Mikitaka Itoh, *NTT, Japan* [IThG1]
- Silicon microphotonics
  Lionel C. Kimerling, *MIT, USA* [IFB1]
- Full-vector finite element solution of photonic crystal fibers
  Masanori Koshiba, *Hokkaido Univ., Japan* [IWD1]
- Passive polarization conversion in SiON technology: Structures and applications
  Ton Koster, *IBM, Switzerland* [IThA1]
- Optical signal regeneration for 40 Gbit/s transmission systems
  Olivier Leclerc, *Alcatel Res. & Innovation, France* [IWC1]
- III-V semiconductor photonic crystal active devices
  Yong-Hee Lee, *KAIST, S. Korea* [IFF1]
- Photon sieves and resonant transmission enhancement through sculpted sub-wavelength apertures in metallic films
  Richard A. Linke, *NEC Res. Inst., USA* [IFD1]
- Advanced processing technologies for III-V photonic integrated circuits
  John H. Marsh, *Intense Photonics, U.K* [IFC1]
- SOA-Integrated Mach-Zehnder interferometer all-optical switch by selective area MOVPE
  Yoshiaki Nakano, *Univ. Tokyo, Japan* [IWC3]
- Design and applications of AWGs and PLC
  Katsunari Okamoto, *NEL, Japan* [IFE3]
- Optical MEMS based on moving micromechanical waveguide technology and component developments
  Eric Ollier, *CEA/Grenoble, France* [IFB3]
- Single-mode vertical integration of active devices within the passive waveguides of InP-based planar WDM components
  Valery I. Tolstikhin, *MetroPhotonics, Inc., Canada* [IFC4]

- Waveguide photodetectors for high speed digital communication systems
  Timothy A Vang, *VSK Photonics, USA* [IThE2]
- Wavelength conversion using SOAs: Simulations and experiment
  Bing Wang, *Princeton Univ., USA* [IThH5]
- Very high-speed pulse sequence generation via femtosecond read-out of arrayed waveguide gratings
  Andrew M. Weiner and D.E. Leaird, *Purdue Univ., USA* [IThG4]
- Nonlinear response of resonant modes in 2D planar photonic crystal microcavities
  Jeff Young, *Univ. of British Columbia, Canada* [IThF2]

OAA Short Course

Short courses are a wonderful way to enhance your knowledge of the optical field. OAA routinely picks experts in their fields to provide you with an in-depth look at intriguing topics. The courses are designed to increase your knowledge of a specific subject while learning from experienced teachers. An added benefit of the courses is the availability of continuing education credits (CEUs).

CEUs are awarded to each participant that successfully completes the short course. The CEU is a nationally recognized unit of measure for continuing education and training programs that meet established criteria. To earn CEUs, a participant must complete the CEU credit form and course evaluation and return it to the course instructor at the end of the course. CEUs will be calculated and certificates will be mailed to participants.

- Tuition for the short course is a separate fee. Advance registration is recommended as the number of seats in the course is limited.
- Short courses sell out quickly! There will be no wait list for the short course.
- Short course materials are not available for purchase.

Register now!

>> Raman amplifiers for broadband communications

July 14, 2002; 1:00pm - 4:00pm
Chris Fludger, Nortel Networks, UK

Course Description

This course will describe and summarize the use of Raman amplification in broadband optical communications systems. The content will range from the basic physics, to non-linear signal distortion. The Raman effect has the potential of offering gain anywhere in the silica fiber transmission window. Distributed amplification has also been demonstrated to give great improvements in capacity and reach. This course will explore the performance benefits and noise impairments experienced in Raman amplified systems.

Benefits and Learning Objectives

This course should enable you to:

- Describe the physical basis of the Raman effect, and identify key results.
- Design and model multi-wavelength pumped Raman amplifiers.
- Compute the linear noise performance of Raman amplified systems and explain the contributions of pump-to-pump interactions, pump saturation, SRS cross-talk and temperature.
- Identify the noise impairments due to fast gain dynamics in co- and counter-pumped Raman amplifiers, including cross-gain modulation and pump-to-signal amplitude noise transfer and gain transients.
- Assess the impact of multi-path interference caused by double Rayleigh scattering in Raman amplified systems.
- Compare the influence non-linear distortion of the signal in systems using and not sing distributed Raman amplification.
- Cite uses of Raman amplification in optical transmission systems.

Intended Audience

This course is intended for engineers and scientists working on optically amplified transmission systems. Graduate student level knowledge of optics and optical fibers is assumed.

Instructor Background

Chris Fludger works on Raman amplification at Nortel Networks Research and Development group in Harlow, UK, and has published several papers in this area.

Publications

>> Advance Program

Authors submitting papers, past meeting participants, and current committee members will automatically receive the Advance Program. Other individuals who wish to receive a mailed copy of the Advance Program should contact OSA Customer Service.

>> Technical Digests

The OAA and the IPR Technical Digests will be comprised of the camera-ready summaries of papers being presented during the meeting. At the meeting, each registrant will receive a copy of one Technical Digest of their choice. Extra Copies can be purchased at the meeting for a special price of $60 USD.

>> TOPS Volume

OSA is pleased to announce another volume in our book series, Trends in Optics and Photonics (TOPS). For the 2002 OAA Topical Meeting, a proceedings volume will be completed featuring expanded technical digest and postdeadline papers.

TOPS offers specialists, students, and practioners a convenient and reliable source for information on the newest and most promising research and advances in many optical technologies. Each registrant will receive an OAA '02 TOPS volume upon publication as part of the full registration fee.

Exhibitor List

As of June 25, 2002

>> OAA Exhibitors

- 3M Company
- ADC
- Aegis Semiconductor, Inc.
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- Axcel Photonics, Inc.
- B&W TEK, Inc.
- CiDRA Corporation
- CISILIAS A/S
- Coadna Photonics
- CorActive High-Tech Inc.
- Fibercore Limited
- Fitel Technologies, Inc.
- Gemfire Corporation
- ITF Optical Technologies
- JDS Uniphase
- KEOPSYS, Inc.
- Laser Focus World
- Lightwave Electronics
- Molecular OptoElectronics Corp.
- Nufern
- OFS Specialty Photonics
- Oluma
- Optiwave Corporation
- Photonics Spectra
- PowerNetix
- RSoft Design Group
- StockerYale, Inc.
- TeraXion, Inc.
- Thorlabs, Inc.
- Verrillon, Inc.
- VPIsystems, Inc.

>> IPR Exhibitors

- Crosslight Software, Inc.
- Laser Focus World
- Optiwave Corporation
- Photonics Spectra
- RSoft, Inc.
- Thorlabs, Inc.

Collocated Agenda of Sessions

Sunday, July 14, 2002	
OAA	
12:00pm - 7:00pm	Registration BC Foyer
1:00pm - 4:00pm	Short Course 101 Vancouver Room

Monday, July 15, 2002	
OAA	
7:30am - 5:00pm	Registration/Speaker and Presider Check-In BC Foyer
8:15am - 8:30am	Opening Remarks Pacific Ballroom
8:30am - 9:45am	OMA: OAA Plenary Session Pacific Ballroom
9:45am - 10:15am	Coffee Break BC Ballroom
10:15am - 11:45am	OMB: Pump Lasers Pacific Ballroom
11:45am - 1:15pm	Lunch Break
1:15pm - 2:30pm	OMC: Raman Amplification Pacific Ballroom
2:30pm - 3:00pm	Coffee Break BC Ballroom
3:00pm - 4:30pm	OMD: Novel Fiber Amplifiers and Technique Pacific Ballroom
4:30pm - 6:00pm	OME: Poster Session BC Ballroom
7:00pm - 8:30pm	OAA Reception Pacific Ballroom

Tuesday, July 16, 2002	
OAA	
7:30am - 5:00pm	Registration/Speaker and Presider Check-In BC Foyer
8:30am - 10:00am	OTuA: Raman Amplified DWDM Systems Pacific Ballroom
10:00am - 10:30am	Coffee Break BC Ballroom
10:30am - 12:00pm	OTuB: High Capacity Transmission Effects Pacific Ballroom
12:00pm - 1:45pm	Lunch Break
1:45pm - 3:00pm	OTuC: Doped Amplifiers and Materials Pacific Ballroom
3:00pm - 3:30pm	Coffee Break
3:30pm - 5:00pm	OTuD: All-optical Signal Processing Pacific Ballroom
7:00pm - 10:00pm	Rump Session Pacific Ballroom

Wednesday, July 17, 2002

Wednesday, July 17, 2002

OAA	
7:30am - 5:00pm	Registration/Speaker and Presider Check-InBC Foyer
8:30am - 10:00am	OWA: Transients and Noise in Raman Amplifiers Pacific Ballroom
10:00am - 10:30am	Coffee Break BC Ballroom
10:30am - 11:45am	OWB: Amplifier Subsystems Pacific Ballroom
11:45am - 1:15pm	Lunch Break
1:15pm - 3:00pm	JW: OAA/IPR Joint Session Pacific Ballroom
3:00pm - 3:30pm	Coffee Break BC Ballroom
3:30pm - 5:00pm	OWC: Integrated Devices Pacific Ballroom
6:30pm - 8:00pm	Postdeadline Session Pacific Ballroom

IPR	
7:30am - 5:00pm	Registration/Speaker and Presider Check-In BC Foyer
8:45am - 9:00am	Opening Remarks Vancouver Room
9:00am - 10:30am	IWA: Plenary Session I Vancouver Room
10:30am - 11:00am	Coffee Break BC Ballroom
11:00am - 11:45am	IWB: Plenary Session II Vancouver Room
11:45am - 1:15pm	Lunch Break
1:15pm - 3:00pm	JW: OAA/IPR Joint Session Pacific Ballroom
3:00pm - 3:30pm	Coffee Break BC Ballroom
3:30pm - 5:00pm	IWC: Optical Switching & Regeneration Vancouver Room
3:30pm - 4:45pm	IWD: Photonic Crystals-Modeling Waddington Room
6:30pm - 8:00pm	IPR Reception The Roof

Thursday, July 18, 2002	
IPR	
7:30am - 5:00pm	Registration/Speaker and Presider Check-In BC Foyer
8:15am - 9:45am	IThA: High Index Contrast Devices Vancouver Room IThB: Systems Symposium Waddington Room
9:45am - 10:15am	Coffee Break BC Ballroom
10:15am -	IThC: Integrated Laser

Friday, July 19, 2002	
IPR	
8:00am - 5:00pm	Registration/Speaker and Presider Check-In BC Foyer
8:15am - 9:45am	IFA: Modulators Vancouver Room IFB: Silicon Microphotonics Waddington Room
9:45am - 10:15am	Coffee Break BC Ballroom
10:15am - 11:45am	IFC: Integrated Active-Passive Components

11:30am	Structures Vancouver Room
10:15am - 11:45am	IThD: Waveguide Structures and Components Waddington Room
11:45pm - 1:15pm	Lunch Break
1:15pm - 2:45pm	IThE: Integrated Detector Technology Vancouver Room
1:45pm - 2:45pm	IThF: Nonlinear Optics Waddington Room
2:45pm - 3:15pm	Coffee Break BC Ballroom
3:15pm - 5:00pm	IThG: Planar Lightwave Circuits Vancouver Room IThH: Analysis Methods and Devices Waddington Room
5:00pm - 6:30pm	IThI: IPR Poster Session BC Ballroom

	Vancouver Room IFD: Optical Propagation in Nanostructures Waddington Room
11:45pm - 1:15pm	Lunch Break
1:15pm - 2:45pm	IFE: PLC Demultiplexers Vancouver Room IFF: Active Microphotonic Devices Waddington Room
2:45pm - 3:15pm	Coffee Break BC Ballroom
3:15pm - 4:45pm	IFG: Novel Waveguide Devices Vancouver Room IFH: Microphotonic Fabrication Waddington Room
5:00 - 6:00pm	IPR Postdeadline Session Vancouver Room

OAA Abstracts

■ Sunday
■ July 14, 2002

Room: Tweedsmuir
12:00pm–7:00pm
Registration

Room: Vancouver Island
1:00pm–4:00pm
Short Course 101

■ Monday
■ July 15, 2002

Room: Tweedsmuir
7:30am–5:00pm
Registration/Speaker and Presider Check-In

Room: Pacific
8:15am-8:30am
Opening Remarks

Room: Pacific
8:30am-9:45am Presider
OMA ■ Plenary Session
John L. Zyskind, Sycamore Networks, United States, Presider

OMA1 8:30am Plenary
Undersea fiberoptic cable systems: High-tech telecommunications tempered by a century of ocean cable experience, *Neal Bergano, Tyco Telecommunications, USA.*
In today's Internet age information flows across continents as easily as it flows across the office. With so many "point and click" virtual connections, it's easy to forget that the world's communications needs are made possible by real systems, based on fiberoptic cables. , This comes as no surprise to those of us in the optics community; however, many others underestimate the importance of undersea fiberoptic cables for intercontinental telecommunications. The earth's continents are connected with a web of undersea fiberoptic cables that join the world's major population centers. Anyone who makes international phone calls, sends international faxes, or simply surfs the web at sites in other continents uses undersea fiberoptic cables.

OMA2 9:15am Invited
Raman amplification in unrepeatered submarine systems pushes the limits of distance and bandwidth, *F. Boubal, E. Brandon, L. Buet, V. Havard, P. Le Roux, L. Labrunie, L. Piriou, J.-P. Blondel, Alcatel, France.*
Raman amplification is a key technology for unrepeatered transmissions as it allows to widely increase both span length and optical bandwidth in a very simple manner. We review in this paper recent record demonstrations and installed systems where Raman amplification fulfills its role as a mean to reach very long repeaterless distances and to expand into new spectral areas.

Room: BC Ballroom
9:45m-10:15am
Coffee Break

Room: Pacific
10:15am-11:45am Presider
OMB ■ Pump Lasers
Yumi Naito-Yamada, MC Fitel, Japan, Presider

OMB1 10:15am Invited
InGaAs broad-area laser diodes for telecom application, *Yasuo Oeda, T. Fujimoto, MC-FITEL, Inc., Japan.*
High power InGaAs broad area laser diodes are required as an optical pumping source for Er+ and Yb+ doped double clad fiber lasers and amplifires. We'll report the performance and reliability of 100mm aperture laser diodes with our decoupled confinement heterostructure.

OMB2 10:45am
High power and high efficiency single mode AlGaInAs/InP 14xx laser with high temperature operation, *Angela Hohl-AbiChedid, Audra Rice, Jin Li, Xiaoyuan Chen, Randal Salvatore, Yi Qian, Corning Lasertron, USA; Rajaram Bhat, Martin Hu, Chung-En Zah, Corning Inc., USA.*
0.5W fiber-output power with a slope efficiency of 0.36W/A at 25C is demonstrated from a 2mm long ridge waveguide structure using AlGaInAs/InP material. Characteristic temperatures T0 = 99K, T1 = 348K and Tmax = 232C were measured.

OMB3 11:00am
High power 14xx pump lasers with wavelength locker for co-pumped Raman amplifiers, *A.Miki, H.Yabe, J.Shinkai, H.Go, G.Sasaki, Sumitomo Electric Industries, Ltd., Japan.*
Low noise and high power 14xx pump lasers with wavelength locker were proposed for co-pumped Raman amplification. A wavelength monitor photo-diode detects the LD back-facet optical power through a short-wavelength-pass filter. The stability of the Raman gain flatness may be remarkably improved, since the pump wavelength drift can be canceled by the feedback system for keeping the wavelength monitor current constant.

OMB4 11:15am
Advantage of inner-grating-multi-mode laser (iGM laser), *N. Tsukiji, N. Hayamizu, H. Shimizu, Y. Ohki, T. Kimura, S. Irino, J. Yoshida, T. Fukushima, S. Namiki, The Furukawa Electric Co., Ltd., Japan.*
We demonstrated the advantage of inner-grating-multi-mode (iGM) lasers for suppressing Stimulated-Brillouin-scattering (SBS) in comparison with normal single-mode DFB lasers. We found that iGM laser with over 18 longitudinal-modes successfully reduces SBS down to Rayleigh-scattering level.

OMB5 11:30am
Linewidth limitations of low noise, wavelength stabilized Raman pumps, *L.L. Wang, R. E. Tench, L. M. Yang, Z. Jiang, Agere Systems, USA.*
Abstract: Low noise, wavelength stabilized Raman pumps are critical components in Raman amplification systems. We present study on the linewidth limitations of low relative intensity noise (RIN) Raman pumps. We show that stimulated Brillouin scattering in transmission fibers imposes a lower limit on the minimum modal linewidth of these lasers. This lower limit on the modal linewidth in return will limit the lowest achievable RIN.

11:45am-1:15pm
Lunch Break

Room: Pacific
1:15pm-2:30pm Presider
OMC ■ Raman Amplification
Yan Sun, Onetta, Inc, United States, Presider

OMC1 1:15pm Invited
Novel fibers for Raman amplifiers, *Takeshi Yagi, The Furukawa Electric Co., Ltd., Japan.*
Fiber Raman amplifiers have been a key technology for high bit rate and long distance optical transmission. In this presentation, some investigations of novel fibers for Raman amplification would be mentioned.

OMC2 1:45pm
Raman gain prediction in germano-silicate single mode fibers, *Ivo Flammer, Philippe Guenot, Alcatel Cable, France; Catherine Martinelli, Alcatel R & I, France.*
The influence of effective area and germanium doping on stimulated Raman gain is experimentally investigated. Raman gain is predicted within ±5% for single mode fibers with core refractive index differences ranging from 3x10-3 to 22x10-3.

OMC3 2:00pm
Changes in Raman gain coefficient with pump wavelength in modern transmission fibres, *Kevin J Cordina, Chris R.S. Fludger, Nortel Networks, UK.*
The relationship of the magnitude of Raman gain to pump wavelength is measured for a range of modern fibre types. A simple empirical relationship is presented and the physical fibre properties are discussed.

OMC4 2:15pm
Efficiency spectrum comparison between germanium and phosphorus based Raman fiber converters, *N. Kurukitkoson, S.K. Turitsyn, Aston Univ., UK; O.N. Egorova, A.S. Kurkov, E.M.Dianov, Russian Acad. of Sciences, Russia.*
We report an efficiency spectrum comparison between a Germanium based and Phosphorus based Raman fiber converters (RFCs) pumped by an Yb-doped double-clad fiber laser. The results show that the full range coverage of emitting wavelength from 1400-1600 nm is possible by exploiting Ge-doped and P-doped RFCs.

Room: BC Ballroom
2:30pm–3:00pm
Coffee Break

Room: Pacific
3:00pm-4:30pm Presider
OMD ■ Novel Fiber Amplifiers and Techniques
Johan Nilsson, Univ. of Southampton, United Kingdom, Presider

OMD1 3:00pm Invited
Highly nonlinear holey fibers and their applications, *David Richardson, Univ. of Southampton, UK.*
Abstract not available at this time.

OMD2 3:30pm
Novel method of extremely flat supercontinuum generation using distributed optical gain in long Erbium-doped fiber amplifier, *Yasuyuki Ozeki, Kenji Taira, Yuichi Takushima, Kazuro Kikuchi, Univ. of Tokyo, Japan.*
We propose a novel method of the supercontinuum (SC) generation, in which the extremely flat SC spectrum can be obtained by the Kerr nonlinearity in a distributed optical fiber amplifier. We successfully demonstrate the SC generation over 34 nm using a 1-km-long Erbium-doped fiber.

OMD3 3:45pm
Measurement of the photon statistics of a fiber parametric amplifier, *Paul Voss, Renyong Tang, Prem Kumar, Northwestern Univ., USA.*
We report on the measurement of the noise statistics of spontaneous parametric fluorescence in a fiber optical parametric amplifier with single-mode, single-photon resolution. The results agree with quantum theoretical predictions

OMD4 4:00pm
Distributed-gain measurements and splice loss characterization in S-band TDFA by coherent optical frequency-domain reflectometry, *A. S. L. Gomes, M. T. Carvalho, M. L. Sundheimer, Cidade Univ., Brazil; M. B. Costa e Silva, J. P. von der Weid, CETUC-PUC Rio, Brazil; W. Margulis, F. Carlsson, ACREO, Sweden.*
We describe the implementation of the OFDR technique to characterize S-band TDFA amplifiers. Using this non-destructive method, we have characterized the distributed gain along the fibre length and the silica-to-ZBLAN fibre splice losses.

OMD5 4:15pm
In-situ time-gated method for fiber characterization and performance prediction of distributed Raman amplification, *D. Meshulach, O. Eyal, R. Klein, RedC Optical Networks Ltd., Israel.*
We demonstrate a novel method to identify and characterize installed fibers for distributed Raman amplification. The ratio between the Raman gain coefficient and the fiber effective area is calculated from measurements of amplified OTDR signals.

Room: BC Ballroom
4:30pm-6:00pm
OME ■ OAA Posters

OME1
Cascaded Sagnac interferometers for SOA-based demultiplexing, *Pierpaolo Boffi, Paola Parolari, Lucia Marazzi, CoreCom, Italy; Mario Martinelli, CoreCom and Politecnico di Milano, Italy.*
Cascading a SOA-based Sagnac interferometer with a second filtering stage allows significant improvement in the demultiplexing window sharpness and time compression. Experiments show eye diagrams and Q-factor measurements.

OME2

CSO and CTB evaluation in XGM-SOA based wavelength converted CTAV-SCM systems, *Jose Capmany, S.Sales, D.Pastor, B.Ortega, Univ. Politécnica de Valencia, Spain.*

We present for the first time to our knowledge closed form expressions for the evaluation of CSO and CTB distortion in XGM SOA based wavelength converted SCM frequency plans.

OME3

All-optical binary half-adder with XOR gate using cross-gain modulation in SOAs, *Young Min Jhon, Jae Hun Kim, Young Tae Byun, Seok Lee, Deok Ha Woo, Sun Ho Kim, Korea Inst. of Science and Tech., Korea.*

We propose and demonstrate an all-optical binary half-adder with XOR gate using cross-gain modulation in semiconductor optical amplifiers (SOAs) at 10 Gb/s. The half adder operates at a single wavelength without requiring additional light sources.

OME4

Low input intensity, high contrast optical AND gate based on vertical-cavity semiconductor optical amplifiers (VCSOAs), *Pengyue Wen, Michael Sanchez, Matthias Gross, Sadik Esener, Univ. California San Diego, USA.*

We have demonstrated, the first time to our knowledge, a low input intensity ($16nW/\mu m^2$) high contrast (10:1) optical AND gate based on a VCSOA. In the experiment the device also shows an optical gain of 10dB.

OME5

Experimental reduction of FWM impact in SOA operating in WDM regime, *Thierry Zami, Denis Penninckx, Olivia Rofidal, Alcatel Res. & Innovation, France.*

Four-Wave Mixing limits the input dynamic range of WDM signal in SOA. A new method is proposed to reduce this impairment.

OME6

DWDM system upgrade in the L band using a Raman pumped broadband lossless DCF module, *M. R. X. de Barros, J. B. Rosolem, M. R. Horiuchi, M. L. Rocha, A. A. Juriollo, R. Arradi, CPqD, Brazil.*

We present gain and BER characterization of a Raman pumped dispersion compensating module for L and L+ bands using a single erbium fiber laser as pump source. This module has applications in DWDM system bit rate upgrades.

OME7

40Gbps all-optical wavelength conversion using XPM in a distributed fiber Raman amplifier, *Wei Wang, Lavanya Rau, Daniel J. Blumenthal, Univ. of California-Santa Barbara, USA.*

Wavelength conversion at 40 Gbps using distributed Raman gain and Cross Phase Modulation (XPM) in a dispersion-shifted fiber is demonstrated. The distributed characteristic of fiber Raman gain exhibits several advantages including relatively low signal-to-noise degradation compared with lumped amplification and an increased extinction ratio due to decreased signal Self-Phase-Modulation (SPM) at the input. Bit-error-rates with less than 1.0dB penalty at 40Gbps RZ and electrical signal-to-noise ratio of the converted signal are measured.

OME8

Multipath Interference (MPI) Measurements using a laser with a variable linewidth, *William S. Wong, Chien-Jen Chen, Hak Kyu Lee, Gordon Wilson, Min-Chen Ho, Onetta, Inc., USA.*
By varying the linewidth of a laser, we convert otherwise coherent MPI measurements into incoherent measurements. We are able to measure MPI generated from a path delay of 3 meters accurately to +/- 1 dB.

OME9

Pump-wavelength dependence of Raman gain, *N. R. Newbury, NIST, USA.*
The scaling of the Raman gain with pump wavelength is determined by three complementary techniques: gain comparison at different pump wavelengths, gain asymmetry at a fixed pump wavelength, and theory combined with known fiber properties.

OME10

Design of small-effective-area hole-assisted fibers for discrete raman amplification, *Yu-Li Hsueh, Eric Shih-Tse Hu, Michel E. Marhic, Leonid G. Kazovsky, Stanford Univ., USA.*
The design of small-effective-area hole-assisted lightguide fibers (HALF) for discrete Raman amplification is described. Our results based on a full-vectorial algorithm show that the holes assist in reducing the effective area, while the higher germanium concentration in the core also helps enhance the Raman gain coefficient.

OME11

High power test on highly reliable optical passive components for Raman amplifiers, *M.Tsuyuki, T.Ota, K.Tanaka, T.Kimura, The Furukawa Electric Co.,LTD., Japan.*
Raman amplifiers are in practical use. Furukawa evaluated own passive components such as PBC, WDM, Isolator and TAP under high power condition: 6W / short-term, 3W / dump-heat / 2000hours, and thermo-viewer observation. We confirmed their reliability for Raman application.

OME12

Fiber Bragg grating gain flattening filters for high performance optical amplifiers, *Francois Trepanier, Michel Morin, Guillaume Robidoux, Martin Guy, TeraXion Inc., Canada.*
Low ripple fiber Bragg grating gain flattening filters with ±0.1dB error function and < 0.2 ps RMS group delay ripple amplitude allow efficient equalization of optical amplifiers in high bit rate systems.

OME13

Thulium-doped fiber amplifier using a novel 1055 nm laser diode pumping configuration, *Bruno Bourliaguet, Frédéric Émond, Anne-Claire Jacob-Poulin, Pierre-Yves Cortès, Jocelyn Lauzon, INO, Canada; Stéfan Mohrdiek, Nortel Networks, Switzerland.*
We constructed a novel Thulium-doped fiber amplifier with using a novel 1055 nm diode pumping configuration. We obtained a small signal gain larger than 20 dB in the 1455-1480 nm region and a Noise Figure of less than 6.5 dB.

OME14
High-reliability fluoride fiber modules for fiber amplifier applications, *H. Ono, K. Shikano, K. Oikawa, M. Shimizu, Y. Nishida, K. Hoshino, K. Nakagawa, K. Kobayashi, Y. Hiraki, Y. Ohishi, NTT Corp., Japan*
The accelerated lifetests are performed on our fluoride fiber modules. The twenty-year hazard rate is estimated to be 27 FIT for our fiber modules at 45 °C / 50 %RH.

Room: Pacific
7:00pm–8:30pm
OAA Reception

■ Tuesday
■ July 16, 2002

Room: Tweedsmuir
7:30am–5:00pm
Registration/Speaker and Presider Check-In

Room: Pacific
8:30am-10:00am Presider
OTuA ■ Raman Amplified DWDM Systems
Jonathan A. Nagel, AKA Technology Solutions, United States, Presider

OTuA1 8:30am Invited
Overview of developments in ultra-long haul transmission systems, *Noboru Edagawa, KDDI R&D Laboritories, Inc., Japan.*
Abstract not available at this time.

OTuA2 9:00am
40Gbit/s x 25WDM unrepeatered transmission over 362km, *Takayuki Miyakawa, Itsuro Morita, Noboru Edagawa, KDDI R&D Lab. Inc., Japan.*
40Gbit/s-based unrepeaterd WDM transmission over 362km has been demonstrated for the first time. The obtained BER was better than 1 x 10-9 for all the 25 channels despite of the highly dispersive transmission line (~8000ps/nm).

OTuA3 9:15am
Reduction of pattern dependent stimulated Raman scattering crosstalk by codirectional Raman pumping, *P.M. Krummrich, C.-J. Weiske, A. Schöpflin, B. Kessler, B. Lankl, Siemens AG, Germany.*
Pattern dependent crosstalk in a 160 x 10Gbit/s DWDM transmission system induced by stimulated Raman scattering was analyzed experimentally. Reduction of the crosstalk magnitude by the application of codirectional Raman pumping could be demonstrated.

OTuA4 9:30am
Inter-symbol interference and inter-channel crosstalk in Raman amplification with forward pumping, *Seemant Choudhary, Takeshi Hoshida, Fujitsu Network Comm., Inc., Japan.*
Mechanisms and impact of signal degradation in Raman amplifier with co-propagating pump is investigated. The eye penalty induced by two distinct mechanisms can be significant so that appropriate selection of signal and pump wavelengths are necessary.

OTuA5 9:45am
Multi-wavelength pump power balance in distributed Raman amplifier with a bandwidth of Raman shift frequency, *Hiroshi Nakamoto, Toshiki Tanaka, Kenichi Torii, Takao Naito, Toshikazu Ueki, Masuo Suyama, Fujitsu Lab. Ltd, Japan.*
As the gain was increased in a 100-nm distributed Raman amplifier with strong pump-to-pump interaction, the required pump power for the shortest wavelength was rapidly increased and that for the longest one was decreased.

Room: BC Ballroom
10:00am–10:30am
Coffee Break

Room: Pacific

10:30am-12:00pm Presider

OTuB ■ High Capacity Transmission Effects

Atul K. Srivastava, Onetta, Inc., United States, Presider

OTuB1 10:30am Invited

OCDM techniques for improved spectral efficiency, *Hideyuki Sotobayashi, Comm. Res. Lab., Japan.*
OCDM is promising technique for improving spectral efficiency. 1.6 bit/s/Hz spectral efficiency is achieved in OCDM/WDM link by QPSK optical encoding/decoding along with ultra-fast optical time-gating and optical hard thresholding in addition to polarization multiplexing.

OTuB2 11:00am

Carrier-suppressed differential phase shift keying format for ultra-high-speed channel transmission, *Yutaka Miyamoto, Akira Hirano, Shoichiro Kuwahara, Yasuhiko Tada, Koichi Murata, Hiroshi Miyazawa, NTT Corp., Japan.*
We proposed a novel carrier-suppressed return-to-zero differential phase shift keying (CS-RZ DPSK) format as dispersion-tolerant and nonlinearity - tolerant format. The four times larger dispersion tolerance and 1.2-dB higher power tolerance are experimentally confirmed, compared with CS-RZ format.

OTuB3 11:15am

Performance comparison between symmetric and asymmetric filtering for bandlimited 40 Gbit/s RZ signals, *Itsuro Morita, Takehiro Tsuritani, Noboru Edagawa, KDDI R&D Lab. Inc., Japan.*
The transmission performance for bandlimited 40 Gbit/s RZ signals were experimentally investigated. It was found that the symmetrically filtered signals were more tolerant for the dispersion, while the asymmetrically filtered signals were more tolerant for the fiber nonlinearity.

OTuB4 11:30am

Optical add/drop multiplexing ring network with fast response and band upgradable distributed Raman amplifier, *Yasuhiko Aoki, Susumu Kinoshita, Fujitsu Network Comm., Inc., USA.*
We propose distributed Raman amplifiers for optical add/drop multiplexing (OADM) ring networks. The fast transient characteristic of distributed Raman amplifier realizes no surviving channel degradation under add/drop power fluctuation condition.

OTuB5 11:45am

Impact of fast transient power excursions on the received signal performance, *Ioannis Tomkos, Robert Hesse, Manish Sharma, Corning, Inc., USA.*
A study is performed to quantify the influence of power excursions on system performance due to receiver constraints. The impact of the high-pass frequency response of the AC-coupled receiver is discussed. We found that the penalty is greater for faster and larger excursions and it is more significant during a decrease in power than an increase of the same magnitude.

12:00pm–1:45pm

Lunch Break

Room: Pacific
1:45pm-3:00pm Presider
OTuC ■ Doped Amplifiers and Materials
Tadashi Kasamatsu, NEC Corp., Japan, Presider

OTuC1 1:45pm Invited
TDFA and ultra-wide band amplifiers, *Hiroji Masuda, A. Mori, S. Aozasa, M. Shimizu, NTT, Japan.*
We introduce a 1480-1510-nm band thulium-doped fiber amplifier with a conversion efficiency of 42%, a tellurite fiber Raman amplifier (FRA) with a 160-nm bandwidth and > 10-dB gains, and a hybrid tellurite/silica FRA with a 135-nm bandwidth and > 22.8-dB gains.

OTuC2 2:15pm
Dispersion and pulse amplification characteristics of Bismuth oxide-based Erbium doped fiber amplifiers, *Kenji Taira, Kazuro Kikuchi, Univ. of Tokyo, Japan; Naoki Sugimoto, Asahi Glass Co., Ltd., Japan.*
We observe the group-velocity-dispersion (GVD) induced by population inversion of Er ions in a 12-cm-long Bismuth Oxide-based Erbium doped fiber amplifier, and discuss the pulse amplification characteristics determined from the intrinsic GVD.

OTuC3 2:30pm
Extremely low nonlinear Er, La co-doped fiber suitable for L-band amplifier, *Keiichi Aiso, Youko Moriai, Norihisa Shibayama, Toshihiro Nakamura, Takeshi Yagi, Furukawa Electric, Japan.*
We realized very high absorption coefficient EDF by optimizing the core composition and structure, and also achieved large chromatic dispersion without enhancing the nonlinear coefficient. Consequently extremely low nonlinear EDF suitable for L-band was materialized.

OTuC4 2:45pm
Room-temperature luminescence properties of chromium-doped silicate optical fibers, *V.V.Dvoyrin, V.M.Mashinsky, V.B.Neustruev, E.M.Dianov, A.N.Guryanov, A.A.Umnikov, Russian Acad. of Sciences, Russia.*
Absorption and luminescence spectra and luminescence lifetime of optical fibers with silica-based core doped with chromium are studied. For the first time, the broadband luminescence of Cr^{4+} and Cr^{3+} ions was observed at room temperature with the quantum yield up to 10%.

Room: BC Ballroom
3:00pm–3:30pm
Coffee Break

Room: Pacific
3:30pm-5:00pm Presider
OTuD ■ All-optical Signal Processing
Leo H. Spiekman, Genoa Corporation, Netherlands, Presider

OTuD1 3:30pm Invited
MZ-SOA interferometers for optical signal processing: From device to sytems, *B. Dagens, Alcatel Res. and Innovation, France.*
Semiconductor optical amplifier based interferometers for optical processing are described: different integration schemes are presented, technical solutions for high bit rate operation are addressed and several optical processing functions achieved with such devices are reviewed.

OTuD2 4:00pm
Analysis of all-optical DEMUX based on four-wave mixing in semiconductor optical amplifiers, *H. Kawaguchi, Yamagata Univ. and JST, Japan; Y. Yamayoshi, Yamagata Univ., Japan.*
We have numerically analyzed the basic characteristics of all-optical demultiplexing based on four-wave mixing in semiconductor optical amplifiers. Ultrafast all-optical time division demultiplexing with simultaneous multiple-channel output has also analyzed.

OTuD3 4:15pm
Demonstration of an all-optical 3-input xor-gate and a data encryption/decryption scheme at 10 Gb/s based on all-active Mach-Zehnder interferometers, *Mads L. Nielsen, Jakob D. Buron, Tech. Univ. of Denmark, Denmark; Beatrice Dagens, Alcatel R&I, France.*
An all-optical exclusive-OR (XOR) gate with 3 inputs operating at 10 Gb/s has been realized experimentally by cascading two all-active Mach-Zehnder interferometers. The same setup was used to successfully demonstrate data encryption and decryption.

OTuD4 4:30pm
Gain-dynamics measurements of SOAs using the two-color pump-probe technique with supercontinuum optical pulses, *Takeo Katayama, Hitoshi Kawaguchi, Yamagata Univ., Japan.*
We have measured the gain dynamics of wide gain-bandwidth SOAs using the two-color pump-probe technique. The optical pulses with different wavelengths were used, which were created from supercontinuum optical pulses by optical filtering.

OTuD5 4:45pm
A gain-transparent ultrafast-nonlinear interferometer (GT-UNI) in a 160 Gb/s optical sampling system, *C. Schubert, C. Schmidt, C. Börner, E. Dietrich, S. Ferber, R. Ludwig, H. G. Weber, Heinrich-Hertz-Inst., Germany.*
We measured 160 Gb/s eye diagrams with an optical sampling system using a semiconductor optical amplifier (SOA) based interferometric gate. Gain-transparent operation provided high input to output linearity and a large wavelength range for operation.

Room: Pacific
7:00pm–10:00pm
Rump Session

■ Wednesday
■ July 17, 2002

Room: Tweedsmuir
7:30am–5:00pm
Registration/Speaker and Presider Check-In

Room: Pacific
8:30am-10:00am Presider
OWA ■ Transients and Noise in Raman Amplifiers
Chris R.S. Fludger, Nortel Networks, United Kingdom, Presider

OWA1 8:30am Invited
Transient effects and their control in Raman optical amplifiers, *Chien-Jen Chen, Jun Ye, William S. Wong, Yen-Wen Lu, Onetta, Inc., USA.*
We observed and modeled transient effects in a Raman-optical-amplifier-based WDM system during changes in channel loading. A control scheme for successfully suppressing transients in Raman amplifiers is demonstrated.

OWA2 9:00am
Impact of double Rayleigh backscattering in discrete fiber Raman amplifiers employing highly nonlinear fiber, *T. Tsuzaki, T. Miyamoto, T. Okuno, M. Kakui, M. Hirano, M. Onishi, M. Shigematsu, Sumitomo Electric Industries, Ltd., Japan.*
The feasibility of discrete Raman amplifiers employing HNLF (HNLFAs) has been examined by evaluating the DRBS characteristics. The HNLFA with the DRBS crosstalk of less than 35dB is demonstrated employing the optimized configuration.

OWA3 9:15am
Double Rayleigh backscatter noise measurements in discrete and distributed Raman amplifiers, *Paola Parolari, Lucia Marazzi, Lorenzo Bernardini, Mario Martinelli, CoreCom, Italy.*
Multiple path interference measurements on four different discrete and distributed Raman amplifiers are presented. A novel synthetical expression of the MPI valid for both discrete and distributed Raman amplifiers is derived and simulations are also shown.

OWA4 9:30am
Transient response of double Rayleigh scattering in the optical time-domain extinction method, *Shinichirou Muro,Yasushi Sugaya, Etsuko Ishikawa Fujitsu Lab. Ltd., Japan.*
We present an experimental and numerical study of the noise transient response including double Rayleigh scattering in order to investigate the applicability of an optical time-domain extinction method for measuring the Raman amplifier noise.

OWA5 9:45am
Raman-enhanced pump-signal four-wave mixing in bidirectionally-pumped Raman amplifiers, *Jake Bromage, L.E. Nelson, OFS, USA; P.J. Winzer, C.J. McKinstrie, Lucent Tech., USA.*
We show that four-wave mixing (FWM) between pumps and signals, different from pump-pump FWM, can severely degrade the optical signal-to-noise ratio if the amplifier fiber has a zero dispersion wavelength lying midway between co-propagating pumps and signals

Room: BC Ballroom
10:00am–10:30am
Coffee Break

Room: Pacific
10:30am-11:45am Presider
OWB ■ Amplifier Subsystems
Morten Nissov, TyCom (US) Inc., United States, Presider

OWB1 10:30am (Invited)
Advances in bidirectional transmission, *S. Radic, S. Chandrasekhar, Lucent Tech., USA.*
Advances in dense bidirectional transmission are reviewed. Upper limits on spectral efficiency of interleaved bidirectional links is investigated in NRZ transmission links. Introduction of hybrid and exclusively distributed bidirectional amplification is explored for links with large span reach.

OWB2 11:00am
C-band discrete Raman amplification with simultaneous dispersion and dispersion-slope compensation for NZDF, *Yujun Qian, Carsten G. Jorgensen, Peter B. Gaarde, Bera Palsdottir, Bent Edvold, OFS Fitel Denmark, Denmark.*
We present a dispersion and dispersion-slope compensating Raman amplifier. From 1528.8nm to 1567.2nm an average net gain of 8 dB with flatness of 0.25dB can be achieved, while the optical link residual dispersion is within >± 0.1ps/nm-km.

OWB3 11:15am
Noise figure, ripple and output power advantage of Erbium doped fiber amplifier with slope adjustable filter element, *Parag V. Kelkar, S. D. Benjamin, P. G. Wigley, Corning Inc., USA.*
Noise figure, ripple and output power advantage of Erbium doped fiber amplifier incorporating a slope adjustable filter element is demonstrated for the first time over a range of input power and gain slope conditions.

OWB4 11:30am
Temperature dependence of S-band amplification utilizing EDFA, *Masato Nishihara, Yasushi Sugaya, Etsuko Ishikawa, Fujitsu Laboratories Ltd., Japan.*
We report the temperature dependence of an S-band multi-stage silica-based erbium doped fiber amplifier (EDFA). As the EDF temperature increased, the output power and noise figure improved by 5.2 dB and 3.7 dB, respectively.

11:45am–1:15pm
Lunch Break

Room: Pacific
1:15pm-3:00pm Presider
JW ■ OAA/IPR Joint Session
Robert J. Manning, Corning Research Centre, United Kingdom, Presider

JW1 1:15pm Invited
Linear optical amplifiers, *Gerlas van den Hoven, Genoa, The Netherlands.*
Amplification in metro networks sets new requirements on amplifier performance. Amplifiers that meet the cost, power and size requirements can enable metro networks in terms of performance and functionality. Device and system tests results demonstrate the metro network capability of linear optical amplifiers.

JW2 1:45pm
Hybrid integrated gain-clamped SOA module using UV-gratings on PLC platform, *I. Ogawa, T. Tanaka, T. Kitagawa, T. Hashimoto, R. Kasahara, Y. Tohmori, NTT Corp. Japan.*
We have realized a hybrid integrated gain-clamped semiconductor optical amplifier (SOA) module, in which UV-gratings written on PLC waveguides are used as external mirrors for laser oscillation. This structure makes it very easy to fabricate multi-channel gain-clamped SOA modules with good gain uniformity among channels.

JW3 2:00pm
Gain-clamped operation of a linear laser amplifier with electrically variable gain, *A.R. Davies, K.A. Williams, R.V. Penty, I.H. White, Cambridge Univ., UK; M. Glick, D. McAuley, Marconi Lab., UK; P. J. Williams, Bookham Tech., UK.*
Novel gain control of the absolute gain of a gain-clamped sampled grating laser amplifier has been demonstrated. Up to 12 dB of control of the gain level of a gain-clamped SOA has been achieved.

JW4 2:15pm
Optimization of operating conditions of semiconductor optical amplifier for single wavelength and WDM applications, *Yihong Chen, Richard Pavlik, Christopher Visone, Leda Lunardi, JDS Uniphase Corp., USA.*
We studied saturation behavior of semiconductor optical amplifier (SOA) and its impact on amplifier performance. Optimal operating conditions of SOA in both single channel and WDM applications were explored.

JW5 2:30pm
High-performance Er/Yb-doped waveguide optical amplifier, *Brian L. Lawrence, Russell Fuerst, Andrew Shapiro, Mark Cheverton, Mark C. Mendrick, Thomas P. Maney, Stephen J. DeDell, Molecular OptoElectronics Corp. (MOEC), USA.*
Single-mode optical amplification in novel rare-earth-doped multimode waveguides is demonstrated, at what we believe is the highest gain per unit length yet reported. Design and measurements of a single-pass and double-pass waveguide amplifier are presented.

JW6 2:45pm
Multi-port EDFA for banded-channel amplification, *M.P. Hehlen, M.J. Brinkman, S.R. Luthi, K. Nguyen, W.K. Bischel, Gemfire Corp., USA.*
We present a compact 8-port EDFA for banded-channel amplification. The unit comprises an 8-port 980-nm pump source and an 8-port gain block, achieving saturated output powers in excess of 15 dBm/port with excellent port-to-port uniformity.

Room: BC Ballroom
3:00pm–3:30pm
Coffee Break

Room: Pacific
3:30pm-5:00pm Presider
OWC ■ Integrated Devices
Hitoshi Kawaguchi, Yamagata Univ., Japan, Presider

OWC1 3:30pm Invited
Hybrid integration, *Graeme Douglas Maxwell, BT Exact Tech., UK.*
Hybrid integration is an attractive way to achieve advanced optical functionality by taking optimised discrete active components and integrating them with passive planar waveguides. This paper will describe the technique used to achieve such hybrid integration.

OWC2 4:00pm
DFB-lasers with amplified optical feedback for tunable high-frequency generation, *O. Brox, S. Bauer, J. Kreissl, M. Moehrle, B. Sartorius, Heinrich-Hertz-Inst., Germany.*
An optical amplifier section which is placed in an integrated feedback cavity of a DFB-laser allows the generation of high-frequency oscillations with a wide tuning range. Experimental characteristics of fabricated devices are presented.

OWC3 4:15pm
Stability and jitter of 10 GHz fiber ring laser using a Mach-Zehnder interferometer with integrated SOAs, *L. Schares, L. Occhi, G. Guekos, H. Melchior, Swiss Federal Inst. of Tech., Switzerland.*
A 10 GHz fiber ring laser using all-optical modulation of a monolithic Mach-Zehnder interferometer is used to generate 1.6 ps, 7 mW pulses with less than 320 fs timing jitter. A 0.7 degrees temperature change tolerance allows over 4 hours stable operation.

OWC4 4:30pm
Novel all-optical switching device with cascaded multimode interferometers and its 40 Gbit/s wavelength conversion, *Kohki Mukai, Haruhiko Kuwatsuka, Ken Morito, Haruhisa Soda, Fumio Futami, Shigeki Watanabe, Fujitsu Lab. Ltd., Japan.*
We propose novel all-optical switching device integrating multimode interferometers cascaded in a line. We simulate its stable and high-speed (>160G) demultiplexing, and experimentally demonstrate its 3.4-ps switching window and 40Gbit/s wavelength conversion.

OWC5 4:45pm
Noise and saturation properties of semiconductor quantum dot optical amplifiers, *Tommy W. Berg, Jesper Mørk, Technical Univ. of Denmark, Denmark.*
We present a detailed theoretical analysis of quantum dot optical amplifiers. Due to the presence of a reservoir of wetting layer states, the saturation and noise properties differ markedly from bulk or QW amplifiers and may be significantly improved

Room: Pacific
6:30pm–8:00pm
Postdeadline Session

IPR Abstracts

■ Wednesday
■ July 17, 2002

Room: Tweedsmuir
7:30am–5:00pm
Registration/Speaker and Presider Check-In

Room: Vancouver
8:45am–9:00am
Opening Remarks

Room: Vancouver
9:00am-10:30am
IWA ■ Plenary I

IWA1 9:00am Plenary
Optoelectronic components for advanced transport networks, *Thomas L. Koch, Agere Systems, USA.*
Abstract not available at this time.

IWA2 9:45am Plenary
Market prospects and opportunities for optical components, *Karen Liu, RHK Inc., USA.*
Continuing changes in the service provider and system vendor landscape will create new opportunities but demand as much business agility as technical innovation.

Room: BC Ballroom
10:30am–11:00am
Coffee Break

Room: Vancouver
11:00am-11:45am
IWB ■ Plenary II

IWB1 11:00am Plenary
Integrated devices for wavelength agile all-optical networks, *Dan Blumenthal, Univ. of California-Santa Barbara, USA.*
Wavelength-agile networks will require optical technologies that support a wide range of function, granularity, flexibility and performance. Device integration will be critical to cost, reliability and scalability for these networks. In this talk the basic definitions and requirements of wavelength-agile all-optical networks will be summarized. Integrated functions and underlying device technologies and their requirements will then be discussed. The potential impact of future integration technologies will also be addressed.

11:45am–1:15pm
Lunch Break

Room: Pacific
1:15pm-3:00pm Presider
JW ■ OAA/IPR Joint Session
Robert J. Manning, Corning Research Centre, United Kingdom, Presider

JW1 1:15pm Invited
Linear optical amplifiers, *Gerlas van den Hoven, Genoa, The Netherlands.*
Amplification in metro networks sets new requirements on amplifier performance. Amplifiers that meet the cost, power and size requirements can enable metro networks in terms of performance and functionality. Device and system tests results demonstrate the metro network capability of linear optical amplifiers.

JW2 1:45pm

Hybrid integrated gain-clamped SOA module using UV-gratings on PLC platform, *I. Ogawa, T. Tanaka, T. Kitagawa, T. Hashimoto, R. Kasahara, Y. Tohmori, NTT Corp. Japan.*

We have realized a hybrid integrated gain-clamped semiconductor optical amplifier (SOA) module, in which UV-gratings written on PLC waveguides are used as external mirrors for laser oscillation. This structure makes it very easy to fabricate multi-channel gain-clamped SOA modules with good gain uniformity among channels.

JW3 2:00pm

Gain-clamped operation of a linear laser amplifier with electrically variable gain, *A.R. Davies, K.A. Williams, R.V. Penty, I.H. White, Cambridge Univ., UK; M. Glick, D. McAuley, Marconi Lab., UK; P. J. Williams, Bookham Tech., UK.*

Novel gain control of the absolute gain of a gain-clamped sampled grating laser amplifier has been demonstrated. Up to 12 dB of control of the gain level of a gain-clamped SOA has been achieved.

JW4 2:15pm

Optimization of operating conditions of semiconductor optical amplifier for single wavelength and WDM applications, *Yihong Chen, Richard Pavlik, Christopher Visone, Leda Lunardi, JDS Uniphase Corp., USA.*

We studied saturation behavior of semiconductor optical amplifier (SOA) and its impact on amplifier performance. Optimal operating conditions of SOA in both single channel and WDM applications were explored.

JW5 2:30pm

High-performance Er/Yb-doped waveguide optical amplifier, *Brian L. Lawrence, Russell Fuerst, Andrew Shapiro, Mark Cheverton, Mark C. Mendrick, Thomas P. Maney, Stephen J. DeDell, Molecular OptoElectronics Corp. (MOEC), USA.*

Single-mode optical amplification in novel rare-earth-doped multimode waveguides is demonstrated, at what we believe is the highest gain per unit length yet reported. Design and measurements of a single-pass and double-pass waveguide amplifier are presented.

JW6 2:45pm

Multi-port EDFA for banded-channel amplification, *M.P. Hehlen, M.J. Brinkman, S.R. Luthi, K. Nguyen, W.K. Bischel, Gemfire Corp., USA.*

We present a compact 8-port EDFA for banded-channel amplification. The unit comprises an 8-port 980-nm pump source and an 8-port gain block, achieving saturated output powers in excess of 15 dBm/port with excellent port-to-port uniformity.

Room: BC Ballroom

3:00pm–3:30pm

Coffee Break

Room: Vancouver
3:30pm-5:00pm Presider
IWC ■ Optical Switching and Regeneration
Mario Dagenais, Quantum Photonics, Inc., United States, Presider

IWC1 3:30pm Invited
Optical signal regeneration for 40Gbit/s transmission systems, *P.Brindel, E.Balmefrezol, B.Lavigne, D.Rouvillain, F.Seguineau, O.Leclerc, Alcatel CIT, France.*
In this paper, we review different techniques for optical regeneration targeting either ultra long-haul transmission or/and terrestrial networking applications. Principles of operation as well as recent system experiments are described

IWC2 4:00pm
An all-optical wavelength converter in a layer-stack suitable for compact photonic integration, *R.G. Broeke, Delft Univ. of Tech., The Netherlands; J.J.M. Binsma, M. van Geemert, F. Heinrichsdorff, T. van Dongen, JDS Uniphase, The Netherlands; J.H.C. van Zantvoort, E. Tangdiongga, H. deWaardt, X.J.M. Leijtens, Y.S. Oei, M.K. Smit, Eindhoven Univ. of Tech., The Netherlands.*
We have developed a new layer stack based on the integration of active and passive devices in InGaAsP/InP using an MOVPE re-growth technique. The high quality of the new stack is shown by the performance of an all-optical wavelength converter. The converted wavelength showed a static extinction ratio of 33 dB and a —1.5 dB power penalty in 2.5 Gb/s BER measurements. No error floor was detected.

IWC3 4:15pm Invited
SOA-integrated Mach-Zehnder interferometer all-optical switch by selective area MOVPE, *Yoshiaki Nakano, Univ. of Tokyo, Japan.*
This paper reviews our attempt to integrate Mach-Zehnder interferometers and semiconductor optical amplifiers monolithically on InP substrates by the selective area metalorganic vapor phase epitaxy for fabrication of all-optical switch circuits.

IWC4 4:45pm
160 Gbit/s error-free all-optical demultiplexing using monolithically integrated band gap shifted Mach-Zehnder interferometer (GS-MZI), *T. Tekin, C. Schubert, J. Berger, M. Schlak, B. Maul, W. Brinker, R. Molt, H. Ehlers, M. Gravert, H.-P. Nolting, Heinrich-Hertz-Inst., Germany.*
Error-free all-optical demultiplexing is demonstrated with a monolithically integrated switch for 160 Gbit/s data stream. The switch comprises 'band gap shifted' semiconductor optical amplifiers, monolithically integrated within a symmetric Mach-Zehnder interferometer.

Room: Waddington
3:30pm-4:45pm Presider
IWD ■ Photonic Crystals - Modeling
Phillip Sewell, Univ. of Nottingham, United Kingdom, Presider

IWD1 3:30pm Invited
Full-vector finite element solution of photonic crystal fibers, *Masanori Koshiba, Hokkaido Univ., Japan.*
Using a full-vector finite element method, the propagation characteristics of index-guiding photonic crystal fibers are investigated. The group velocity dispersion is calculated as a function of their geometrical parameters, and the degeneracy is numerically verified.

IWD2 4:00pm
Photonic bandgap fibers with high birefringence, *Kunimasa SAITOH, Masanori Koshiba, Hokkaido Univ., Japan.*
A highly birefringent air-guiding photonic bandgap fiber is proposed. It is shown from computed results by a full-vector finite element method that the proposed photonic bandgap fiber has birefringence of the order of 10e-3.

IWD3 4:15pm
Photonic band gaps on cascade discontinuities in optical waveguides: Application to optical devices, *J. Rodríguez, S. Fernández, I. Ibañez , Univ. of Oviedo., Spain; O. Hidalgo, Univ. of Havana., Cuba; J. Liñares, J. R. Salgueiro, Univ. of Santiago de Compostela, Spain.*
A procedure for obtaining the complete scattering properties of cascade discontinuities between arbitrary integrated optical waveguides is presented. We demonstrate the possibilities of the method for analysing waveguide photonic crystals as well as optical devices.

IWD4 4:30pm
Photonic crystals, FBGs, and AWGs modelled as isomorphic fourier transform light propagators, *Michael C. Parker, Fujitsu Network Comm. Inc., UK; Stuart D. Walker, Univ. of Essex, UK.*
A unified theory of light propagation in photonic crystals, FBGs and AWGs is presented, based on an isomorphic Fourier transform approach. Weak- and strong-coupled devices are shown to be related via a modified Debye-Waller equation.

Room: The Roof
6:30pm–8:00pm
IPR Reception

■ Thursday
■ July 18, 2002

Room: Tweedsmuir
7:30am–5:00pm
Registration/Speaker and Presider Check-In

Room: Vancouver
8:15am-9:45am Presider
IThA ■ High Index Contrast Devices
Louay A. Eldada, Telephotonics, Inc., United States, Presider

IThA1 8:15am Invited
Passive polarization conversion in SiON technology : Structures and applications, *Ton Koster, Paul Lambeck, Univ. of Twente, The Netherlands; Folkert Horst, Zurich Res. Lab., Switzerland.*
Passive polarization converters realized in SiON technology will be presented. Their structure, operating principle, and various application circuits will be discussed in detail

IThA2 8:45am
Increased polarization crosstalk in planar silica waveguides with high index contrast and non-vertical side walls, *B.M.A. Rahman, N. Somasiri, M. Windmann, City Univ., UK.*
The effects of the waveguide sidewall slope angle on the polarization crosstalk in planar silica waveguides with high index contrast are calculated by using rigorous full vectorial numerical approaches.

IThA3 9:00am
Efficient polarization conversion in silicon-on-insulator waveguides, *O.A. Burke, I. Evans, H.F. Arrand, B.J. Luff, Bookham Tech., UK.*
The authors demonstrate a broadband, single-mode, passive scheme for polarization conversion in a silicon-on-insulator waveguide. Polarization conversion of greater than 97% is achieved in a 2 period device of length 6mm.

IThA4 9:15am
Silicon rich nitride thin films and waveguides, *K.N. Anderson, Peter Caroee Nielsen, Winnie Svendsen, COM, Oersteds Plads, Denmark.*
The material properties of silicon rich nitride thin films are presented. Waveguides have been processed with this material as a core layer using LPCVD. The optical loss has been measured in straight waveguides of varying thickness.

IThA5 9:30am
Cascaded multimode interference-based 1x2 light splitter for photonic integrated circuits, *Milan L. Masanovic, Erik J. Skogen, Jonathon S. Barton, Joseph Sullivan, Daniel J. Blumenthal, Larry A. Coldren, Univ. of California-Santa Barbara, USA.*
A novel cascaded multimode interference 1x2 light splitter is proposed and demonstrated in Indium Phosphide material system. For most structures of interest, the new splitter is shorter than standard MMI light splitters, with large optical bandwidth of 80nm and low inherent loss of 0.37 dB.

Room: Waddington
8:15am-9:45am Presider
IThB ■ Systems Symposium
Janet L. Jackel, Telcordia Technologies, United States, Presider

IThB1 8:15am Invited
New advances in modeling optical fiber communication systems, *J. Zweck, I.T. Lima, Jr., R. Holzloehner, Univ. of Maryland Baltimore County, USA; C.R. Menyuk, Univ. of Maryland-Baltimore County and PhotonEx Corporation, USA.*
For a single-channel chirped return-to-zero system we compute accurate eye diagrams using linearization, and for a wavelength-division multiplexed system we compute outage probabilities due to polarization effects using importance sampling.

IThB2 8:45am Invited
Issues in simulating amplified transmission, *D. Breuer, N. Hanik, T-Systems Nova GmbH Tech. Center, Germany.*
The rapid technological evolution of optical transmission systems necessitates an improved understanding of the performance and potential of new technologies and components in a system environment. It will be shown that simulations allow for improving system performance and provide a better understanding for system optimization.

IThB3 9:15am Invited
Polarization dependent loss and its effect in WDM systems, *Antonio Mecozzi, Univ. of L'Aquila, Italy and Celion Networks, USA; Mark Shtaif, Celion Networks, USA.*
We study the statistics of polarization dependent loss (PDL) in optical systems, discuss its evolution with system length and explore its effect on the performance of fiber-optic systems. The penalties to system performance are shown to be related to the reduction of optical signal to noise ratio.

Room: BC Ballroom
9:45am–10:15am
Coffee Break

Room: Vancouver
10:15am-11:30am Presider
IThC ■ Integrated Laser Structures
James J. Coleman, Univ. of Illinois, United States, Presider

IThC1 10:15am
High counter-mode suppression semiconductor ring lasers, *S.H. Cho, R. J. Ram, MIT, USA.*
Two types of single transverse mode, integrated semiconductor ring lasers are designed to achieve unidirectional operation. As prototypes, S-crossover and retro-reflected, unidirectional semiconductor fiber ring lasers have demonstrated 21.5dB and 23.5dB counter-mode suppression ratio, respectively.

IThC2 10:30am Invited
GaAs based lasers for telecommunications, *Alfred Forchel, Univ. of Wuerzburg, Germany.*
Abstract not available at this time.

IThC3 11:00am
An integrated coupled-cavity 16-wavelength digitally tunable laser, *J.H. den Besten, E.A.J.M. Bente, X.J.M. Leijtens, M.K. Smit, Eindhoven Univ. of Tech., The Netherlands.*
We report a 16-channel Phased-Array tunable laser realized by coupling two periodical 4-channel lasers with channel spacings of 100 and 400 GHz. SMSR for each laser is better than 40 dB.

IThC4 11:15am
Wide range tunable laterally coupled distributed feedback lasers, *M. Müller, GmbH, Germany;M. Fischer, M. Kamp, A. Forchel, Univ. of Würzburg, Germany. J.L Gentner, OPTO+, France.*
We have investigated widely tunable distributed feedback lasers with lateral coupling. We demonstrated devices on the GaInNAs/GaAs and the InGaAsP/InP material system with side mode suppression rations of about 30 dB.

Room: Waddington
10:15am-11:45am Presider

IThD ■ Waveguide Structures and Components

Phillip Sewell, Univ. of Nottingham, United Kingdom, Presider

IThD1 10:15am
Calculation of dispersion in AWG demultiplexers by a shifting-image method, *M.E. Marhic, Stanford Univ., USA; X. Yi, Intel Corp., USA.*
We introduce a novel method for calculating dispersion in AWG demultiplexers, based on the shift of the image of the input field across the output waveguide. A complex field leads to dispersion. An input waveguide with parabolic taper is treated in detail.

IThD2 10:30am
Design issues for ultracompact multimode interference-based 3dB power splitters, *C. Themistos, M. Rajarajan, S.S.A. Obayya, B.M.A. Rahman, K.T.V. Grattan, City Univ. London, UK.*
Design considerations such as loss, dispersion and wavelength tolerance of multimode interference-based 3dB splitters, on InP-based deeply-etched ridge waveguide, using the finite element-based beam propagation and the least square boundary residual approaches, are presented.

IThD3 10:45am
The wavelength dependence of a synthesized codirectional-coupled electrooptic modulator with π-phase shifters, *K. -H. Baek, A. Gopinath, Univ. of Minn., USA; C. Laliew, Chulalongkorn Univ., Thailand.*
The wavelength dependence of a 1.3 mm codirectional-coupled electrooptic modulator with four p-phase shifters is examined by using the modified matrix multiplication method, considering the coupling coefficient and the difference of propagation constant.

IThD4 11:00am
Dispersion slope compensation with co-directional optical couplers, *Tan Li, Kung Hyun Baek, Anand Gopinath, Univ. of Minnesota, USA; Chanin Laliew, Chulalongkorn Univ., Thailand.*
Dispersion slope compensation with co-directional coupler is numerically demonstrated. The profile of the coupling coefficient is obtained by an inverse scattering technique for the coupled mode equations. A third order dispersion in the phase response of the coupler for dispersion slope compensation is obtained.

IThD5 11:15am
Analysis of a reflected field from a waveguide facet: comparison between the reflection method with Pade approximants and the FDTD method, *Jun Shibayama, Junji Yamauchi, Hisamatsu Nakano, Hosei Univ., Japan.*
It is shown, through comparison with the FDTD method, that an accurate reflected field is obtained by the Pade (1,1) approximant with an appropriate branch-cut rotation rather than the higher-order Pade approximants.

IThD6 11:30am
Efficient GA/FE design of single-section passive polarization rotators, *Davi Correia, Hugo E. Hernández-Figueroa, Univ. Estadual de Campinas, Brazil.*
Genetic algorithm (GA) and finite-element (FE) design of very short passive polarization rotators consisting of a single-section asymmetric waveguide, is presented. Devices shorter than 100 mm and nearly 99% polarization conversion were attained.

11:45am–1:15pm
Lunch Break

Room: Vancouver
1:15pm-2:45pm Presider
IThE ■ Integrated Detector Technology
Daniel P. Dapkus, Univ. of Southern California, United States, Presider

IThE1 1:15pm
A 12X12 InGaAs/InAlAs avalanche photodetector array, *Xiaoguang Zheng, J. Hsu, X. Sun, J. B. Hurst, X. Li, S. Wang, A.L. Holmes Jr., J. C. Campbell, Univ. of Texas-Austin, USA; A.Huntington, L. A. Coldren, Univ. of California-Santa Barbara, USA.*
A 12X12 InGaAs/InAlAs avalanche photodetector array for short wavelength infrared three-dimensional imaging was demonstrated. The avalanche photodetectors exhibited uniform distributions of breakdown, dark current, multiplication gain, and high external quantum efficiency.

IThE2 1:30pm Invited
Waveguide photodetectors for high speed digital communication systems, *Timothy A. Vang, David C. Scott, Srinath Kalluri, VSK Photonics Inc., USA.*
Waveguide p-i-n photodiodes are compared to top illuminated devices for high speed operation. A design approach for waveguide p-i-n photodetectors using a single epitaxial growth and common fabrication processes is presented and compared to measured results. Fabricated devices showing over 50 GHz bandwidth, 0.9 A/W pigtailed responsivity, 10 mA CW photocurrent handling and less than 0.1 dB polarization dependence are presented.

IThE3 2:00pm Invited
Low-noise, high-speed avalanche photodiodes, *J. C. Campbell, A.L. Holmes Jr., Univ. of Texas-Austin, USA.*
We describe materials and structural modifications to avalanche photodiodes with thin multiplication regions that have yielded ultra low multiplication noise.

IThE4 2:30pm
Resonant-cavity-enhanced GaAsSb avalanche photodiodes with separate absorption, charge and multiplication regions operating at 1300nm, *X. Sun, S. Wang, X. G. Zheng, X. Li, J. C. Campbell, A. L. Holmes, Jr., Univ. of Texas-Austin, USA.*
A GaAsSb resonant-cavity-enhanced avalanche photodiode with separate absorption, charge and multiplication regions has been demonstrated. The peak external quantum efficiency was 36% at 1310nm. The device also exhibited very low dark current and multiplication noise.

Room: Waddington
1:45pm-2:45pm Presider
IThF ■ Nonlinear Optics
Siegfried Janz, National Res. Council Canada, Canada, Presider

IThF1 1:45pm Invited
Nonlinear response of resonant modes in 2D planar photonic crystal microcavities, *M. Banaee, A.R. Cowan, X. Shen, W. Jiang, W.J. Mandeville, Jeff F. Young, Univ. of British Columbia, Canada.*
The second and third order nonlinear responses of 2D planar photonic crystals are considered. Strong enhancements associated with in-coming and out-going resonant excitation of photonic eigenstates reveal the microcavity nature of these structures.

IThF2 2:15pm
An extremely narrowband directional coupler wavelength filter based on electromagnetically induced transparency, *Marcelo Davanço, Daniel Blumenthal, Univ. of California-Santa Barbara, USA; Lars Thylén, Royal Inst. of Tech., Sweden.*
A directional coupler wavelength filter with exceptionally narrow bandwidths achieved with the use of electromagnetically induced transparency is proposed. Calculations show that, for a 1 mm coupler length, transmission bandwidths on the order of pm are obtained by optically controlling the EIT medium. An assessment is made on physical requirements for the desired performance.

IThF3 2:30pm
Enhancement of third order nonlinearity calculated for 2-D photonic crystal, *Toshihiko Baba, Takeshi Iwai, Yokohama Natl. Univ., Japan.*
The FDTD calculation of a 2-D photonic crystal with the third order nonlinearity shows that the photonic band near the second G point allows large nonlinearity and low loss usable for optical limiting devices.

Room: BC Ballroom
2:45pm–3:15pm
Coffee Break

Room: Vancouver
3:15pm-5:00pm Presider
IThG ■ Planar Lightwave Circuits
Koichi Takiguchi, NTT, Japan, Presider

IThG1 3:15pm Invited
High-density and low-loss arrayed waveguide gratings composed of high index difference PLCs, *Itoh Mikitaka, NTT Corp., Japan.*
This paper reviews recent progress on high-density arrayed waveguide gratings composed of high index difference waveguides. These AWGs with high levels of optical performance are attractive for constructing large capacity WDM networks at reduced cost.

IThG2 3:45pm
Ultra wide range dynamic gain equalizer with high contrast silica planar lightwave circuit, *K. Suzuki, T. Kitoh, S. Suzuki, Y. Inoue, Y. Hibino, T. Shibata, A. Mori, M. Shimizu, NTT Corporation, Japan.*
We describe the simultaneous equalization of the C+L bands by using a PLC-based dynamic gain equalizer that consists of 10 cascaded Mach-Zehnder interferometers. We realized gain flattening over 68 nm for an Er^{3+} -doped-tellurite fiber amplifier.

IThG3 4:00pm
An integrated polarization mode dispersion emulator or compensator with tunable chromatic dispersion, *C.K. Madsen, E.J. Laskowski, L. Stulz, A. Griffin, M.A. Cappuzzo, L. Gomez, R. Long, J. Bailey, J. Weld, P. Oswald, Lucent Tech., USA.*
PMD and chromatic dispersion emulator and compensator architectures using allpass filters are presented. The tuning range and bandwidth for 10 and 40 Gb/s using planar waveguide ring resonators with 75 GHz FSR are discussed.

IThG4 4:15pm Invited
Very high speed pulse sequence generation via femtosecond read-out of arrayed waveguide gratings, *A.M. Weiner, D.E. Leaird, Purdue Univ., USA; K. Okamoto, A. Sugita, NTT Electronics Corp., Japan; S. Kamei, M. Ishii, NTT Photonics Lab., Japan.*
Arrayed waveguide gratings (AWGs) are important devices for wavelength demultiplexing and routing in WDM networks. Here we discuss a completely new functionality for AWGs involving generation of very high rate (~500 GHz-1 THz) sequences of ultrashort pulses.

IThG5 4:45pm
Silica based planar lightwave circuit for beam forming of mm-wave array antennas, *B. Kuhlow, G. Przyrembel, H. Ehlers, G. Grosskopf, R. Eggemann, D. Rohde, Heinrich-Hertz-Inst., Germany.*
We report on first results of a novel silica based signal processor for beam forming in wireless communication smart antenna environments. An experiment with some components of an envisaged 60 GHz transmission system is described.

Room: Waddington
3:15pm-5:00pm Presider

IThH ■ Analysis Methods and Devices

Anand Gopinath, Univ. of Minnesota, United States, Presider

IThH1 3:15pm
Improved time-domain beam-propagation method with highly accurate finite-difference schemes in time and space, *Jun Shibayama, Atsushi Yamahira, Junji Yamauchi, Hisamatsu Nakano, Hosei Univ., Japan.*
A time-domain beam-propagation method is formulated for both TE and TM modes. The effectiveness is demonstrated through the analyses of a waveguide facet and a waveguide grating.

IThH2 3:30pm
Full-vector finite-element beam propagation method for three-dimensional nonlinear optical waveguides, *Takeshi Fujisawa, Masanori Koshiba, Hokkaido Univ., Japan.*
A full-vector finite-element beam propagation method is newly formulated for the analysis of three-dimensional nonlinear optical waveguides. The effectiveness of the present approach is verified by analyzing spatial soliton emission phenomena.

IThH3 3:45pm
Improved finite-element formulation for vector beam propagation in transverse anisotropic media, *J. P. da Silva, H. E. Hernández-Figueroa, Univ. Estadual de Campinas, Brazil.*
An efficient finite-element vector beam propagation formulation for transverse anisotropic dielectric media, expressed in terms of the magnetic field's transverse components, is presented. This formulation includes the wide angle Padé approach and perfectly matched layers.

IThH4 4:00pm
Full vectorial finite element solution of complex and nonlinear modes in optical waveguides, *S.S.A Obayya, B.M.A Rahman, K.T.V Grattan, City Univ. London, UK.*
In this paper, a novel finite element-based beam propagation approach, combined with the complex axis propagation technique is proposed accurately to solve for complex modes in general linear and nonlinear optical waveguides.

IThH5 4:15pm Invited
Wavelength conversion using SOAs: simulations and experiment, *Paul R.Prucnal, Bing C. Wang, Ivan Glesk, Princeton Univ., USA.*
Simulations of wavelength conversion using SOAs offer a deeper understanding of the capability of the device as well as their role in the system while the various experimental demonstrations illustrates their viability.

IThH6 4:45pm
From VCSEL links to coupled VCSEL arrays: An ultrafast approach to VCSEL interconnect simulation, *Spilios Riyopoulos, Science Applications Intl. Corp., USA.*
Multimode link simulations at 1 sec CPU time per bit realistically capture the driven VCSEL behavior including relaxation oscillations, intra-pulse mode switching, frequency chirp and optical tails due to carrier diffusion. The simulation of VCSEL arrays involves mutually coupled VCSEL link simulators. Fast time, short range optical interactions among nearby cavities are described via the introduction of cross cavity coupling coefficients describing fringe-field overlapping. Collective VCSEL array behavior such as modulation lattice waves and phase locked arrays are numerically observed.

Room: BC Ballroom
5:00pm-6:30pm
IThI ■ IPR Posters

IThI1
Passive and active glass waveguide devices utilizing silicon overlay grating, *Jaeyoun Kim, Kim A. Winick, Catalin Florea, Univ. of Michigan, USA.*
Bragg gratings fabricated on top of ion exchanged glass waveguides using PECVD-deposited silicon overlays are reported. The resulting Bragg gratings are characterized and transmission dips at 1536 nm in excess of 18 dB are observed. Design and implementation issues are also presented.

IThI2
Fabrication of planar waveguide WDM add drop multiplexers by direct UV writing, *Wonshik Yoon, Manyong Park, G. Hugh Song, Kwangju Inst. of Science and Tech., Rep. of Korea.*
By direct UV-writing on Ge-doped silica plates made by the flame-hydrolysis deposition technique, optical add-drop multiplexers, based on the design of a symmetrical directional coupler combined with Bragg grating placed in the coupling zone, have been fabricated. Both the waveguide structure and the grating structure have been made by UV-exposure techniques.

IThI3
Novel design for integrated wavelength-flat 980/1550 nm pump-signal multiplexer, *Rasmus K. Sandberg, Lasse Leick, Tech. Univ. of Denmark, Denmark.*
A novel design for an integrated 980/1550 nm pump-signal multiplexer is proposed. Simulations show that within the limits of our process variations it has less than 0.1 dB signal loss over a 100 nm wide passband.

IThI4
The resonant router, *Andrea Melloni, Mario Martinelli, Politecnico di Milano, Italy; Paolo Monguzzi, Raffaella Costa, CoreCom, Italy.*
The Resonant Router (ReR) is an integrated optical crossbar matrix based on the ring resonator. The ReR can operate as cross connect or wavelength Router. The characteristics of the single nodes, the necessary technologies and the impact of the ReR in WDM system are investigated.

IThI5
A novel fabrication method of silica PLC platforms for hybrid integration, *Joo-Hoon Lee, Duk-Yong Choi, Dong-Su Kim, Sun-Tae Jung, Samsung Electronics Co., Ltd, Korea.*
A simple and cost-effective method for fabricating silica PLC platforms for hybrid integration is proposed using alumina etch-stop layer. Alumina etch-stop makes terraced-silica structure for accurate alignment of passive and active devices.

IThI6
Form-birefringence in waveguide devices, *David M. Mackie, U.S. Army Research Lab., USA; Tristan J. Tayag, Texas Christian Univ., USA.*
The use of subwavelength stratification to create strong form-birefringence in (normally isotropic) waveguide devices is proposed. As an example application, we design self-imaging-based polarization separation/combination devices in MgF_2/ZnS that outperform similar devices in $LiNbO_3$.

IThI7
Efficient light coupling into sub-micrometer rib and strip SOI waveguides, *D. Pascal, S. Lardenois, E. Cassan, A. Koster, S. Laval, Univ. Paris, France; M. Heitzmann, L. Mollard, B. Dal'Zotto, N. Bouzaida, CEA –DRT – LETI/DTS, France; R. Orobtchouk, LPM – INSA, France.*
SOI waveguides allows drastic size reduction, but focusing light on the end is inefficient for injection. Using grating couplers and tapered sections towards microguides, efficiency of the order of fifty per cent is measured.

IThI8
Comprehensive modeling of semiconductor lasers including the effect of gain saturation, *S. Ghoniemy, L. MacEachern, S. Mahmoud, Carleton Univ., Canada.*
Fabry-Perot laser diode models incorporating spectral hole burning and index non-linearity in a modified gain formulation are discussed. Modified rate equations based on the proposed modified gain formula are presented. Symbolically Defined Devices (SDD)implemented in a commercial simulator are constructed using modified rate equations. Simulated laser modulation response characteristics are obtained with the SDD implementation. Predicted modulation response curves obtained using the modified gain formulation correctly predict laser modulation characteristics for higher laser bias levels, in contrast to results obtained using conventional non-modified gain formulations.

IThI9
A new bend design criterium: The matched bend, *A.Melloni, M.Martinelli, Politecnico di Milano, Italy; R.Costa, P.Monguzzi, CoreCom, Italy.*
A new concept for the design of bent waveguides is proposed and implemented. Both the transition losses, and the field distortion are reduced at the output of a 'Matched Bend'.

IThI10
Discrete Bessel-based modified Arnoldi method, *Q. Luo, C.T. Law, Univ. of Wisconsin - Milwaukee, USA.*
For modeling of cylindrical beam propagation, we have applied Discrete Bessel transformation to the Modified Arnoldi method. We demonstrate its performance with propagation in (3+1)-dimensional nonlinear pulse propagation as well as in graded index waveguides.

IThI11
A novel numerical approach for the analysis of 2D photonic crystals: The cell method, *Massimiliano Marrone, Univ. of Trieste, Italy; Vitaly F.R. Esquerre, Hugo E.H. Figueroa, DMO-FEEC, UNICAMP, Brazil.*
An efficient numerical method, using the Cell Method and the microcell interpolation scheme, it is proposed to study the characteristics of 2D photonic crystals. This method, suitable for working with periodic structures having anisotropic inhomogeneus media with curved shapes, is used to analyze the band gap of 2D photonic crystals for in-plane propagation of TM and TE waves.

IThI12
Micro-branch in silicon photonic wire waveguides, *Atsushi Sakai, Tatsuhiko Fukazawa, Toshihiko Baba, Yokohama Natl. Univ., Japan.*
We demonstrate a micro-branch in Si photonic wire waveguides. The loss measured is as low as 0.3 dB. An H-tree circuit is also demonstrated with clear light outputs from 8 ports.

IThI13
Design and fabrication of a planar coupling structure for photonic band gap devices, *Dennis W. Prather, Janusz Murakowski, Shouyuan Shi, Sriram Venkataraman, Caihua Chen, David Pustai, Univ. of Delaware, USA.*
In this paper we present the design and fabrication of a planar coupling structure for photonic band gap devices. Calculations predict a coupling efficiency of greater than 90% from a multimode silicion waveguide to a singlemode photonic crystal channel. Experimental results are presented.

IThI14
Paper withdrawn.

IThI15

Effective carrier confinement in microdisk lasers by strain relaxation in quantum wells, *Masayuki Fujita, Reona Ushigome, Toshihiko Baba, Yokohama Natl. Univ., Japan.*

We estimate the improved carrier confinement and caused threshold reduction by the strain relaxation effect in microdisk lasers with compressively strained quantum wells. This will also be effective for other membrane type microlasers

IThI16

Fourier spectroscopy analysis of ring resonators, *J. A. Lázaro, P. Kersten, J. Koppenborg, Alcatel Res. & Innovation, Germany.*

The Fourier spectroscopy analysis of ring resonators has been investigated. The simulation shows that the basic parameters of the ring resonator can be directly measured. First measurements show a good agreement with previous simulations results.

■ Friday
■ July 19, 2002

Room: Tweedsmuir
8:00am–5:00pm
Registration/Speaker and Presider Check-In

Room: Vancouver
8:15am–9:45am Presider
IFA ■ Modulators
Richard V. Penty, Cambridge University, United Kingdom, Presider

IFA1 8:15am Invited
$LiNbO_3$ modulators for high speed transport, *Doug Gill, Lucent Tech., USA.*
The current state of the art for $LiNbO_3$ modulators will be reviewed. A user's perspective of modulator performance and function within a system will be discussed.

IFA2 8:45am
Basic performance analysis of optical single sideband modulator using arrayed waveguide gratings, *Katsumi Takano, Kiyoshi Nakagawa, Yamagata Univ., Japan.*
The optical single sideband (SSB) modulator using a spatial filter and arrayed waveguide gratings (AWG) is proposed. The sideband suppression characteristics are evaluated from output spectrum by simulation. It is adequate for high-speed SSB modulation.

IFA3 9:00am
A $LiNbO_3$ modulator with chirp adjusted by domain inversion, *Nadege Courjal, Anthony Martinez, Univ. de Franche Comté, France; Henri Porte, Photline Tech., France.*
Ferroelectric domain inversion associated with electrical field inversion is proposed to improve the chirp parameter of one single-drive Mach-Zehnder modulator integrated in Z-cut Lithium Niobate substrate. Description of the device and experimental results are proposed.

IFA4 9:15am
Technological implementation of Bragg grating reflectors in Ti:$LiNbO_3$ waveguides by proton exchange, *B.-E. Benkelfat, Inst. Natl. des Télécommunications, France; R. Ferriere, N. Bodin, LOPMD Univ. de Franche-Comté, France.*
We propose and demonstrate a simple and novel method for fabrication of efficient Bragg grating reflectors at 1550 nm in titanium-indiffused lithium niobate channel waveguides. This technique is based on patterned proton-exchanged process

IFA5 9:30am
Solid state absorption attenuator in silicon-on-insulator with MHz bandwidth, *I.E. Day, R. Whiteman, A.A. House, A.P. Knights, J. Drake, M. Asghari, Bookham Tech., UK.*
Solid state variable optical attenuator (VOA) fabricated in silicon-on-insulator material (SOI) with high efficiency, high speed (>2MHz) and no inherent polarisation dependence with a manufacturable fabrication process suitable for high levels of integration is presented.

Room: Waddington
8:15am-9:45am Presider
IFB ■ Silicon Microphotonics
Richard A. Soref, USAF, United States, Presider

IFB1 8:15am Invited
Silicon microphotonics, *Lionel C. Kimerling, MIT, USA.*
Silicon microphotonics provides a scalable solution to interconnection constraints from the chip to the network level. Using standard silicon integrated circuit fabrication processes we have made and tested high performance waveguides, add/drop filters and detectors.

IFB2 8:45am
Coupling of single mode fibers to planar Si waveguides using vertically tapered mode converters, *M. B. Frish, J. Fijol, E. E. Fike, S. A. Jacobson, P. B. Keating, W. J. Kessler, J. LeBlanc, Confluent Photonics Corp., USA; C. Bozler, M. Fritze, C. Keast, J. Knecht, R. Williamson, MIT Lincoln Lab., USA; C. Manolatou, MIT, USA.*
3-d adiabatic tapers, monolithically integrated with 240nm Si waveguides and fabricated with 50nm precision, couple light between optical fibers and the waveguides. The fabrication is a breakthrough in precision gray scale photolithography and etching.

IFB3 9:00am Invited
Optical MEMS based on moving micromechanical waveguides: technology and component developments, *Eric Ollier, CEA/LETI, France.*
Many Optical MEMS are based on micromirrors or micro-membranes providing optical functions. Another technology, based on moving optical waveguides, is presented in the paper : overview of the activity, specific technological problems and component examples.

IFB4 9:30am
Evaluation of bend loss and polarization conversion, *Atsushi Sakai, Tatsuhiko Fukazawa, Toshihiko Baba, Yokohama Natl Univ., Japan.*
Less than 0.5 dB bend loss and 5 – 10% polarization conversion were experimentally evaluated for micro-bend in Si photonic wire waveguide. For the polarization stability, the perfect rectangular cross-section is crucial.

Room: BC Ballroom
9:45am–10:15am
Coffee Break

Room: Vancouver
10:15am-11:45am Presider
IFC ■ Integrated Active-Passive Components
Allen Vawter, Sandia National Lab., United States, Presider

IFC1 10:15am Invited
Advanced processing technologies for III-V photonic integrated circuits, *John H. Marsh, Intense Photonics, UK.*
Regrowth-free technologies are described for integrating multiple bandgaps and photonic crystal structures monolithically in a semiconductor chip. Practical devices examples include high power 980 nm pumps, 2x2 crosspoint switches and lasers modelocked at THz frequencies.

IFC2 10:45am
On tuning efficiency of sampled grating DBR lasers using quantum well intermixing, *Erik J. Skogen, Jonathon S. Barton, Steven P. DenBaars, Larry A. Coldren, Univ. of California-Santa Barbara, USA.*
We have applied quantum well intermixing to sampled-grating DBR lasers to improve device characteristics. We show the effects of injection efficiency and wavelength detuning on the tuning characteristics of sampled-grating DBR lasers using quantum well intermixing.

IFC3 11:00am
Monolithic integration of Mach-Zehnder modulators with sampled grating distributed Bragg reflector lasers, *Jonathon S. Barton, Erik J. Skogen, Milan L. Masanovic, Steven P. DenBaars, Larry A. Coldren, Univ. of California-Santa Barbara, USA.*
The first Mach-Zenhder modulator monolithically integrated with a sampled-grating distributed-bragg reflector laser is characterized. DC extinction of greater than 18dB with 2V bias is demonstrated across a 30nm wavelength range.

IFC4 11:15am Invited
Single-mode vertical integration of active devices within passive waveguides of InP-based planar WDM components, *Valery I. Tolstikhin, MetroPhotonics Inc., Canada.*
A new design concept, in which active devices are integrated in passive waveguides of InP-based planar WDM components within a single epitaxial growth run, is presented. Physical principles of and experimental results on this integration method are reviewed referring to embodiments in form of waveguide photodetector, electro-absorptive variable optical attenuator and semiconductor optical amplifier.

Room: Waddington
10:15am-11:45am Presider
IFD ■ Optical Propagation in Nanostructures
Jeff F. Young, Univ. of British Columbia, Canada, Presider

IFD1 10:15am Invited
Photon sieves and resonant transmission enhancement through sculpted sub-wavelength apertures in metallic films, *Richard A. Linke, Ajay Nahata, K.M. Pellerin, Geoff Lewen, Tineke Thio, NEC Res.Inst., USA.*
Anomolously high resonant transmission of light is seen for thin metallic films perforated by periodic arrays of sub-wavelength diameter holes. Progress in understanding this phonomenon as it relates to arrays of holes as well as to single enhanced-transmission apertures is discussed along with potential applications.

IFD2 10:45am
One-dimensional photonic crystal microcavity with enhanced transmission, *A. S. Jugessur, R. M. De La Rue, P. Pottier, P. Viktorovitch, Univ. of Glasgow, UK.*
The design, simulation and fabrication of one-dimensional photonic crystal microcavity with light transmission of more than 90 % is reported. Employing an efficient coupling mechanism significantly reduces the mode mismatch at the interface of the waveguide and photonic crystal sections.

IFD3 11:00am
Optical properties of artificial dielectrics with refractive index less than unity, *Brian T. Schwartz, Rafael Piestun, Univ. of Colorado-Boulder, USA.*
Total external reflection can occur at the interface between vacuum and a medium with refractive index less than unity. Here, analytical and numerical models predict such reflection at optical wavelengths for a metal-dielectric composite material.

11:45am–1:15pm
Lunch Break

Room: Vancouver
1:15pm-2:45pm Presider
IFE ■ PLC Demultiplexers
Kenneth A. McGreer, Lightwave Microsystems, United States, Presider

IFE1 1:15pm
The scalable planar waveguide component technology: 40- and 256-channel Echelle grating demultiplexers, *S. Janz, M. Pearson, P.A. Krug, B. Lamontagne, L. Erickson, A. Delage, P. Cheben, D.-X. Xu, M. Gao, M. Cloutier, M. Packirisamy, A. Balakrishnan, J. Miller, S. Charbonneau, Optenia Inc., Canada.*
Silica-on-silicon planar waveguide echelle grating demultiplexers with 40 channels and 256 channels have been fabricated. The optical performance is comparable for both devices. The 256 channel demultiplexer occupies a chip approximately 4x4 cm in size.

IFE2 1:30pm
Passband flattening in waveguide grating devices, *Jian-Jun He, Emil S. Koteles, Bedwyr Humphreys, MetroPhotonics Inc., Canada.*
A new passband flattening technique for waveguide grating devices is proposed and experimentally verified. It uses phase modification of grating elements to flatten and steepen the passband shape while maintaining single mode input and output waveguides.

IFE3 1:45pm Invited
Design and applications of AWG and PLC, *Katsunari Okamoto, NEL, Japan; Kazumasa Takada, NTT Photonics Lab.,Japan.*
Design aspects of AWGs and their fundamental properties will be described in detail. Channel numbers of AWGs have been dramatically increased up to 400ch in single wafer. In the multi-chip configuration (tandem AWGs), 1080 ch has been achieved with 25 GHz channel spacing. For telecom applications, not only crosstalk characteristics but also dispersion of AWG is equally important. Origin of dispersion and its relation to the waveguide geometry will be explained. Although throughput of the transport can be increased to tera-bit level by the WDM technology, signal processing in the electrical layer becomes a serious problem due to its speed limit. Optical functional devices, therefore, are important for solving these issues. Various kinds of optical signal processing devices have been developed; they are, dispersion slope equalizers, PMD equalizers, temporal pulse shapers and optical label recognition circuits.

IFE4 2:15pm
Improved performance of compact silica 2DIO wavelength filters, *C.N. Morgan, R.V. Penty, I.H. White, Cambridge Univ., UK;S.Yu, Univ.of Bristol, UK.*
Following etch process optimisation, passband characteristics of a 3.2nm spacing silica 2DIO demultiplexer for datacommunications applications is shown. Non-adjacent crosstalk is improved from 21.7dB minimum to 23.5dB minimum, with insertion loss variation reduced to 0.9dB.

IFE5 2:30pm
Novel polarization-insensitive AWG with undercladding ridge structure, *R. Kasahara, M. Itoh, Y. Hida, T. Saida, Y. Inoue, Y. Hibino, NTT Corp., Japan.*
We propose a novel method for realizing a polarization-insensitive silica-based AWG with an undercladding ridge. We successfully demonstrated low polarization dependence without any optical degradation by using a slightly longer etching time during core formation.

Room: Waddington
1:15pm-2:45pm Presider
IFF ■ Active Microphotonic Devices
Richard M. De La Rue, Univ. of Glasgow, United Kingdom, Presider

IFF1 1:15pm Invited
III-V semiconductor photonic crystal active devices, *Y. H. Lee, H. Y. Ryu, H. K. Park, S. H. Kim, S.H. Kwon, Korea Advanced Inst. of Science and Tech., Korea.*
2-D slab photonic crystal active devices based on III-V semiconductors such as triangular lattice modified single-cell monopole mode lasers, very low-threshold triangular lattice band edge lasers and high-Q square lattice single-cell lasers are discussed.

IFF2 1:45pm
Room temperature operation of a two dimensional photonic crystal defect-waveguide-laser with optical pump, *Atsushi Sugitatsu, Kyoto Univ. & Mitsubishi Electric Corp., Japan; Susumu Noda, Kyoto Univ. & CREST-JST, Japan.*
We demonstrate room temperature operation of a two dimensional photonic crystal defect-waveguide-laser with InGaAsP multiple quantum well active layer with low optical pumping for the first time.

IFF3 2:00pm
High efficiency light emitting diode with 2-D surface grating photonic crystal, *Hiroyuki Ichikawa, Toshihiko Baba, Yokohama Natl. Univ., Japan.*
We demonstrate the 2-D surface grating PC LED exhibiting 3.4-fold enhancement in total efficiency. We think that this figure is attractive because of its very simple process and the applicability to arbitrary semiconductors.

IFF4 2:15pm
GaInAsP microdisk injection laser with benzocyclobutene polymer cladding and its athermal effect, *Reona Ushigome, Masayuki Fujita, Atsushi Sakai, Toshihiko Baba, Yasuo Kokubun, Yokohama Natl. Univ., Japan.*
We demonstrate a GaInAsP-microdisk injection laser with the benzocyclobutene (BCB) polymer cladding. Low threshold lasing, the reduction in thermal resistance, and the potential of athermal operation are discussed.

IFF5 2:30pm
Microgear laser – A fusion of whispering galley mode cavity and photonic crystal, *Masayuki Fujita, Toshihiko Baba, Yokohama Natl. Univ., Japan.*
Room temperature continuous-wave lasing was demonstrated in a GaInAsP microgear laser with a threshold of 17 microwatts. A kind of photonic crystal, i.e., circularly periodic grating, improved the Q in the whispering galley mode cavity.

Room: BC Ballroom
2:45pm–3:15pm
Coffee Break

Room: Vancouver

3:15pm-4:45pm Presider

IFG ■ Novel Waveguide Devices

Folkert Horst, IBM, Switzerland, Presider

IFG1 3:15pm Invited

Active microresonator devices for WDM photonic integrated circuits, *P. Daniel Dapkus, Kostadin Djordjev, Seung June Choi, Sang Jun Choi, Univ. of Southern California, USA.*

Active microdisk resonators vertically coupled to transparent waveguides are discussed as general purpose elements for wavelength selective switches, tunable add / drop filters, amplifiers, and sources in a WDM photonic integrated circuit technology and demonstrated.

IFG2 3:45pm

Filter using vertical coupling between a single-mode waveguide and a multimode waveguide, *Min-Suk Kwon, Sang-Yung Shin, Korea Advanced Inst. of Science and Tech., Korea.*

We have demonstrated the feasibility of the process fabricating a single-mode waveguide and a multimode waveguide aligned vertically on the same substrate. Using this process, we have proposed and demonstrated a filter that drops optical signal propagating in a single-mode waveguide to a multimode waveguide in the specific wavelength interval by a long-period grating.

IFG3 4:00pm

Design for high gain in waveguide amplifiers, *S. Saini, K. Chen, X. Duan, J.Michel, K. Wada, L.C. Kimerling, MIT, USA; M. Lipson, Cornell Univ., USA.*

Er_2O_3 is explored as a gain medium for ultra-compact waveguide amplifiers. With sputtered and annealed films, we measure three radiative lifetimes (7, 0.8, 0.5 ms) and upconversion coefficients, correlating with three crystalline phases. Gains of > 2.4 dB/cm are indicated from initial measurements.

IFG4 4:15pm

Small V-bend optical waveguide using an elliptic mirror for miniaturizing planar lightwave circuits, *Takanori Suzuki, Yutaka Shibata, Hiroyuki Tsuda, Keio Univ., Japan.*

The small V-bend optical waveguide using an elliptic mirror, which bend size is much smaller than one of the conventional bend waveguides, is proposed and the optimized V-bend waveguide was fabricated with fluorinated polyimide.

IFG5 4:30pm

Low-loss controlled-birefringence waveguides fabricated by electron-beam irradiation of germanium doped FHD silica, *S. Garcia Blanco, J.M. Cooper, R.M. De La Rue, Univ. of Glasgow, Scotland; J.S. Aitchison, Univ. of Toronto, Canada.*

Waveguides with tailored birefringence have been realised using electron-beam irradiation of FHD Ge-doped silica. The birefringence, Dn and propagation losses have been characterized for different electron-beam doses and germanium content.

Room: Waddington
3:15pm-4:45pm Presider
IFH ■ Microphotonic Fabrication
Trevor M. Benson, Univ. of Nottingham, United Kingdom, Presider

IFH1 3:15pm Invited
Realizing optical frequency 3D photonic crystals through advanced VLSI techniques, *J.G.Fleming, Shawn-Yu Lin, Sandia Natl. Lab., USA.*
This paper will overview our work on the fabrication of photonic crystals using advanced silicon processing techniques. We will discuss the fabrication of three-dimensional silicon structures, metallic three-dimensional structures and dielectric one-dimensional structures.

IFH2 3:45pm
Thin-film wavelength demultiplexer based on photonic crystal and group velocity effects, *Martina Gerken, Bianca E. Nelson, David A. B. Miller, Stanford Univ., USA.*
We experimentally observe the "superprism effect" in a periodic thin-film structure acting as a one-dimensional photonic crystal. The design of non-periodic structures exhibiting a linear shift with wavelength in the EDFA C-band is discussed.

IFH3 4:00pm
Microring resonator based widely tunable semiconductor lasers, *Farhan Rana, Christina Manolatou, Rajeev J. Ram, MIT, USA.*
We propose a new class of widely tunable semiconductor laser structures that use microring resonators, as either wavelength selective reflectors or as inter-cavity filters, with tuning bandwidths reaching 50 nanometers.

IFH4 4:15pm Invited
Large-scale production techniques for photonic nanostructures using excimer laser replication, *Wim Bogaerts, Dirk Taillaert, Roel Baets, Ghent Univ. - IMEC, Belgium; Vincent Wiaux, Stephan Beckx, IMEC, Belgium.*
We demonstrate wavelength-scale photonic structures for photonic integrated circuits fabricated with 248nm-excimer laser deep UV lithography. Deep UV lithography combines mass-manufacturing capability with the resolution needed for photonic crystals or other submicron photonic structures.

Room: Vancouver
5:00pm-6:00pm
IPR Postdeadline Session