Advance Program

Wednesday, 17 September 2008

ALL SESSIONS WILL BE HELD IN NETTUNO 1-2-3

08.30 - 10.30
Session WA: MODULATOR
Session Chair: Roel Baets, *Ghent University, Ghent, Belgium*

08.30 - 08.45 OPENING REMARKS

WA1 08.45 - 09.15 (Invited)

Recent Progress in Fast Silicon Modulators, D. Marris-Morini, G. Rasigade, L. Vivien, E. Cassan, S. Laval, *Institut d'Electronique Fondamentale, Orsay, France*, P. Rivallin, P. Lyan and J.-M. Fedeli, *Commissariat à l'Énergie Atomique, Grenoble, France*

Impressive progresses have been performed on high speed silicon optical modulators for a few years. An overview of recent works will be reported and new results on a lateral pin diode will be presented.

WA2 09.15 - 09.45 (Invited)

Ultralow Power Silicon Microdisk Modulators and Switches, M. R. Watts, D. Trotter, R. Young and A. L. Lentine, *Sandia National Laboratories, Albuquerque, NM, USA*

We demonstrate a 4-micron silicon microdisk modulator with a power consumption of 85fJ/bit. The modulator utilizes a reverse-biased, vertical p-n junction to achieve 10Gb/s data transmission, with 3.5V drive voltage, BER<10^{-12}, and without signal pre-emphasis. High-speed silicon bandpass switches are constructed from pairs of modulators.

WA3 09.45 - 10.00

A 10Gb/s Mach-Zehnder Silicon Evanescent Modulator, H.-W. Chen, Y.-H. Kuo and J. E. Bowers, *University of California - Santa Barbara, Santa Barbara, CA, USA*

We demonstrate a 10 Gb/s Mach-Zehnder silicon evanescent modulator utilizing a coplanar waveguide design. The device has a modulation efficiency of 1.5V-mm and modulation bandwidth of 8 GHz.

WA4 10.00 - 10.15

Ultralow Energy, Integrated GeSi Electroabsorption Modulators on SOI, J. Liu, M. A. Beals, *Massachusetts Institute of Technology, Cambridge, MA, USA*, A. T. Pomerene, *BAE Systems, Arlington, VA, USA*, S. Bernardis, R. Sun, J. Cheng, L. C. Kimerling and J. Michel, *Massachusetts Institute of Technology, Cambridge, MA, USA*

We report a waveguide-integrated, gigahertz GeSi electroabsorption modulator on SOI with a 10 dB extinction ratio at 1540 nm, a ultralow energy consumption of 50 fJ/bit, and an operation spectrum range of 1539-1553 nm.

WA5 10.15 - 10.30

Low Driving-Voltage Optical Modulator Based on Carrier Depletion in Silicon with Periodically Interleaved P-N Junctions, Z.-Y. Li, D.-X. Xu, R. McKinnon, S. Janz, J. H. Schmid, J. Lapointe, P. Cheben, *National Research Council, Ottawa, ON, Canada* and J. Yu, *Chinese Academy of Sciences, Beijing, China*

We present the novel design of a silicon modulator with low operation voltage of ≤ 3 V by employing periodically interleaved pn junctions. Simulations predict that in depletion mode it has a high modulation efficiency of better than 1.5 V•cm.

10.30 - 11.00 COFFEE BREAK

11.00 - 13.00
Session WB: MONOLITHIC LIGHT SOURCES (GE, THZ AND ER)
Session Chair: Francesco Priolo, *University of Catania, Catania, Sicily, Italy*

WB1 11.00 - 11.30 (Invited)
Towards a Ge based Laser for CMOS Applications, J. Liu, X. Sun, P. Becla, L. C. Kimerling and J. Michel, *Massachusetts Institute of Technology, Cambridge, MA, USA*

We report experimental observation of direct band gap photoluminescence (PL) and optical bleaching of band-engineered epitaxial Ge-on-Si at room temperature, confirming that this material is a promising candidate for efficient light emitting devices on Si.

WB2 11.30 - 11.45

GeOI Photonic Crystal Cavities Probed by Room-Temperature Photoluminescence, M. El Kurdi, T. P. Ngo, *Université Paris-Sud, Orsay, France*, X. Checoury, S. David, P. Boucaud, *Institut d'Electronique Fondamentale, Orsay, France*, J.-F. Damlencourt, *Commissariat à l'Énergie Atomique, Grenoble, France*, O. Kermarrec, Y. Campidelli and D. Bensahel, *STMicroelectronics, Crolles, France*

We have investigated pure germanium two-dimensional photonic crystals L3 cavities. The photonic crystals cavities were fabricated on germanium-on-insulator substrates using standard silicon-based processing. The near infrared optical properties of the cavities are probed by the direct band gap optical recombination of pure germanium.

WB3 11.45 - 12.00

Influence of Stoichiometry on the Structural and Optical Properties of Erbium Silicate, R. Lo Savio, M. Miritello, *University of Catania, Catania, Italy*, F. Iacona, *Institute for Microelectronics and Microsystems, Catania, Italy*, G. Franzo, A. M. Piro and F. Priolo, *University of Catania, Catania, Italy*

We report a detailed study of the properties of Er silicate films as a function of the stoichiometry and of the annealing conditions. A strong correlation between the structural and optical properties has been demonstrated.

WB4 12.00 - 12.15

Lifetime Measurements of Group V Donor Rydberg States in Silicon at THz Frequencies, S. A. Lynch, P. T. Greenland, *University College London, London, UK*, N. Q. Vinh, *FOM Institute, Nieuwegein, The Netherlands*, K. L. Litvinenko, *University of Surrey, Guildford, Surrey, UK*, B. Redlich, L. van der Meer, *FOM Institute, Nieuwegein, The Netherlands*, M. Warner, A. M. Stoneham, G. Aeppli, *University College London, London, UK*, C. R. Pidgeon, *Heriot-Watt University, Edinburgh, UK* and B. N. Murdin, *University of Surrey, Guildford, Surrey, UK*

We have measured the T1 lifetimes of Rydberg states of phosphorus and arsenic in silicon at THz frequencies using the FELIX pulsed free electron laser. Our results show the dominant decoherence mechanism is lifetime broadening.

WB5 12.15 - 12.30

Relaxation of Upper Laser Levels in Terahertz Silicon Lasers, S. Pavlov, H.-W. Hübers, *German Aerospace Center, Berlin, Germany*, R. K. H. Zhukavin, *Institute for Phasics of Microstructures, Nizhny Novgorod, Russia*, J. Phillips, D. Carder, *FOM Institute, Nieuwegein, The Netherlands*, N. Hovenier, T. Klaassen, *Delft University of Technology, Delft, The Netherlands* and V. N. Shastin, *Russian Academy of Sciences, Nizhny Novgorod, Russia*

Decay times of lower exited states, $2p_0$ and $2p_{\pm}$, of group-V donors in silicon which serve as upper working states of intracenter silicon lasers have been experimentally defined to be within 4-90 ps range.

WB6 12.30 - 12.45

SiGeSSi Quantum Cascade Structures Deposited by Low-Energy Plasma Enhanced CVD, G. Isella, *Politecnico di Milano, Como, Italy*, G. Matmon, *University of Cambridge, Cambridge, UK*, A. Neels, *University of Neuchatel, Neuchatel, Switzerland*, E. Mueller, *Swiss Federal Institute of Technology Zurich, Zurich, Switzerland*, M. Califano, *University of Leeds, Leeds, UK*, D. Chrastina, H. von Kaenel, *Politecnico di Milano, Como, Italy*, L. J. M. Lever, Z. Ikonic, R. W. Kelsall, *University of Leeds, Leeds, UK* and D. Paul, *University of Glasgow, Glasgow, UK*

SiGe/Si quantum cascade structures have been deposited by low-energy plasma-enhanced CVD according to a bound-to-continuum design and characterized by high resolution x-ray diffraction and transmission electron microscopy. Electro-luminescence from the active region is peaked around 2.5THz (10meV) and exhibits Stark shift and polarization dependence.

WB7 12.45 - 13.00

Visible to Infrared Light Emission from Reverse Defect Engineered Silicon Junctions, M. Morschbach, M. Oehme, J. Werner, and E. Kasper, *Universität Stuttgart, Stuttgart, Germany*

Experimental results of light emission by defect engineered silicon pn-junctions, operated at room temperature under reverse bias, are presented. Increased efficiency by the usage of defect engineered layers is proofed with optical and electrical results.

13.00 - 14.30 LUNCH BREAK

14.30 - 16.30

Session WC: MONOLITHIC LIGHT SOURCES (SI)
Session Chair: Lorenzo Pavesi, *University of Trento, Povo, Italy*

WC1 14.30 - 15.00 (Invited)

Silicon Nanocrystals in Silicon Nitride Structures: Towards Efficient Light Emission Under Optical and Electrical Pumping, L. Dal Negro, R. Li, J. Warga and S. Basu, *Boston University, Boston, MA, USA*

We will discuss light emission, Er sensitization and electroluminescence from small (2nm-diameter) Si nanoclusters embedded in silicon nitride/Si superlattice structures fabricated by direct co-sputtering. We will show efficient Er emission sensitization via controllable non-radiative energy transfer and demonstrate enhanced electroluminescence from superlattice-based electrical devices.

WC2 15.00 - 15.15

Structural Properties of Si Nanocrystals: Implications for Light Emitting Devices Fabrication, A. Irrera, G. Franzo, M. Miritello, R. Lo Savio, S. Boninelli, F. Priolo, *University of Catania, Catania, Italy*, F. Iacona, G. Nicotra, C. Bongiorno, C. Spinella, *Institute for Microelectronics and Microsystems, Catania, Italy* and S. Coffa, *ST Microelectronics srl, Catania, Italy*

In this work we investigate and compare the structural and optical properties of SiO_x layers obtained by different techniques. We demonstrate that they are very different and this affects the performances of light emitting devices.

WC3 15.15 - 15.30

Luminescence Properties of Silicon Nanocrystals in Al_2O_3 Grown by Low Temperature Atomic Layer Deposition, R. Walters, R. van Loon, *Foundation for Fundamental Research on Matter, Amsterdam, The Netherlands*, A. Polman, *Institute for Atomic and Molecular Physics, Amsterdam, The Netherlands*, I. Brunets, G. Piccolo and J. Schmitz, *University of Twente, Enschede, The Netherlands*

We have produced silicon nanocrystals by low-temperature (T<300°C) CMOS-compatible processes in an alumina matrix. This material exhibits near-infrared and visible photoluminescence and electroluminescence properties that suggest that the luminescence be attributed to exciton recombination in well-passivated silicon nanocrystals.

WC4 15.30 - 15.45

Light Emitting Transistors using Silicon Quantum Dots in an Organic Matrix, G. Aggrawal, X. Pi, *University of Minnesota Twin Cities, Minneapolis, MN, USA*, R. Lu, A. D. Ramirez, *SPAWAR Systems Center - San Diego, San Diego, CA, USA*, U. Kortshagen and S. Campbell, *University of Minnesota Twin Cities, Minneapolis, MN, USA*

Optically emitting silicon nanoparticles were incorporated into organic layers to fabricate a quantum dot light emitting transistor. The peak luminescence occurred at about -5V of gate bias.

WC5 15.45 - 16.00

Electroluminescence from Nanocrystalline-Si/SiO_2 Multilayers with an Electron Injection Barrier, A. Marconi, O. Anopchenko, E. Moser, *University of Trento, Povo, Italy*, M. Wang, *Zhejiang University, Hangzhou, Zhejiang, China*, G. Pucker, *Fondazione Bruno Kessler - Irst, Trento, Italy*, P. Bellutti, *Istituto Trentino di Cultura, Povo, Italy* and L. Pavesi, *University of Trento, Povo, Italy*

The effect of an injection barrier placed on top of a nanocrystalline-Si/SiO_2 multilayered LED is discussed. Direct and alternating current injection schemes and time resolved electroluminescence are reported.

WC6 16.00 - 16.15

Silicon LEDs with Antifuse Injection, G. Piccolo, *University of Twente, Enschede, The Netherlands*, T. Hoang, *Institut für Mikroelektronic Stuttgart, Stuttgart, Germany*, J. Holleman, A. Kovalgin and J. Schmitz, *University of Twente, Enschede, The Netherlands*

A novel carrier-confinement structure is proposed and realized to generate light in a silicon diode. A significant enhancement of the external power efficiency is observed compared to reference silicon diodes on SOI.

WC7 16.15 - 16.30

Simultaneous Achievement of High-Quality Oxide Passivation of nc-Si and Suppression of Er De-activation by Silicon-rich Silicon Oxide / Er-doped Silicon Nitride, I. Y. Kim, J. H. Shin, *Korea Advanced Institute of Science and Technology, Daejeon, Korea*, K. J. Kim, *Korea Research Institute of Standards and Science, Daejon, Korea*, M.-S. Yang and Y. Park, *Samsung Advanced Institute of Technology, Daejeon, Korea*

The effect of nc-Si/Er environment is investigated. We find that by using a silicon-rich silicon-oxide / SiN:Er multilayers, high quality nc-Si passivation and suppression of Er de-activation can be achieved simultaneously for optimal Er luminescence.

16.30 - 17.00 COFFEE BREAK

17.00 - 19.00

Session WD: HYBRID APPROACH (III-V ON SI)
Session Chair: Lionel C. Kimerling, *Massachusetts Institute of Technology, Cambridge, MA, USA*

WD1 17.00 - 17.30 (Invited)

Hybrid Silicon Sampled Grating DBR Tunable Lasers, M. N. Sysak, *Intel Corporation, Santa Clara, CA, USA*, J. O. Anthes, D. Liang, J. E. Bowers, *University of California - Santa Barbara, Santa Barbara, CA, USA*, O. Raday, *Intel Corporation, Jerusalem, Israel* and R. Jones, *Intel Corporation, Santa Clara, CA, USA*

We present a hybrid silicon sampled grating DBR laser fabricated using quantum well intermixing. The laser utilizes two III-V bandgaps spanning >80 nm. Output power is >2.5 mW with CW lasing to 40°C and tuning >12 nm.

WD2 17.30 - 17.45

A Distributed Bragg Reflector Silicon Evanescent Laser, A. W. Fang, *University of California - Santa Barbara, Santa Barbara, CA, USA*, B. R. Koch, R. Jones, *Intel Corporation, Santa Clara, CA, USA*, E. Lively, D. Liang, Y.-H. Kuo and J. E. Bowers, *University of California - Santa Barbara, Santa Barbara, CA, USA*

We report a distributed Bragg reflector silicon evanescent laser operating continuous wave at 1596nm. The lasing threshold and maximum output power are 65mA and 11mW, respectively andshows open eye-diagrams under direct modulation at 2.5 Gb/s.

WD3 17.45 - 18.00

Hybrid Integration of InP Lasers with SOI Waveguides Using Thermocompression Bonding, M. Kapulainen, *VTT Technical Research Center of Finland, Espoo, Finland*

Thermocompression bonding of InP lasers to 4µm thick SOI waveguides has been demonstrated. Good horizontal alignment is achieved by using active alignment. Excellent passive vertical alignment is reached by using a easily controlled fabrication process.

WD4 18.00 - 18.15

Silicon Evanescent Optical Frequency Comb Generator, B. R. Koch, *Intel Corporation, Santa Clara, CA, USA*, A. W. Fang, *University of California - Santa Barbara, Santa Barbara, CA, USA*, R. Jones, *Intel Corporation, Santa Clara, CA, USA*, O. Cohen, *Intel Corporation, Jerusalem, Israel*, M. Paniccia, *Intel Corporation, Santa Clara, CA, USA*, D. J. Blumenthal and J. E. Bowers, *University of California - Santa Barbara, Santa Barbara, CA, USA*

A mode-locked silicon evanescent laser is used to generate over 100 wavelengths evenly spaced by 10 GHz. Optical injection locking reduces the linewidths of the remaining 30 modes to less than 100 kHz.

WD5 18.15 - 18.30

Improving Contact Design for Micro-Disc Based Lasers in Integrated Circuits, F. Mandorlo, P. Rojo-Romero, X. Letartre, *École Centrale de Lyon, Ecully, France*, J.-M. Fedeli, *Commissariat à l'Énergie Atomique, Grenoble, France* and P. Viktorovitch, *École Centrale de Lyon, Ecully, France*

For mass production and implementation easiness, electrically driven sources are required, and consequently metal based elements and absorbing medium are necessary. In order to lower lasing thresholds, we propose cost free improvements concerning the contact design and the electrical injection.

WD6 18.30 - 18.45

Vertical Emitting Lasers Based on 2D Photonic Crystal Heterostructure Coupled to Strip Silicon Waveguide, L. Ferrier, O. El Daif, P. Rojo-Romero, X. Letartre, E. Drouard and P. Viktorovitch, *École Centrale de Lyon, Ecully, France*

We study the coupling between a compact vertical emitting lasers based on a 2D photonic crystal heterostructure bonded on a silicon/silica Bragg mirror and a silicon strip waveguide around 1.5microns.

WD7 18.45 - 19.00

Monolithic Integration of the III/V Laser Material Ga(NAsP) Lattice-Matched on (001) Silicon Substrate, B. Kunert, *NAsP III/V Gmbh, Marburg, Germany*, I. Németh, S. Zinnkann, R. Fritz, G. Lukin, K. Volz and W. Stolz, *Philipps University, Marburg, Germany*

Multi quantum well (MQW) heterostructures in the GaP-based dilute nitride Ga(NAsP) were pseudomorphically grown on exact oriented (001) Silicon substrates without the formation of misfit dislocations. Efficient room temperature photoluminescence has been observed.

19.00 - 21.00 **WELCOME RECEPTION**

19.00 - 21.00

Session WP: WELCOME RECEPTION/POSTER SESSION I

WP1 Preparation for SiGe/Si Heterogeneous Nanostructures via a Two-Step Approach Strategy, S. Chen, B. Zhou, S. Pan, C. LI, H. Lai, *Xiamen University, Xiamen, China*, J. Yu, *Chinese Academy of Sciences, Beijing, China* and X. Zhu, *China-Australia Joint Lab for Functional Nanomaterials, Xiamen, China*

SiGe/Si heterogeneous nanostructures were prepared by electrochemical anodization of SiGe/Si MQWs. Structural and optical properties of the materials were characterized. The origin of the photoluminescence from the heterogeneous nanostructures at room temperature is discussed.

WP2 Intraband Radiative and Nonradiative Transitions of Carriers Confined in Si Nanocrystals, A. Poddubny, A. Prokofiev, A. Moskalenko, S. Goupalov and I. Yassievich, *Russian Academy of Sciences, St Petersburg, Russia*

Silicon quantum dots in silicon oxide matrix are studied.Radiative intraband transition rates of confined carriers are calculated and compared with nonradiative transition rates. A new mechanism of electron nonradiative relaxation is proposed.

WP3 Optical Add-Drop Multiplexer with FSR Higher than 140 nm using Ring Resonators and Photonic Bandgap Structures, J. Garcia, A. Martinez and J. Marti, *Universidad Politécnica de Valencia, Valencia, Spain*

We propose a novel configuration of OADM where its free spectral range is hugely increased to values higher than 140 nm by combining ring resonators with photonic bandgap structures.

WP4 Monitoring Infrared Light using a Commercial Variable Optical Attenuator Subjected to Defect Engineering, A. P. Knights, P. E. Jessop, D. Bruce, D. Logan, *McMaster University, Hamilton, ON, Canada*, B. J. Luff, D. Zheng, R. Shafiiha and M. Asghari, *Kotura, Monterey Park, CA, USA*

The fabrication of silicon-waveguide power monitors via the introduction of defects to commercially produced variable optical attenuators is demonstrated. Devices show an effective quantum efficiency of ~1% for a tapped fraction of signal of 30%.

WP5 Metal-Semiconductor-Metal Ge Photodetectors on SOI Substrates for Near Infrared Wavelength Operation, C. LI, Z. Zhou, Z. Cai, H. Lai and S. Chen, *Xiamen University, Xiamen, China*

Metal-semiconductor-metal Ge photodetectors on SOI substrates operating at 1.3-1.6μm have been demonstrated. Ge films with thin top silicon layer for suppressing dark current were grown on low-temperature buffers by ultra-high vacuum chemical vapor deposition.

WP6 Blue-Light Emission from Crystalline Si/Silica Core/Shell Nanowires, S.-H. Choi, S. Kim, S. W. Hwang, C. O. Kim, *Kyung Hee University, Yongin, Korea*, T. Kim and R. G. Elliman, *Australian National University, Canberra, Australia*

Photoluminescence spectra of crystalline Si/silica core/shell nanwires obtained by annealing Ni-coated Si-rich oxide have two major emission bands in the near UV (381 nm) and blue (435nm) ranges at a Si concentration of 43 %, whilst at 37 %, only blue band is observed.

WP7 Improved Silicon Nanocrystal Photoluminescent Quantum Yields by SF_6 Passivation, R. Liptak and S. Campbell, *University of Minnesota, Minneapolis, MN, USA*

We demonstrate full visible spectrum emission from Si-NCs which were treated by an SF_6 inline passivation process which creates an oxyflouride shell on the surface. PL quantum yields as high as 40% have been achieved.

WP8 Structure and Photoluminescence Comparison of Er_2SiO_5 and Er_2O_3 Prepared by Sol-Gel Method, X. Wang, *University of Electro-Communications, Tokyo, Japan*

Two erbium compound films, Er_2SiO_5 and Er_2O_3 were fabricated by sol-gel method using two kinds of starting sol solutions, respectively, and corresponding structure and photoluminescence properties were studied.

WP9 Crystalline Structure and Luminescence Properties of Er Silicates Fabricated on Si and SiO_2/Si by the Sol-Gel Method, T. Kimura, *University of Electro-Communications, Tokyo, Japan*

Well-ordered Er_2SiO_5 silicates with a fast decay (~10~50μs) of the 1.53μm emission was obtained on Si by sol-gel. In contrast, Er silicates on SiO_2/Si showed different luminescence spectra with a slow fluorescence decay (τ > 100μs).

WP10 Silicon Based Photonic Quantum Dots, K. Chen, S. Chen, B. Qian, X. Zhang, W. Li, J. Xu and X. Huang, *Nanjing University, Nanjing, China*

We use a patterned conformal deposition technique to fabricate Si-based 3D optical microcavities. The size-dependent confined photonic modes were observed when the size is reduced to 1.0 μm which is similar to the quantum effect of electronic states in semiconductor quantum dots.

WP11 Vertical Grating Couplers for Silicon Sandwiched Slot Waveguides, J. V. Galan Conejos, J. Blasco Solves, P. Sanchis Kilders, A. M. Abietar, J. Marti, *Universidad Politécnica de Valencia, Valencia, Spain*, J.-M. Fedeli, E. Jordana, P. Gautier and M. Perrin, *Commissariat à l'Énergie Atomique, Grenoble, France*

Grating couplers for efficient vertical coupling between sandwiched slot waveguides and standard single-mode fibers are demonstrated. 20% coupling efficiency is experimentally measured. Higher coupling efficiency is expected for particular designs according to simulation results.

WP12 Si Wire Optical Waveguide Wavelength Demultiplexer for ONU, H. Okayama, *Oki Electric Industry Co., Ltd., Tokyo, Japan*

We report a compact wavelength demultiplexer design for widely separated wavelengths used in ONU. The Mach-Zehnder lattice interferometeric filter structure is chosen. The large wavelength dispersion of the Si wire waveguide requires special design considerations.

WP13 Polarization Independent Micro-Ring Resonators on Sub-Micron Silicon-on-Insulator (SOI) Rib Waveguides, T. Y. L. Ang, *Nanyang Technological University, Singapore, Singapore,* S.T Lim, C.E Png, *Institute of High Performance Computing, ASTAR, Singapore,* M.K Chin, *Nanyang Technological University, Singapore, Singapore*

Designing polarization independent (PI) ring resonators using submicron waveguides is a challenge as they exhibits strong polarization dependency. We demonstrate theoretically the feasibility of realizing single-mode and PI ring resonator on submicron SOI rib waveguides.

WP14 Influence of Si Crystallization evolution on the Er Luminescence in Superlattices Er:Si /Al_2O_3, J. Wang, *Nanjing University, Nanjing, China*

We report the greatly enhanced Er luminescence at 1.54μm sensitized by Si nanocrystals (nc-Sis) in 20 periods superlattices of Er:Si/Al_2O_3.The Si crystallization evolution makes the optimal luminescence occur under low annealing temperature which is related to the maximum number of nc-Sis.

WP15 Photoluminescence Enhancement of Silicon-rich Silicon Nitride Film Induced by Silver Localized Surface Plasmon, D. Li, P. Cheng and D. Yang, *Zhejiang University, Hangzhou, Zhejiang, China*

The light emission of SRSN films was coupled with the LSP of the Ag island films. Combining with the PL under two wavelengths excitation, excitation spectrum and intensity decay dynamics, it is demonstrated that LSP enhanced excitation is the main cause of the PL enhancement.

WP16 Electroluminescence of Silicon-rich Silicon Nitride Light-Emitting Devices, D. Yang, D. Li and J. Huang, *Zhejiang University, Hangzhou, China*

The EL of light emitting MIS devices fabricated with SRSN films was found originating from the electronic transitions of defect levels. At high and low intensity of electric fields the electrons were injected via Fowler-Nordheim tunneling, trap assisted tunneling and Poole-Frenkel conduction, respectively.

WP17 Free Carrier Lifetime Modification for Silicon Waveguide Based Devices, N. M. Wright, D. Thomson, K. L. Litvinenko, W. R. Headley, A. J. Smith, *University of Surrey, Guildford, Surrey, UK*, A. P. Knights, *McMaster University, Hamilton, ON, Canada*, F. Y. Gardes, G. Z. Mashanovich, R. M. Gwilliam and G. T. Reed, *University of Surrey, Guildford, Surrey, UK*

We investigate the effects of implanting silicon directly into a silicon waveguide to modify carrier lifetime. Experimental results show over 85% reduction in the carrier lifetime for only a small net increase in optical absorption.

WP18 Electro-Luminescence from Un-Doped and Doped Nanocrystilline Si/SiO_2 Multilayers, D. Wei, T. Wang, H. Sun, Y. Liu, D. Chen, J. Xu, Z. Ma and K. Chen, *Nanjing University, Nanjing, China*

Electroluminescence devices based on nanocrystalline Si/SiO_2 multilayers were fabricated and the luminescence can be observed both from vertical and lateral direction. Moreover, P-doped nanocrystalline Si/SiO_2 multilayers were prepared and the improved electro-luminescence characteristics were achieved.

WP19 Intersected Slot Waveguide for Dual Polarized Mode Low-Index Confinement and Its Polarization Conversion, X. Jiang and H. Zhou, *Zhejiang University, Hangzhou, Zhejiang, China*

Intersected slot waveguide is proposed to strongly confine TE and TM modes simultaneously. A pertinent polarization-independent device can be realized by size tuning, or employing the analyzed polarization converter to alternatively treat the polarized modes.

WP20 Low Reflection Double Stage Coupling to Slow Light Waveguides, A. Petrov, J. Hampe and M. Eich, *Technical University of Hamburg-Harburg, Hamburg, Germany*

Efficient coupler is presented for a mode with group velocity 0.02c. First, light is coupled to normal group velocity mode which is then abruptly transformed to slow light mode with reflection intensity less than -20dB.

WP21 Measurement of the Near Infrared Absorption of Ge on Si Films by Differential Spectroscopy, V. Sorianello, A. Perna, L. Colace, G. Assanto, *Università degli Studi Roma Tre, Rome, Italy*, H. C. Luan and L. C. Kimerling, *Massachusetts Institute of Technology, Cambridge, MA, USA*

Using a differential method on epitaxially grown Ge films on silicon, we measure the near-infrared absorption and its temperature dependence.

WP22 SOI Submicron Rib Waveguides: Design, Fabrication and Characterization, X. Xu, S. Chen, Z. Li, Y. Yu and J. Yu, *Chinese Academy of Sciences, Beijing, China*

We present detailed design, fabrication, and characterization issues of submicron rib waveguides based on silicon-on-insulator. The waveguides fabricated by EBL and ICP processes have propagation loss of 1.8dB/mm and bend loss of 0.14dB/90° for bends with radius of 5μm.

WP23 Low Threading-Dislocation-Density Ge Film on Si Grown on a Pitting Ge Buffer Layer, B. Cheng, H. Xue, D. Hu, G. Han, Y. Zeng, A. Bai, C. Xue, L. Luo, Y. Zuo and Q. Wang, *Chinese Academy of Sciences, Beijing, China*

A Ge layer with a pitting surface can be obtained when the growth temperature is lowered to 290°C. On the low temperature Ge buffer layer with pits, high quality Ge layer was grown at 600°C with a threading dislocation density of ~$1x10^5/cm^{-2}$.

WP24 Characteristics of SOI Rib Waveguide Microring and Racetrack Resonators, Q. Huang, X. Xiao, Y. Li, Y. Yu and J. Yu, *Chinese Academy of Sciences, Beijing, China*

Characteristics of microring/racetrack resonators, in submicron SOI rib waveguides, have been investigated. The effects of waveguide dimensions, coupler design, roughness, and oxide cladding are considered. Moreover, guided mode, loss and dispersion of such waveguides are analyzed.

WP25 Fabrication Method of silicon Nanostructures by Anisotropic Etching, W. Han, X. Yang, Y. Wang, F. Yang and J. Yu, *Chinese Academy of Sciences, Beijing, China*

A fabrication method of silicon nanostructures is presented. Silicon nanowire, shift-line structure and islands have been successfully fabricated on SOI wafer using e-beam lithography and anisotropic etching technique.

WP26 1.5 μm Light Emission from Er-doped SiO_x with Widegap Carrier Injection Layers, S. Soneda, T. Minami, K. Ito, A. Kotake, S. Nakano, Y. Naka, *Kumamoto University, Kumamoto, Japan*, N. Yamamoto, M. Tsuchiya, *National Institute of Information and Communications Technology, Tokyo, Japan* and Y. Nakamura, *Kumamoto University, Kumamoto, Japan*

We have observed room-temperature 1.5μm-infrared electroluminescence from a silicon suboxide-based p-i-n heterostructure: N-SnO_2 / Er-doped SiO_x / P-GaN. The N-SnO_2 and P-GaN layers are introduced as efficient current-injection layers of wide bandgaps.

WP27 Fabrication of High-Speed Optical Modulator by Hybridization of Silicon Waveguide and Organic Polymer, M. Uenuma, H. Nojima and T. Motooka, *Kyushu University, Fukuoka, Japan*

We designed a high speed and low power all-optical modulator by hybridizing organic materials and a silicon waveguide on silicon-on-insulator substrates. A prototype device was fabricated and its feasibility was confirmed in low speed modulation.

WP28 Spot-Size Converters for a Two-Port Single-Mode Fiber-Silicon Wire Waveguide Coupler Module, H. Yoda, K. Shiraishi, A. Ohshima, T. Ishimura, H. Tsuchiya, *Utsunomiya University, Utsunomiya, Tochigi, Japan* and C. S. Tsai, *University of California - Irvine, Irvine, CA, USA*

The performance of a single-mode fiber-silicon wire waveguide coupler module which utilizes an identical spot-size converter (SSC) at the input and output ports is reported. The structural parameters of the SSCs were designed for compactness and relaxed tolerance to fabrication errors.

WP29 Intense Green Light Emission From Low Temperature Grown SiNO Complex System, K. Chen, H. Dong, R. Huang, D. Wang, W. Li, Z. Ma, J. Xu and X. Huang, *Nanjing University, Nanjing, China*

We report intense green photoluminescence from amorphous oxidized silicon nitride film (a-SiN:O). A-SiN:O light-emitting devices of green-yellow color are successfully fabricated. Notably, EL efficiency can be significantly enhanced by modulating Si/N ratio in luminescent active layer.

WP30 Investigation of Silicon–Germanium Metal-Oxide-Semiconductor Field-Effect Transistors Grown by Laser-assisted Plasma-Enhanced Chemical Vapor Deposition, C.-T. Lee, J.-G. Lin and H.-Y. Lee, *National Cheng Kung University, Tainan, Taiwan, R.O.C.*

SiGe based metal-oxide-semiconductor field-effect transistors (MOSFETs) were fabricated, in which the SiGe channel layer was deposited by using laser-assisted plasma-enhanced chemical vapor deposition (LAPECVD) system. The characteristics were compared with the device without laser assistance.

WP31 High Speed Ge Photodetector Integrated on Silicon-on-Insulator Operating at Very Low Bias Voltage, J. Osmond, G. Isella, D. Chrastina, *Politecnico di Milano, Como, Italy*, R. Kaufmann, *Centre Suisse d'Electronique et de Microtechnique, Zürich, Switzerland* and H. von Kaenel, *Politecnico di Milano, Como, Italy*

Experimental results of Ge/Si heterojunctionphotodetectors of 2 GHz bandwidth operating at very low biasvoltage and fabricated from epitaxial Ge grown on Si and SOIsubstrates by low-energy plasma-enhanced CVD are reported.

WP32 Experimental Characterization of Mach-Zehnder Interferometers with Coupled Ring Resonators in Silicon Nanocrystals Horizontal Slot Waveguides, J. Blasco Solves, J. M. M. Martinez, M. Soria, J. Marti, *Universidad Politécnica de Valencia, Valencia, Spain*, R. Spano, L. Pavesi, *University of Trento, Povo, Italy*, J.-M. Fedeli, E. Jordana, P. Gautier, *Commissariat à l'Énergie Atomique, Grenoble, France* and A. Martinez, *Universidad Politécnica de Valencia, Valencia, Spain*

We report the fabrication and characterization of both symmetric and asymmetric Mach-Zehnder interferometers (MZIs) with ring resonators (RRs) coupled to both MZI arms using Silicon nanocrystals horizontal slot waveguides. Observed transmission dips are due to both MZI destructive interference and resonances of the coupled RRs.

WP33 All-Optical Ultra-Compact Photonic Crystal Controllable Logic Gate Based on Nonlinear Ring Resonator, P. Andalib and N. Granpayeh, *K.N.Toosi University of Technology, Tehran, Iran*

In this paper we propose an all-optical photonic crystal controllable logic gate based on nonlinear ring resonator. Simulation and analysis have been done by finite difference time domain and plane wave expansion method.

WP34 Reducing the Free-Carrier Lifetime in Silicon Waveguides by Controlled Au Doping, A. Gajda, *Technical University Berlin, Berlin, Germany*, J. Mueller, *Technical University of Hamburg-Harburg, Hamburg, Germany*, O. Nobis, J. Bruns, I. Giuntoni, *Technical University Berlin, Berlin, Germany*, M. Krause, H. Renner, *Technische Universität Hamburg-Harburg, Hamburg, Germany*, K. Petermann, *Technical University Berlin, Berlin, Germany* and E. Brinkmeyer, *Technische Universität Hamburg-Harburg, Hamburg, Germany*

We show a reduction of the free-carrier lifetime insilicon-on-insulator waveguides as a result of gold doping. Linear losses as well as temporal carriers recombination processes have been measured at different doping levels.

Thursday, 18 September 2008

08.30 - 10.30

Session ThA: PHOTODETECTORS
Session Chair: Dan-Xia Xu, *National Research Council, Ottawa, ON, Canada*

ThA1 08.30 - 09.00 (Invited)

Waveguide-Integrated Si Nano-Photodiode with Surface-Plasmon Antenna and Its Application to On-Chip Optical Clock Signal Distribution, J. Fujikata, K. Nose, J. Ushida, K. Nishi, M. Kinoshita, T. Shimizu, T. Ueno, D. Okamoto, A. Gomyo, M. Mizuno, *MIRAI-Selete, Tsukuba, Ibaraki, Japan*, T. Tsuchizawa, T. Watanabe, K. Yamada, S.-I. Itabashi, *NTT Corporation, Atsugi, Kanagawa, Japan* and K. Ohashi, *MIRAI-Selete, Tsukuba, Ibaraki, Japan*

We developed a waveguide-integrated Si nano-photodiode with a surface plasmon antenna for on-chip optical interconnections. By using this technology, we fabricated a prototype of an LSI on-chip optical clock system and demonstrated 5 GHz of optical clock circuit operation connected with a 4-branching H-tree structure.

ThA2 09.00 - 09.15

Low Dark-Current Ge Photodiodes on Si Without Post-Growth Annealing, S. Park, S. Takita, Y. Ishikawa, J. Osaka and K. Wada, *University of Tokyo, Tokyo, Japan*

We demonstrated as-grown Ge p-i-n photodiode on Si with low dark current (~10mA/cm^2) and comparable responsivity. We believe that this is attributed to use of Si-cap layer on Ge and shallow ion-implantation of phosphorous into Si-cap.

ThA3 09.15 - 09.30

Waveguide Coupled Ge-on-Oxide Photodetectors for Integrated Optical Links, M. Reshotko, B. A. Block, B. Jin and P. Chang, *Intel Corporation, Hillsboro, OR, USA*

We demonstrate Ge MSM photodetectors with responsivities of 0.9 A/W at 1310 nm and capable of data rates of 20 Gb/s. Direct Ge on oxide deposition makes these photodetectors potentially suitable for CMOS back-end optical links.

ThA4 09.30 - 09.45

42 GHz Waveguide Germanium-on-Silicon Vertical PIN Photodetector, L. Vivien, D. Marris-Morini, *Institut d'Electronique Fondamentale, Orsay, France*, J. Mangeney, *Université Paris 11, Orsay, France*, P. Crozat, E. Cassan, S. Laval, *Institut d'Electronique Fondamentale, Orsay, France*, J.-M. Fedeli, J.-F. Damlencourt and Y. Lecunff, *Commissariat à l'Énergie Atomique, Grenoble, France*

High speed, high responsivity and reliable CMOS compatible photodetectors are key elements for low cost telecommunications systems at 1.55µm. A 42 GHz germanium on silicon vertical PIN photodetector integrated in SOI waveguide is presented.

ThA5 09.45 - 10.00

Ge on Si p-i-n Photodetectors with 40 GHz Bandwidth, S. Klinger, W. Vogel, M. Berroth, M. Kaschel, M. Oehme and E. Kasper, *University of Stuttgart, Stuttgart, Germany*

Germanium photodiodes grown on a silicon substrate are characterized for various diameters and thicknesses of the active absorption region. High frequency measurements using a vector network analyzer are reported for frequencies up to 45 GHz showing a record bandwidth of 40 GHz.

ThA6 10.00 - 10.15

35 GHz Ge p-i-n Photodetectors Implemented Using RPCVD, D. Suh, S. Kim, J. Joo, G. Kim and I. G. Kim, *Electronics & Telecommunications Research Institute, Daejeon, Korea*

Vertical Ge photodetectors were fabricated on silicon using RPCVD showing bandwidth of 35 GHz at -3 V, dark current of 30 nA, and responsivity of 0.47 A/W for 20 µm-diameter detectors.

ThA7 10.15 - 10.30

Ge/SiGe Multiple Quantum Wells for Optical Applications, D. Chrastina, *Politecnico di Milano, Como, Italy*, A. Neels, *University of Neuchatel, Neuchatel, Switzerland*, M. Bonfanti, *Universita' Degli Studi di Milano Bicocca, Milano, Italy*, M. Virgilio, *University of Pisa, Pisa, Italy*, G. Isella, *Politecnico di Milano, Como, Italy*, E. Grilli, M. Guzzi, *Universita' Degli Studi di Milano Bicocca, Milano, Italy*, G. Grosso, *University of Pisa, Pisa, Italy*, H. Sigg, *Paul Scherrer Institute, Villigen, Switzerland* and H. von Kaenel, *Politecnico di Milano, Como, Italy*

High-quality $Ge/_{0.15}Ge_{0.85}$ multiple quantum wells have been grown by low-energy plasma-enhanced chemical vapor deposition. Structural and optical properties have been measured by x-ray diffraction, optical transmission, photoluminescence and photocurrent experiments.

10.30 - 11.00 COFFEE BREAK

11.00 - 13.00

Session ThB: Waveguides
Session Chair: Andrew P. Knights, *McMaster University, Hamilton, ON, Canada*

ThB1 11.00 - 11.15

Phase and Group Birefringence of Silicon Waveguides, T. Pagel, S. Gäde, M. Krause, H. Renner and E. Brinkmeyer, *Technische Universität Hamburg-Harburg, Hamburg, Germany*

Experimental data of phase and group birefringence are presented for numerous SOI waveguides. The measurements are enabled by a novel easily surveyed analysis of the magnetooptic determination method and allow for spatially resolved evaluation.

ThB2 11.15 - 11.30

Spot-Size Converters for Rib-Type Silicon Photonic Wire Waveguides, T. Tsuchizawa, K. Yamada, T. Watanabe, H. Fukuda, H. Nishi, H. Shinojima and S.-I. Itabashi, *NTT Corporation, Atsugi, Kanagawa, Japan*

We developed spot-size converters to efficiently connect a rib-type silicon photonic wire waveguide with an optical fiber. The coupling loss per connection is reduced from 7.5 dB to about 0.7dB by the spot-size converter.

ThB3 11.30 - 11.45

Focusing Polarization Diversity Gratings for Silicon-on-Insulator Integrated Circuits, F. van Laere, W. Bogaerts, P. Dumon, G. Roelkens, D. J. Van Thourhout and R. G. Baets, *Ghent University, Gent, Belgium*

We present experimental results for focusing grating couplers for coupling between optical fiber and nanophotonic Silicon-on-Insulator waveguides in polarization diversity configuration. The footprint is reduced by a factor of 8 compared to standard grating couplers.

ThB4 11.45 - 12.00

Monolithic Integration of Three-Dimensional Multimode Interference Couplers with Silicon Photonic Wires via Self-Profile Transformation, W.-C. Chiu, C.-Y. Lu and M.-C. M. Lee, *National Tsing Hua University, Hsinchu, Taiwan, R.O.C.*

A novel 3-D MMI coupler with silicon photonic wires is demonstrated using self-profile transformation for the first time. The preliminary simulation results show the low excess loss of 0.27 dB.

ThB5 12.00 - 12.15

SOI based 2×2 and 4×4 Waveguide Couplers - Evolution from DPSK to DQPSK, K. Voigt, L. Zimmermann, G. Winzer and K. Petermann, *Technical University Berlin, Berlin, Germany*

We compare 2×2 and 4×4 multi-mode interference (MMI) couplers with respect to performance of D(Q)PSK-demodulators. We shall provide simulation and experimental data of MMI-devices realized in 4µm silicon-on-insulator (SOI) rib waveguide technology.

ThB6 12.15 - 12.30

Er^{3+} Coupled to Si Nanoclusters Rib Waveguides, A. Pitanti, D. Navarro-Urrios, R. Guider, N. Daldosso, *University of Trento, Povo, Italy*, L. Khomenkova, F. Gourbilleau, *École Nationale Supérieure d'Ingénieurs de Caen, Caen, France*, C. J. J. Oton, W. Loh, *University of Southampton, Southampton, UK*, R. Rizk, *École Nationale Supérieure d'Ingénieurs de Caen, Caen, France*, O. Jambois, B. Garrido, *University of Barcelona, Barcelona, Spain* and L. Pavesi, *University of Trento, Povo, Italy*

Er doped nano-Si system has been optimised in terms of photoluminescence intensity and lifetime. Reduction of carrier absorption losses and increasing of the number of Er ions coupled to Si-nc (around 25%)have been achieved.

ThB7 12.30 - 12.45

High Quality Coupled Ring Resonators Based on Silicon Clusters Slot Waveguide, Y. Lebour, *University of Barcelona, Barcelona, Spain*, R. Guider, *University of Trento, Trento, Italy*, E. Jordana, J.-M. Fedeli, *Commissariat à l'Énergie Atomique, Grenoble, France*, P. Pellegrino, S. Hernandez, B. Garrido, *University of Barcelona, Barcelona, Spain*, N. Daldosso and L. Pavesi, *University of Trento, Povo, Italy*

High Q factor ring resonators based on Si clusters sandwich slot-waveguide structure have been fabricated by standard DUV lithography. These devices are considered an important step towards the demonstration of an all optical logic gate.

ThB8 12.45 - 13.00

Box-Shaped and A-Shaped Low-Loss Waveguides in Si_3N_4/SiO_2 TriPleX Technology, F. Morichetti, *CORECOM, Milano, Italy*, A. Melloni, *Politecnico di Milano, Milano, Italy*, M. Martinelli, *Politecnico di Milano - CoreCom, Milan, Italy*, A. Leinse, D. H. Geuzebroek and R. G. Heideman, *LioniX BV, Enschede, The Netherlands*

Dielectric waveguides with a box-shaped and an A-shaped cross-section realized in the emerging Si_3N_4/SiO_2 TriPleX technology are experimentally compared. Box-shaped waveguides offer the best compromise between low loss, low polarization-dependent loss and low birefringence.

13.00 - 14.30 **LUNCH BREAK**

14.30 - 16.30

Session ThC: Silicon Nanophotonics and Photonic Crystals
Session Chair: Philippe M. Fauchet, *University of Rochester, Rochester, NY, USA*

ThC1 14.30 - 15.00 (Invited)

Silicon Integrated Nanophotonics for On-Chip Optical Interconnects, Y. A. Vlasov, W. M. J. Green, S. Assefa, J. Van Campenhout, Y.-H. Kim and F. Xia*, IBM Research, Yorktown Heights, NY, USA*

As multi-core microprocessor architectures continue to evolve as a promising platform for high-performance computing, an additional set of challenges emerges for the global interconnects between distant cores.

ThC2 15.00 - 15.15

Theoretical and Experimental Studies of an Ultra-compact Photonic Crystal Corner Mirror Based on Silicon-On-Insulator, J. Yu, H. Yu, Y. Zhu and Y. Yu*, Chinese Academy of Sciences, Beijing, China*

An ultra-compact silicon-on-insulator based photonic crystal corner mirror is designed and optimized. A sample is then successfully fabricated with extra losses 1.1±0.4dB for transverse-electronic (TE) polarization for wavelength range of 1510-1630nm.

ThC3 15.15 - 15.30

Whispering-Gallery Modes and Purcell Effect in a Si-Nanocrystal-Based Single Microdisk Resonator, M. Ghulinyan*, Fondazione Bruno Kessler - Irst, Povo Trento, Italy*, D. Navarro-Urrios*,* A. Pitanti*, University of Trento, Trento, Italy*, A. Lui, G. Pucker*, Fondazione Bruno Kessler - Irst, Trento, Italy* and L. Pavesi*, University of Trento, Povo, Italy*

We report on visible light WGM emission and time-resolved studies of Purcell enhancement from Si-nanocrystal-based all-active microdisk resonators. The observed significant, 13-fold mode narrowing (Q~2800) at lowest excitation powers is attributed to the attenuation of pump-induced excited carrier absorption loss mechanism.

ThC4 15.30 - 15.45

Slotted Photonic Crystal Waveguides and Cavities for Slow Light and Sensing Applications, A. Di Falco*,* L. O' Faolain and T. F. Krauss*, University of St. Andrews, St. Andrews, Fife, UK*

We present experimental evidence of light guiding and confinement in suspended slotted Photonic Crystal waveguides and cavities, where light is confined in extremely small air volumes, for slow light and chemical sensing applications.

ThC5 15.45 - 16.00

Delivery of Photons Generated in Silicon Photonic Crystal Nano-Cavity Through Lateral Waveguide, D. F. Dorfner*, Technical University of Munich, Garching, Germany*, S. Iwamoto, M. Nomura, S. Nakayama*, University of Tokyo, Tokyo, Japan*, J. J. Finley, G. Abstreiter*, Technical University of Munich, Garching, Germany* and Y. Arakawa*, University of Tokyo, Tokyo, Japan*

We demonstrate light transmission from a photonic crystal nano-cavity into a planer photonic crystal waveguide. Enhanced photo-luminescence at a cavity resonant wavelength is observed from the cleaved facet of a waveguide with strong position dependence.

ThC6 16.00 - 16.15

Local Infiltration of Individual Pores with Dyes in 2D Macroporous Silicon Photonic Crystals, P. W. Nolte*,* D. Pergande, S. L. Schweizer*,* R. B. Wehrspohn*, Martin-luther University Halle-Wittenberg, Halle, Germany*, M. Geuß, M. Steinhart*, Max Planck Institute for Microstructure Physics, Halle, Germany* and R. Salzer*, Fraunhofer-Institut, Halle, Germany*

We present an experimental technique to infiltrate individual pores, of 2D makroporous Silicon PhC with different dyes. For the experiments we use focused ion beam technique, electrochemical deposition of gold and WASTE infiltration technique.

ThC7 16.15 - 16.30

Box-like Filter Response of Two-Dimensional Array of Microring Resonator Fabricated in Silicon-on-Insulator Technology, L. Y. Tobing*, Nanyang Technological University, Singapore*, P. Dumon, R. G. Baets*, Ghent University, Gent, Belgium* and M.-K. Chin*, Nanyang Technological University, Singapore*

We show theoretically and experimentally that a box-like filter response can be obtained using complementary photonic bandgap properties in the row and columns of two-dimensional microring resonator array. The filter has usable bandwidth of 500 to 750GHz, and rejection ratio of 25dB.

16.30 - 17.00 **COFFEE BREAK**

17.00 - 18.30

Session ThD: Nonlinear Effects in Silicon (Phologic sponsored session)
Session Chair: Kazumi Wada, *University of Tokyo, Tokyo, Japan*

ThD1 17.00 - 17.30 (Invited)

Nonlinear Optics in Si Wires on an SOI Platform, R. M. Osgood, O. Chen, A. Hsieh, J. I. Dadap, *Columbia University, New York, NY, USA*, N. C. Panoiu, *University College London, London, UK*, X. Liu, *Columbia University, New York, NY, USA*, W. M. J. Green and Y. A. Vlasov, *IBM Research, Yorktown Heights, NY, USA*

We discuss measurement of the nonlinear-optical properties of Si-wire waveguides and the design of these wires for use in on-chip waveguide applications.

ThD2 17.30 - 18.00 (Invited)

All-Optical Switching Employing High Confinement Waveguides and Silicon Nano-Crystals, J. Marti, *Universidad Politécnica de Valencia, Valencia, Spain*

In this work, several building blocks to perform all-optical switching on silicon are addressed. The technical approach is based on exploiting the non-linear properties of silicon nanocrystals embedded in slot waveguides, in which propagating light is highly confined.

ThD3 18.00 - 18.15

Enhanced Nonlinear Self-Phase Modulation in Engineered Slow Light Silicon Photonic Crystal Waveguides, C. Monat, B. Corcoran, C. Grillet, B. J. Eggleton, *CUDOS, University of Sydney, Sydney, NSW, Australia*, T. P. White, L. O'Faolain and T. F. Krauss, *University of St. Andrews, St. Andrews, Fife, UK*

We demonstrate enhanced self-phase modulation through short dispersion-engineered slow light silicon photonic crystal waveguides using picosecond pulses. The measurements are supported by simulations, highlighting the simultaneous reinforcement of nonlinear absorption and free carriers.

ThD4 18.15 - 18.30

Nonlinear Properties of Silicon Nanocrystals at 1550 nm and Their Application in Slot Waveguides, R. Spano, *University of Trento, Povo, Italy*, L. Tartara, J. Yu, V. Degiorgio, *University of Pavia, Pavia, Italy*, E. Jordana, J.-M. Fedeli, *Commissariat à l'Énergie Atomique, Grenoble, France*, P. Sanchis Kilders, J. Marti, *Universidad Politécnica de Valencia, Valencia, Spain* and L. Pavesi, *University of Trento, Povo, Italy*

The nonlinear refractive index of Silicon nanocrystals was measured by the z-scan technique. The results were used to estimate the magnitude of the self-phase modulation (SPM) effect in slot waveguide structures filled by Silicon nanocrystals.

18.30 - 20.30

Session ThP: Poster Session II

ThP1 Optical Add/Drop Filter Based on Dual Curved Photonic Crystal Resonator, P. Andalib and N. Granpayeh, *K.N.Toosi University of Technology, Tehran, Iran*

In this paper we propose a novel ultra compact photonic crystal resonator and investigate add/drop filter based on it. Simulation and analysis have been done by finite difference time domain and plane wave expansion method.

ThP2 Substrate Orientation and Alloy Composition Effects in n-type SiGe Quantum Cascade Structures, A. Valavanis, Z. Ikonic, L. J. M. Lever, C. A. Evans and R. W. Kelsall, *University of Leeds, Leeds, UK*

We show using a theoretical self-consistent effective mass/rate equation approach that n-type SiGe-based quantum cascade lasers are potentially made viable by either using the (111) orientation or a Ge-rich substrate.

ThP3 Athermal Silicon Arrayed Waveguide Grating with Polymer-Filled Slot Structure, X. Wang, S. Xiao, W. Zheng, F. Wang, Y. Hao, X. Jiang, M. Wang and J. Yang, *Zhejiang University, Hangzhou, Zhejiang, China*

An athermal silicon arrayed waveguide grating with a polymer-filled slot structure is proposed. By carefully controlling the temperature dependence of the effective index of the polymer-filled slot waveguides, a center wavelength shift of lower than 1.4 pm/°C is achieved.

ThP4 The Power Conversion Efficiency of Visible Light Emitting Devices in Standard BiCMOS Processes, P. Kuindersma, *NXP Semiconductors, Leuven, Belgium*, T. Hoang, J. Schmitz, *University of Twente, Enschede, The Netherlands*, M. N. Vijayaraghavan, *NXP Semiconductors, Leuven, Belgium*, M. Dijkstra, *NXP Semiconductors, Eindhoven, The Netherlands*, W. van Noort, *NXP Semiconductors, Fishkill, NY, USA*, T. Vanhoucke, *NXP Semiconductors, Leuven, Belgium*, W. Peters, *NXP Semiconductors, Nijmegen, The Netherlands* and M. Kramer, *NXP Semiconductors, Leuven, Belgium*

We present experimental and theoretical proof for a single and unique relationship between the breakdown voltage and power efficiency of visible light emitting devices fabricated in standard BiCMOS processes.

ThP5 Silicon Photonic Wires Using Contact Lithography, O. Horn, J. Mueller, T. Lipka and J. Amthor, *Technical University of Hamburg-Harburg, Hamburg, Germany*

In this paper a simple contact lithography with i-line or DUV is used for the production of photonic wires, which are additonally smoothed and shrunk by thermal oxidation.

ThP6 Silicon-Waveguide Duplexers using Nonreciprocal Raman Gain, M. Krause and E. Brinkmeyer, *Technische Universität Hamburg-Harburg, Hamburg, Germany*

Using the Raman-gain nonreciprocity in silicon waveguides, an isolating duplexer has been designed that protects the transmitter from a same-wavelength return signal, while routing the latter to a detector and pre-amplifying it.

ThP7 The Elasto-Optic and the Thermo-Optic Effect in Silicon Nanowires, J. Amthor, O. Horn, T. Lipka and J. Mueller, *Technical University of Hamburg-Harburg, Hamburg, Germany*

The elasto-optic and the thermo-optic effect in silicon nanowires is demonstrated using Mach-Zehnder-Interferometers. The nano wires are placed on undercut SiO_2 membranes which can be deflected electrostatically.

ThP8 Size Distribution of Silicon Nanoclusters Determined by Transmission Electron Microscopy, C. Mokry, P. Simpson, *University of Western Ontario, London, ON, Canada* and A. P. Knights, *McMaster University, Hamilton, ON, Canada*

Silicon nanoclusters were formed in SiO_2 by ion implantation and annealing. Transmission Electron Microscopy (TEM) images were used to investigate their size distribution as a function of depth in the oxide film.

ThP9 Sputtered Ge/Si Heteroepitaxial Thin Films for Photodetection in Third Window, M. Fere, M. Lanata, D. Piccinin, S. M. Pietralunga, *CORECOM, Milano, Italy*, A. Zappettini, *IMEM-CNR, Parma, Italy,* P. M. Ossi and M. Martinelli, *Politecnico di Milano, Milano, Italy*

DC-Pulsed Magnetron Sputtering (PMS) allows to produce heteroepitaxial p-type Germanium thin films on 6"Silicon wafers. Integrated p-n photodiodes, based on DC-PMS deposited Ge/Si heterojunctions, feature flatresponsivity over the whole third communication window.

ThP10 Design of GeSiSn/Ge Quantum Cascase Laser, G. Sun, *University of Massachusetts Boston, MA, USA*, J. B. Khurgin, *Johns Hopkins University, Baltimore, MD, USA*, J. Menéndez, *Arizona State University, Tempe, AZ, USA* and R. Soref, *US Air Force Research Laboratory, Hanscom AFB, MA, USA*

We design a lattice-matched Ge/GeSiSn quantum cascade laser emitting at 49 μm. This particular alloy composition gives a "clean" conduction band offset of 150meV at L-valleys with all other energy valleys sitting higher in energy.

ThP11 Effect of Electron-Beam Irradiation on the Formation of Nanocrystalline Si in Al-Added Amorphous Si Films, J.-H. Shim, N.-H. Cho, *Inha Universi* *Korea Basic Science Institute, Taejon, Korea* and E.-H. Lee, *Inha University, Incheon, Korea*

CANCELLED

Si nanocrystallites of ~ 1 [illegible] Si films by the irradiation of a focused electron-beam; the activation energy for the nucleation of Si crystallites was measured to be 0.8 ± 0.13 eV.

ThP12 Design, Fabrication, and Characterization of an α-Si:H/α-SiCN Multistack Waveguide for Electro Optical Modulation, S. Rao, F. G. Della Corte, *Università "Mediterranea" di Reggio Calabria, Reggio Calabria, Italy*, C. Summonte, *Institute for Microelectronics And Microsystems, Bologna, Italy,* and F. Suriano, *Università "Mediterranea" di Reggio Calabria, Reggio Calabria, Italy*

Electro-optical absorption in α-Si:H/α-SiC_xN_y multilayers has been studied in three different planar multistack waveguides realized by PECVD technology. Light absorption is induced at λ=1.55μm by carrier accumulation through the application of electric field across the multiple insulator/semiconductor device.

ThP13 Defect Modes in Microring Resonator Arrays Fabricated in Silicon-on-Insulator Technology, L. Y. Tobing, *Nanyang Technological University, Singapore,* P. Dumon, R. G. Baets, *Ghent University, Gent, Belgium* and M.-K. Chin, *Nanyang Technological University, Singapore*

We show experimentally the existence of defect modes in mutually coupled microring resonator array fabricated in silicon-on-insulator technology. The movements of donor-like and acceptor-like modes are demonstrated for various defect lengths and in a good agreement with earlier theoretical prediction.

ThP14 Numerical Survey on Bragg Reflectors in Silicon-on-Insulator Waveguides, I. Giuntoni, *Technical University Berlin, Berlin, Germany*, M. Krause, H. Renner, *Technische Universität Hamburg-Harburg, Hamburg, Germany*, J. Bruns, A. Gajda, *Technical University Berlin, Berlin, Germany*, E. Brinkmeyer, *Technische Universität Hamburg-Harburg, Hamburg, Germany* and K. Petermann, *Technical University Berlin, Berlin, Germany*

We present a numerical survey of wavelength-selective Bragg reflectors in silicon-on-insulator waveguides. By an appropriate choice of grating period, duty cycle, etch depth and grating length, usable gratings can be designed.

ThP15 X-ray Spectroscopy Studies of Luminescent Si-based Materials, T. R. Roschuk, P. Wilson, J. Li, J. Wojcik and P. Mascher, *McMaster University, Hamilton, ON, Canada*

X-ray based spectroscopies have been used to study nanocluster formation and luminescence in silicon oxynitride-based materials. For a luminescent Ce-doped silicon oxide details of the local chemical environment of the Ce atoms has been obtained.

ThP16 The Complete Bandgap in Ring-Shaped Photonic Crystal SOI Slab, R. Hao, *Huazhong University of Science and Technology, Wuhan, Hubei, China*, H. Kurt, *TOBB University of Economics and Technology, Ankara, Turkey*, D. S. Citrin, *Georgia Institute of Technology, Atlanta, GA, USA* and Z. Zhou, *Peking University, Beijing, China*

Ring shaped photonic crystals on SOI slab are studied aiming to search for large complete band gap. A gap to mid-gap ratio of 7% is successfully obtained.

ThP17 GaAs-Ge Materials Integration for Electronic and Photonic Applications, C. K. Chia, A. Sridhara, M. Suryana, *Institute of Materials Research & Engineering, Singapore*, J. R. Dong, *Chinese Academy of Science, Suzhou, Jiangsu, China*, B. Z. Wang, G. K. Dalapati and D. Z. Chi, *Institute of Materials Research & Engineering, Singapore*

An ultrathin AlAs interlayer is introduced at the GaAs/Ge interface to block the interdiffusion of Ga, As and Ge atoms. The high crystal quality GaAs/Ge will find applications in multijunction photovoltaics, metal-oxide-semiconductor-field-effect-transistors and avalanche photodiodes.

ThP18 A Compact Slot Waveguide Directional Coupler-Based Silicon-on-Insulator Polarization Splitter, Y.-F. Ma and D.-W. Huang, *National Taiwan University, Taipei, Taiwan*

A slot waveguide directional coupler-based polarization splitter designed on SOI platform is proposed and analyzed. The geometry of the slot waveguide directional coupler allows significant birefringence for the polarization splitting to be achieved in 30 microns with a suitable design.

ThP19 Ultra Broadband SOI Binary Blazed Grating Mirror, H. Wu, Y. Wang, J. Feng, Y. Chen, J. Hou, D. Gao, *Huazhong University of Science and Technology, Wuhan, Hubei, China,* and Z. Zhou*, Peking University, Beijing, China*

A novel SOI grating mirror based on thin binary blazed grating layer is presented. The binary blazed grating mirror (BBGM) has the characteristics of ultra broadband reflection spectrum, high reflectivity and large angular tolerances.

ThP20 Low Loss Sharp Bend for Silicon Nanophotonic Slow-Light Waveguide, H. Yi, Y. Wang, J. Feng, Y. Chen, *Huazhong University of Science and Technology, Wuhan, Hubei, China,* and Z. Zhou*, Peking University, Beijing, China*

A low loss sharp bend is proposed and analyzed in the slow-light waveguide which is consisted of a series of silicon nanopillars. More than 90% of transmission over 100nm bandwidth is obtained.

ThP21 Improved Quality Factor of a Silicon Micro-Ring Resonator for WDM Filter Application, H.-S. Lee and E.-H. Lee*, Inha University, Incheon, Korea*

We report on the design of a silicon micro-ring resonator for improved quality factor for optical filter applications by controlling the geometry of the resonator.

ThP22 Design of Compact Silicon Optical Modulator Using Photonic Crystal MZI Structure, T.-Y. Han, H.-S. Lee and E.-H. Lee*, Inha University, Incheon, Korea*

We designed a compact silicon optical modulator using Photonic Crystal (PhC) Mach-Zehnder interferometer (MZI), where we reduced the length of the modulator by using slow light phenomenon which causes effective phase difference in the MZI.

ThP23 Amorphous Silicon Spot-Size Converters Fabricated with a Shadow Mask, T. Lipka*,* A. Harke*,* O. Horn, J. Amthor, J. Mueller and M. Krause*, Technische Universität Hamburg-Harburg, Hamburg, Germany*

A rib-like spot-size converter was fabricated with a KOH etched shadow mask. The improvement in coupling and an expansion of the spot-size were evaluated with simulations andconfirmed by transmission loss measurements.

ThP24 Group Velocity Dispersion in Horizontal Slot Waveguides Filled by Si Nanocrystals, R. Spano*, University of Trento, Povo, Italy*, J. V. Galan Conejos, P. Sanchis Kilders, A. Martinez, J. Marti*, Universidad Politécnica de Valencia, Valencia, Spain,* and L. Pavesi*, University of Trento, Povo, Italy*

A study of group velocity dispersion of horizontal slot waveguides filled by Si nanocrystals with different Silicon concentrations has revealed a change in the sign of GVD from negative to positive values across the third telecom window.

ThP25 Optoelectronic Effect of High-Pressure Water Vapor Annealing for Nanocrystalline Silicon Films Prepared by Ion Implantation, B. J. Gelloz, A. Takeuchi and N. Koshida*, Tokyo University of Agriculture and Technology, Tokyo, Japan*

Nanocrystalline Si quantum dots were introduced in SiO_2 and Si_3N_4 layers by ion implantation followed by annealing. Their optoelectronic characteristics were much improved by a significant reduction of defects as in the case of nanocrystalline materials prepared by wet processing.

ThP26 Thermal Emission Properties of 2D and 3D Silicon Photonic Crystals, B. Gesemann*,* S. L. Schweizer and R. B. Wehrspohn*, University of Halle-Wittenberg, Halle, Germany*

We present measurements of the thermal emission properties of 2D and 3D silicon photonic crystals heated resistively with and without substrate. The Out-of-plane emission properties were recorded and compared to numerical simulation.

ThP27 Crosstalk Reduction of Silicon Nanowire AWG with Shallow-Etched Grating Arms, D.-J. Kim*, Electronics & Telecommunications Research Inst., Daejeon, Korea*

The grating arms composed of silicon nanowires were shallow-etched to reduce the random phase error caused by the core width fluctuation. A fairly improved crosstalk value of 18 dB was achieved in the arrayed-waveguide grating with the on-chip loss of 3 dB.

ThP28 Modeling Direct Modulation Dynamics in Silicon Nanocrystal Light Emitting Transistors, J. Carreras and B. Garrido*, University of Barcelona, Barcelona, Spain*

We model light modulation from silicon nanocrystal MOSFETs. It is found that an ideal silicon nanocrystal embedded in a defect-free SiO_2 must have an intrinsic absorption cross-section of about 10^{-12} cm^2, which means that there is still a wide margin for electrical injection optimization.

ThP29 Design, Fabrication, and Characterization of a 1D Microcavity for Enhanced Luminescence from Silicon Nanocrystals, B. Redding and D. W. Prather*, University of Delaware, Newark, DE, USA*

We present the design of a 1D microcavity with an active silicon nanocrystal (Si-nc) region for enhanced photo- and electro-luminescence. Microcavity enhanced photoluminescence is realized experimentally and incorporation with a presented electroluminescent structure is discussed.

ThP30 Ultra Compact Photonic Crystal Modulator based on Silicon Nano-Pillar Array Filled with Functional Polymer, X. Wang*, Omega Optics Inc., Austin, TX, USA* and R. T. Chen*, University of Texas at Austin, Austin, TX, USA*

We present the optical design of the photonic crystal modulator based on silicon nano-pillar array filled with functional polymer. The device will achieve an ultra compact size and sub-volt driving voltage with the slow-photon effect.

ThP31 Green, Self-Luminescent Tb^{3+} Doped Silicon Oxy-Nitride Microdisk on Si Chip for Biosensor Applications, H. Jeong, J. H. Shin, *Korea Advanced Institute of Science and Technology, Daejeon, Korea* and G. Y. Sung, *Electronics & Telecommunications Research Inst., Daejeon, Korea*

We design and fabricate green, self-luminescent Tb-doped SiO_xN_y microdisks on Si chip for low-cost, all-Si biosensor applications. WGM was obtained via top-pumping and side-PL measurements, and obtained Q-factor was 220.

ThP32 $Er_xY_{2-x}SiO_5$ Thin Film Waveguide for High Optical Gain per Length at 1.53 μm, K. Suh, S. Lee, J. S. Chang, I. Kim, J. H. Shin, *Korea Advanced Institute of Science and Technology, Daejeon, Korea*, H. Lee and N. Park, *Seoul National University, Seoul, Korea*

Ridge-type $Er_xY_{2-x}SiO_5$ waveguides were fabricated. Amorphous $Er_xY_{2-x}SiO_5$ was deposited using reactive ion beam sputter deposition, and crystallized by high-temperature annealing. The inversion level achieved was 0.4, limited by grain-boundary scattering and multimodedness of waveguide

ThP33 Fabrication and Responsivity Spectra of p-Ge/i-Si/n-Si Near-Infrared Photodiodes, Y. Ishikawa, S. Park, J. Osaka and K. Wada, *University of Tokyo, Tokyo, Japan*

Responsivity spectra are measured for p-Ge/i-Si/n-Si diodes favorable for the high-frequency operation. In spite of thin (90 nm) p-Ge absorption layer, free-space responsivities of ~10 mA/W are obtained, corresponding to the internal quantum efficiency as large as 20%.

Friday, 19 September 2008

08.30 - 10.00

Session FA: Optical Delay Lines and Coupled Resonators
Session Chair: Koji Yamada, *NTT Corporation, Atsugi, Japan*

FA1 08.30 - 08.45

1 Byte Continuously Tunable Delay in Coupled-Resonator Optical Delay Lines, F. Morichetti, *CORECOM, Milano, Italy*, C. Ferrari, A. Melloni, *Politecnico di Milano, Milano, Italy* and M. Martinelli, *Politecnico di Milano - CoreCom, Milan, Italy*

A continuously tunable delay of 8 bit-lengths at 10 and 25 Gbit/s is achieved by using a ring-based coupled-resonator-optical-waveguide fabricated in SiON technology. Fractional loss below 1 dB per bit-delay and storage efficiencies exceeding 1 bit-delay per ring-resonator are demonstrated.

FA2 08.45 - 09.00

Wide Delay Tuning of Narrow Slow Light Pulse in SOI Photonic Crystal Coupled Waveguide, H. Sasaki, *Yokohama National University, Yokohama, Kanagawa, Japan*

We demonstrate continuous delay tuning of 1 – 2 ps wide optical pulses in a SOI photonic crystal coupled waveguide. Maintaining the pulse width, the delay was tuned in the range of 27 ps.

FA3 09.00 - 09.15

50-Element Cascaded-Resonator Devices with Gapless Non-Evanescent Coupling using Double-Notch-Shaped Microdisks on a Silicon Chip, X. Luo and A. W. Poon, *Hong Kong University of Science and Technology, Kowloon, Hong Kong*

We propose many-element cascaded-resonator devices with gapless non-evanescent inter-cavity and waveguide-to-cavity coupling using double-notch-shaped microdisk resonators. We demonstrate such devices with up to 50 elements in a silicon nitride-on-silica substrate.

FA4 09.15 - 09.30

Coupled Cavities in One-Dimensional Photonic Crystal Based on Horizontal Slot Waveguide Structure with Si-nc, A. Pitanti, P. Bettotti, E. Rigo, R. Guider, N. Daldosso, *University of Trento, Povo, Italy*, J.-M. Fedeli, *Commissariat à l'Énergie Atomique, Grenoble, France* and L. Pavesi, *University of Trento, Povo, Italy*

One-dimensional photonic crystal structure is used for a slow light effect in a coupled resonators optical horizontal slot waveguide with Si-nc. We report on design, simulations and preliminary optical transmission characterization around 1.55 μm.

FA5 09.30 - 09.45

Enhanced Direct Bandgap Emission from Germanium-Based Ring Resonators, P. H. Lim, Y. Kobayashi, S. Takita, Y. Ishikawa and K. Wada, *University of Tokyo, Tokyo, Japan*

We report the room temperature enhancement of direct bandgap emission from germanium microcavities with wavelength-scale dimensions and high optical confinement. A decline in the emission enhancement with lower Qs is attributed to the Purcell effect.

FA6 09.45 - 10.00

Enhanced Light Emission from Silicon Photonic Crystal Nanocavity, M. Fujita, Y. Tanaka, Y. Takahashi and S. Noda, *Kyoto University, Kyoto, Japan*

We study the enhanced light emission from a silicon slab with a photonic crystal nanocavity. We find that phonon accumulation in the tiny space is a key for enhanced light emission in addition to the cavity effect for photons.

10.00 - 13.15

Session FB: OPTICAL INTEGRATION AND INTERCONNECTS
Session Chair: Jean-Marc Fedeli, *Commissariat à l'Énergie Atomique, Grenoble, France*

FB1 10.00 - 10.30 (Invited)

Monolithically Integrated High-Speed CMOS Photonic Transceivers, T. J. Pinguet, B. Analui, E. Balmater, D. Guckenberger, M. Harrison, R. Koumans, D. Kucharski, Y. Liang, G. Masini, A. Mekis, S. Mirsaidi, A. Narasimha, M. Peterson, D. Rines, V. Sadagopan, S. Sahni, T. J. Sleboda, D. Song, Y. Wang, B. Welch, J. Witzens, J. Yao, S. Abdalla, S. Gloeckner, P. M. De Dobbelaere, *Luxtera, Inc., Carlsbad, CA, USA* and G. Capellini, *University of Rome 3, Roma, Italy*

We demonstrate monolithically integrated 4x10 Gb/s WDM transceivers built in a production 130 nm SOI CMOS process. Only light sources are external to the chip. 40 Gb/s error-free, bidirectional transmission is demonstrated.

10.30 - 11.00 COFFEE BREAK

FB2 11.00 - 11.30 (Invited)

A Nanophotonic Interconnect for High-Performance Many-Core Computation, R. G. Beausoleil, M. Fiorentino, J. Ahn, N. Binkert, A. Davis, D. Fattal, N. P. Jouppi, *HP Laboratories, Palo Alto, CA, USA*, M. McLaren, *HP Laboratories, Bristol, UK*, C. Santori, R. S. Schreiber, S. M. Spillane, D. Vantrease and Q. Xu, *HP Laboratories, Palo Alto, CA, USA*

We describe the results of a design study of DWDM on-chip and off-chip nanophotonic interconnects and device technologies that could improve computing performance by a factor of 20 above industry projections over the next decade.

FB3 11.30 - 11.45

200 Gbps Photonic Integrated Chip on Silicon Platform, A. Liu, L. Liao, *Intel Corporation, Santa Clara, CA, USA*, Y. Chetrit, *Numonyx Israel Ltd, Qiryat Gat, Israel*, J. Basak, H. Nguyen, *Intel Corporation, Santa Clara, CA, USA*, D. Rubin, *Numonyx Israel Ltd, Qiryat Gat, Israel* and M. Paniccia, *Intel Corporation, Santa Clara, CA, USA*

We report a silicon photonic integrated circuit that contains a fast silicon optical modulator array and wavelength multiplexer/de-multiplexer. We demonstrate high-speed data transmission with an aggregate data rate of 200 Gbps on a single silicon chip.

FB4 11.45 - 12.00

g-Pack - A Generic Testbed Package for SiliconPhotonics Devices, L. Zimmermann, *Technical University Berlin, Berlin, Germany*, H. Schroeder, T. Tekin, *Fraunhofer-Institut, Berlin, Germany*, W. Bogaerts and P. Dumon, *Ghent University, Gent, Belgium*

g-Pack is a low-frequency packaging approach tobreadboarding of Silicon photonics chips. It provides opticali/o through a fiber array coupled to gratings couplers, andmultiple DC i/o through a pin grid array (PGA) carrier.

FB5 12.00 - 12.15

Silicon Photonics Front-End Integration in High-Speed 0.25µm SiGe BiCMOS, L. Zimmermann, K. Voigt, G. Winzer, *Technical University Berlin, Berlin, Germany*, D. Wolansky, S. Geisler, H. Richter and B. Tillack, *Innovations for High Performance Microelectronics, Frankfurt, Germany*

Modular integration of photonic functionality in the front-end of line of a qualified 0.25 µm SiGe BiCMOS technology is considered. First measurements of electronic & waveguide test structures are presented.

FB6 12.15 - 12.30

A Novel Thin-Overcladding Spot-Size Converter for Efficient Silicon-Wire Optical Interconnections and Waveguide Circuits, H. Yoshida, T. Sato, K. Ohira, R. Hashimoto, N. Iizuka and M. Ezaki, *Toshiba Corporation, Kawasaki, Kanagawa, Japan*

We present a novel inverse-taper spot-size converter with submicron-thick overcladding for silicon-based optical interconnections and waveguide circuits. Utilizing this structure, a flying-junction underpass silicon-wire cross-connect on a silicon-on-insulator (SOI) wafer is demonstrated.

FB7 12.30 - 12.45

Silicon Photonic WDM Point-to-Point Network for Multi-chip Processor Interconnects, X. Zheng, *Sun Microsystems, San Diego, CA, USA*, P. Koka, H. Schwetman, *Sun Microsystems, Austin, TX, USA*, J. Lexau, R. Ho, *Sun Microsystems, Menlo Park, CA, USA*, J. E. Cunningham and A. V. Krishnamoorthy, *Sun Microsystems, San Diego, CA, USA*

We introduce a silicon photonic WDM point-to-point network enabled by novel optical proximity communications. This strictly non-blocking network provides scalable interconnectivity between chips, low latency, and high bisection bandwidth.

FB8 12.45 - 13.00

Optical Proximity Communication in Packaged SiPhotonics, J. E. Cunningham, X. Zheng, I. Shubin, *Sun Microsystems, San Diego, CA, USA*, R. Ho, J. Lexau, *Sun Microsystems, Menlo Park, CA, USA* and A. V. Krishnamoorthy, *Sun Microsystems, San Diego, CA, USA*, Mehdi Asghari, Dazeng Feng, Jonathan Luff, Hong Liang and Cheng-Chih Kung, *Kotura, Monterey Park, CA, USA*

We report 10Gb/s Optical-Proximity-Communication with reflecting mirrors micro-machined into Si and co-integrated to low loss SOI waveguides for chip to chip communication using a self-aligned-packaging mechanism with measured 4.0 dB coupling loss.

FB9 13.00 - 13.15

Noval Fabrication Tolerant Flat-Top Demultiplexers Based on Etched Diffraction Grating in SOI, D. Feng, W. Qian, H. Liang, C.-C. Kung, J. Fong, B. J. Luff and M. Asghari, *Kotura, Monterey Park, CA, USA*

Flat-top demultiplexers using etched diffraction gratings in the silicon-on-insulator (SOI) platform are reported and experimentally demonstrated. The novel design enables the loss and crosstalk of the devices to be insensitive to the vertical angle of the grating facets.

13.15 - 14.45 LUNCH BREAK

14.45 - 16.30

Session FC: PHOTOVOLTAICS, THERMAL EFFECTS AND SENSING
Session Chair: Mario Paniccia, *Intel Corporation, Santa Clara, CA, USA*

FC1 14.45 - 15.15 (Invited)
"Third Generation" Photovoltaics and Silicon Nanostructures, M. A. Green, *University of New South Wales, Sydney, Australia*

The booming photovoltaics market is based on “first generation” solar cells relying on expensive silicon wafers. Potentially much lower cost “second generation” thin-films gaining market share. Silicon nanoparticles may play a role in "third generation" technology seeking high conversion efficiency at low cost.

FC2 15.15 - 15.30

Photovoltaic Effect in Ultra-Thin a-Si/SiO_2 Multilayered Structures, A. Shatveryan, O. Anopchenko, S. Minhaz Hossain, A. Marconi, *University of Trento, Povo, Italy*, M. Wang, *Zhejiang University, Hangzhou, Zhejiang, China*, G. Pucker, *Fondazione Bruno Kessler - Irst, Trento, Italy*, P. Bellutti, *Istituto Trentino di Cultura, Povo, Italy* and L. Pavesi, *University of Trento, Povo, Italy*

Photovoltaic and photoconductive properties of ultra-thin a-Si/SiO_2 multilayers grown by PECVD and annealed at 1150 ºC were studied. A quantum yield greater than one is observed due to secondary carrier generation from interface trap states.

FC3 15.30 - 15.45

Photovoltaic Effect in Si / SiO_x Heterostructures, R. V. A. van Loon, K. R. Catchpole, *Foundation for Fundamental Research on Matter, Amsterdam, The Netherlands* and A. Polman, *Institute for Atomic and Molecular Physics, Amsterdam, The Netherlands*

Si/SiO_x heterostructures show a photovoltaic effect when the samples are annealed to form Si quantum dots. Subsequently applying dielectric breakdown increases the short-circuit current by up to an order of magnitude.

FC4 15.45 - 16.00

Sensitivity-Enhanced Silicon Slot Photonic Crystal Waveguides, X. Chen and R. T. Chen, *University of Texas at Austin, Austin, TX, USA*

A compact silicon slot photonic crystal waveguide with dual enhancement capability is demonstrated. The waveguide sensitivity is characterized in a Mach-Zehnder interferometer configuration. The sensitivity enhancement is derived through local refractive index variation.

FC5 16.00 - 16.15

Cancellation of the Temperature Dependence in SOI Photonic Wire Ring Resonator Sensors, D.-X. Xu, E. A. Post, A. Densmore, P. Waldron, S. Janz, J. Lapointe, A. Delage, P. Cheben, J. H. Schmid and B. Lamontagne, *National Research Council, Ottawa, ON, Canada*

We demonstrate a method of canceling the temperature dependence of ring resonator sensors using a double ring configuration. Temperature calibration curves are provided for SOI photonic wire ring sensors with air and SU8 polymer cladding.

FC6 16.15 - 16.30

Thermo-Optical Compensation in High-Index-Contrast Waveguides, W. N. Ye, R. Sun, J. Michel, *Massachusetts Institute of Technology, Cambridge, MA, USA*, L. Eldada, *Dupont Photonics Technologies, Wilmington, MA, USA*, D. Pant, *Dupont Photonics Technologies, Cambridge, MA, USA* and L. C. Kimerling, *Massachusetts Institute of Technology, Cambridge, MA, USA*

Thermo-optical compensation in high-index contrast waveguide system (α-Si on SiO_2) is reported using different cladding materials. We experimentally demonstrate the thermo-opticallycompensated α-Si based racetrack ring resonators with an acrylate polymer cladding.

16.30 - 17.00 COFFEE BREAK

17.00 - 18.15

Session FD: NEW EFFECTS IN SILICON PHOTONICS
Session Chair: Gernot S. Pomrenke, *US Air Force Research Laboratory, Arlington, VA, USA*

FD1 17.00 - 17.30 (Invited)

Entanglement Generation using Silicon Wire Waveguide, H. Takesue, H. Fukuda, T. Tsuchizawa, T. Watanabe, K. Yamada, Y. Tokura and S.-I. Itabashi, *NTT Corporation, Atsugi, Kanagawa, Japan*

We present the first entanglement generation experiments based on spontaneous four-wave mixing in a silicon wire waveguide. This entanglement source is expected to solve the problems found with previous 1.5-μm band entanglement sources.

FD2 17.30 - 18.00 (Invited)

Rolled-up Si Nanomembranes for On-Chip Photonic Applications, O. G. Schmidt*, IFW Dresden, Dresden, Germany*

Strained Si/SiO_x nanomembranes roll-up into microtube ring resonators which emit light at room temperature in the visible spectral range. We disucss the relevant formation processes, structural as well as optical properties and possible applications in optofluidic devices on a single chip.

FD3 18.00 - 18.15

Large Birefringence in SOI Layer and Its Application to Polarization-Insensitive AWG, H. Daichi*, Yokohama National University, Yokohama, Kanagawa, Japan*

We evaluated a large birefringence of 0.85 in a SOI layer by totally analyzing the measured index and theoretical and experimental dispersion characteristics of Si photonic wires. It was applied to an ultracompact polarization-insensitive AWG.

18.15 - 18.25
Session PD: POST DEADLINE

PD1 18.15 - 18.25

Fabrication and Characterization of Resonant Cavity Enhanced Silicon Photodetectors at 1.55 μm, M. Casalino, L. Sirleto, *Consiglio Nazionale delle Ricerche, Napoli, Italy,* L. Moretti, *Universita "Mediterranea" di Reggio Calabria, Reggio Calabria, Italy,* M. Gioffre, G. Coppola, M. Iodice and I. Rendina, *Consiglio Nazionale delle Ricerche, Napoli, Italy*

In this paper the realization and the characterization of a new kind of resonant cavity enhanced photodetector (RCE), fully compatible with silicon microelectronic technologies and working at 1.55 μm, are reported.

18.45 CLOSING REMARKS

END OF PROGRAM