ISPEC 2012

The 2nd International Symposium on Photonics and Electronics Convergence

-Advanced Nanophotonics and Silicon Device Systems-

Final Program

December 3-4, 2012

Venue: Ito International Research Center (IIRC), Hongo Campus

December 5, 2012

Venue: Lecture Hall, Graduate School of Mathematical Science Building, Komaba Campus

Symposium Program

3rd December (Monday)

Venue: Ito International Research Center
Hongo Campus, The University of Tokyo

Registration (9:00-9:45)

Welcome Address (9:45-10:00)

T. Nakano (*Deputy Director General for Science and Technology Policy Cabinet Office*)

Session A: Opening (10:00-12:30)

10:00 **A-1 (Keynote)**
Advances in Photonics and Electronics Convergence System Technology: Overview of the PECST Project
Y. Arakawa (*The University of Tokyo*)

10:30 **A-2 (Invited)**
Distributed On-Chip Light Sources for Parallel Signal Processing
L. C. Kimerling (*Massachusetts Institute of Technology*)

11:10 **A-3 (Invited)**
In search for the ideal hybrid silicon laser
R. Baets (*Ghent University - IMEC*)

11:50 **A-4 (Invited)**
IBM CMOS-Integrated Nanophotonics Technology
Y. Vlasov (*IBM*)

12:30-14:00 Lunch break

Session B: Silicon Nanophotonics Devices & Systems I (14:00-17:40)

14:00 **B-1 (Invited)**
Integrated Silicon Photonics WDM Links
H. Liu (*Intel*)

14:40 **B-2 (Invited)**
Heterogeneous Photonic-Electronic Integration for future Networking and Computing Systems
S. J. Ben Yoo (*University of California, Davis*)

15:20 **B-3**
Demonstration of 12.5-Gbps Silicon Optical Interconnects Integrated with Lasers, Optical Splitters, Optical Modulators, and Photodetectors on a Single Silicon Substrate
Y. Urino (*PETRA*)

15:35 **B-4**

Silicon Photonic Integration by Using Variable-Shaped-Beam EB Lithography and Immersion ArF Lithography

T. Horikawa (*AIST*)

15:50-16:10 Break

(Session B contd.)

16:10 **B-5**

Selective Epitaxial Growth of Strained Ge Modulators

K. Wada (*The University of Tokyo*)

16:25 **B-6**

Multi-Channel Operation of Hybrid Integrated Light Sources Using Trident Spot-Size Convertors for Photonics-Electronics Convergence System

N. Hatori (*PETRA*)

16:40 **B-7**

50-Gb/s Silicon Modulator Using Forward-Biased pin Diode

T. Usuki (*PETRA*)

16:55 **B-8**

45 GHz Bandwidth of Si Waveguide-Integrated PIN Ge Photodiode

J. Fujikata (*PETRA*)

17:10 **B-9**

1.3 μm InAs/GaAs Quantum Dot Lasers on Si Substrates by Wafer Bonding

K. Tanabe (*The University of Tokyo*)

17:25 **B-10**

Advanced Light Manipulation with Photonic Crystal Nanostructures

S. Noda (*Kyoto University*)

Banquet (18:00-20:00): Foyer of Ito International Research Center

4th December (Tuesday)

Venue: Ito International Research Center
Hongo Campus, The University of Tokyo

Session C: Silicon Nanophotonics Devices & Systems II (9:30-11:35)

9:30 **C-1 (Invited)**
Photonic Crystal Cavities for Optical Interconnects
T. F. Krauss (*University of York*)

10:10 **C-2 (Invited)**
Integration Strategies for Advanced Photonic Integrated Circuits on Silicon
S. R. Jain and J. E. Bowers (*University of California, Santa Barbara*)

10:50 **C-3 (Invited)**
Fully Integrated 100-Gb/s CMOS Optical Transceiver for Board-to-board Interconnects
T. Takemoto (*Hitachi*)

11:20 **C-4**
Analysis of Four-Port System for Bistable Memory in Silica Toroid Microcavity
W. Yoshiki (*Keio University*)

11:35-13:00 Lunch break

Poster Session (13:00-15:30)

13:00 **Poster preview**

14:00 **Poster Presentations**

Session D: Silicon Nanophotonics Devices & Systems III (15:30-17:40)

15:30 **D-1 (Invited)**
Silicon Photonics Technology Platform for High-Speed Communications
P. De Dobbelaere (*Luxtera*)

16:10 **D-2**
Silicon Waveguide Optical Circulator
K. Mitsuya (*Tokyo Institute of Technology*)

16:25 **D-3**
InGaAsP Photonic-Wire Mach-Zehnder Interferometer Switches Fabricated on III-V CMOS Photonics Platform
Y. Ikku (*The University of Tokyo*)

16:40 **D-4**
Ultra-Compact 8 x 8 Silicon Optical Switch for Application to Next Generation ROADM
S. Nakamura (*NEC Corp.*)

16:55 **D-5**

Silicon-based Waveguide Platform for Optical Interconnection

H. Yaegashi (*PETRA*)

17:10 **D-6**

Three Dimensional Optical Circuits

M. Mori (*AIST*)

17:25 **D-7**

BCB-buried Si Slot Waveguide Filters for Athermal Operation in On/Near-Chip Application

N. Nishiyama (*Tokyo Institute of Technology*)

5th December (Wednesday)

Venue: Lecture Hall, Graduate School of Mathematical Science Building
Komaba Campus, The University of Tokyo

Session E: Silicon Nanophotonics Devices & Systems IV (9:30-11:40)

9:30 **E-1 (Invited)**
Implementation Path of Si-Photonics - Foundry Model, Challenges, and Opportunities
G. Q. Patrick Lo (*Institute of Microelectronics/A*STAR*)

10:10 **E-2 (Invited)**
How can we bridge the gap between photonics and Si CMOS LSI?
K. Masu (*Tokyo Institute of Technology*)

10:40 **E-3**
Photonic Crystal and Related Photonic Nanostructure Devices Fabricated by CMOS Compatible Process
T. Baba (*Yokohama National University*)

10:55 **E-4**
Narrow Spectral Linewidth Wavelength Tunable Laser Diode with Si Photonic Wire External Cavity
T. Kita (*Tohoku University*)

11:10 **E-5**
Temperature Control Free Silicon Photonics Transmitter with Si-SOA Hybrid Laser
S. Tanaka (*Fujitsu Labs. LTD.*)

11:25 **E-6**
Improvement in Photoluminescence of Coimplanted Germanium by Laser Annealing
L. Y. T. Lee (*Stanford University*)

11:40-13:15 Lunch break

Session F: Silicon Nanophotonics Devices & Systems V (13:15-14:45)

13:15 **F-1 (Invited)**
Advanced Self-Assembled Quantum Dot Lasers
M. Sugawara (*QD Laser*)

13:45 **F-2 (Invited)**
Electrically Driven Photonic Crystal Lasers for On-Chip Interconnect
S. Matsuo (*NTT*)

14:15 **F-3**

Germanium Based Monolithic Light Sources on Silicon

M. Sagawa (*PETRA/Hitachi*)

14:30 **F-4**

Silicon-Based Nano Light Sources Using Photonic Crystal Structures

S. Iwamoto (*The University of Tokyo*)

Closing Session (14:45-14:50)

Poster Session (Tuesday)

P-1

Design Study of Membrane Photonic Integrated Circuit for On-chip Interconnects

Jieun Lee[1], Yoshiaki Yamahara[1], Takahiko Shindo[1], Mitsuaki Futami[1], Kyohei Doi[1], Nobuhiko Nishiyama[1], Shigehisa Arai[1,2]

(*Tokyo Inst. Tech./Japan[1], Quantum Nanoelectronics Research Center/Japan[2]*)

P-2

Simulation of Si/SiGe/Si double heterostructure based carrier-injection modulator

Younghyun Kim, Mitsuru Takenaka, Shinichi Takagi

(*Univ. Tokyo/Japan*)

P-3

A Prospective Sub-micron Range Integration Approach for Photonics-Electronics Heterogeneous Convergence Applications

T. T. Bui, M. Suzuki, F. Kato, N. Watanabe, S. Nemoto, M. Aoyagi

(*AIST/Japan*)

P-4

High-uniformity MSM Ge Photodetector and its Application to Differential Receivers

Makoto Miura[1,2], Junichi Fujikata[1,2], Masataka Noguchi[1,2], Daisuke Okamoto[1,2], Tsuyoshi Horikawa[1,3], Yasuhiko Arakawa[1,4]

(*PECST/Japan[1], PETRA/Japan[2], AIST/Japan[3], Univ. Tokyo/Japan[4]*)

P-5

Polarization properties of emission from a self-assembled InAs quantum dot embedded in a Metal-Insulator-Metal waveguide structure

T. Yamamoto[1,2], Y. Ota[2], S. Ishida[3], N. Kumagai[1], S. Iwamoto[1,2], Y. Arakawa[1,2]

(*NanoQuine, Univ. Tokyo/Japan[1], IIS, Univ. Tokyo/Japan[2], RCAST, Univ. Tokyo/Japan[3]*)

P-6

Design of Photonic Crystal Waveguide with Mickey-Mouse-Like Air Holes for High Gain Raman Amplification

Y. H. Hsiao, S. Iwamoto, Y. Arakawa

(*Univ. Tokyo/Japan*)

P-7

Development of Silicon Waveguide Optical Isolator Employing Nonreciprocal Phase Shift

Y. Shirato, Y. Shoji, T. Mizumoto

(*Tokyo Inst. Tech./Japan*)

P-8

GaInAsP/InP MZI Waveguide Optical Isolator Integrated with Spot Size Converter

Y. Sobu, K. Sakurai, Y. Shoji, T. Mizumoto

(*Tokyo Inst. Tech./Japan*)

P-9

Demonstration of 2x2 4-Channel Silicon Wavelength-Selective Switch

K. Miura, Y. Shoji, T. Mizumoto

(*Tokyo Inst. Tech. /Japan*)

P-10

Modification of Epitaxial GaAs Quantum Dot Emission by Gold Nanodisk Chain Waveguides

Jinfa Ho[1], Sylvain Sergent[1], Alexandre Enderlin[1], Satoshi Iwamoto[1, 2], Yasuhiko Arakawa[1, 2]

(*Institute for Nano Quantum Information Electronics, Univ. Tokyo/Japan[1], Institute of Industrial Science, Univ. Tokyo/Japan[2]*)

P-11

High-speed Si CMOS APD fabricated by standard CMOS process

Toshiyuki Shimotori, Kazuaki Maekita, Takeo Maruyama, Koichi Iiyama

(*Kanazawa Univ./Japan*)

P-12

MBE growth of GaAs nanowires on silicon substrates

Jinkwan Kwoen[1], Katsuyuki Watanabe[2], Satoshi Iwamoto[1,2], Yasuhiko Arakawa[1,2]

(*IIS, Univ. Tokyo/Japan[1], NanoQuine, Univ. Tokyo/Japan[2]*)

P-13

Plasma post-nitridation toward SiGe high-k MOS optical modulators

J. H. Han[1], R. Zhang[1], T. Osada[2], M. Hata[2], M. Takenaka[1], S. Takagi[1]

(*Univ. Tokyo/Japan[1], Sumitomo chemical Corp. Ltd./Japan[2]*)

P-14

40 Gb/s Sub-100 um Photonic Crystal Silicon Optical Modulators

H. C. Nguyen, S. Hashimoto, M. Shinkawa, T. Baba

(*Yokohama Nat'l Univ./Japan*)

P-15

Si waveguide wavelength filter using high-order-mode selection by waveguide coupler

H. Okayama[1,2], Y. Onawa[2], D. Shimura[1,2], S. Miyamura[2], H. Takahashi[1,2], H. Yaegashi[1,2], H. Sasaki[2]

(*PECST, PETRA/Japan[1], Oki Electric Industry Co., Ltd./Japan[2]*)

P-16

Ultrahigh-Speed Slow-Light Tuning using Nonlinear Effects in Photonic Crystal Waveguides

K. Kondo, M. Shinkawa, Y. Saito, T. Baba

(*Yokohama Nat' Univ./Japan*)

P-17

Electroluminescence from Germanium Waveguides on Silicon-On-Insulator Diodes

Kazuki Tani[1,2,3], Shin-ichi Saito[1,2,3], Katsuya Oda[1,2,3], Tadashi Okumura[3], Toshiyuki Mine[3], Tatemi Ido[1,2,3]

(*PETRA/Japan[1], PECST/Japan[2], Hitachi, Ltd./Japan[3]*)

P-18

Two-Photon Absorption Photodiode using pn-Junction Photonic Crystal Slow-Light Waveguide and Its Applications

R.Hayakawa, N.Isikura, H.C.Nguyen, T.Baba

(*Yokohama Nat'l Univ./Japan*)

P-19

Improvement of Photoluminescence from Ge Layers with Si3N4 Stressors

Katsuya Oda[1, 2, 3], Tadashi Okumura[3], Kazuki Tani[1, 2, 3], Shin-ichi Saito[1, 2, 3], Tatemi Ido[1, 2, 3]

(*PETRA/Japan[1], PECST/Japan[2], Hitachi Ltd./Japan[3]*)

P-20

First-principles study of optical gain in strained germanium

Yuji Suwa[1,2,3], Shin-ichi Saito[1,2,3]

(*PECST/Japan[1], PETRA/Japan[2], Hitachi, Ltd./Japan[3]*)

P-21

Low Threshold Operation of Lateral Current Injection Type Membrane Laser

T. Shindo[1], M. Futami[1], K. Doi[1], T. Amemiya[2], N. Nishiyama[1], S. Arai[1,2]

(*Dept. of Electrical and Electronic Engineering, Tokyo Inst. Tech./Japan[1], Quantum Nanoelectronics Research Center, Tokyo Inst. Tech./Japan[2]*)

P-22

Slow-light Tuning in Heater-integrated Photonic Crystal Waveguides and Its Applications

N. Ishikura, R. Hosoi, R. Hayakawa, T. Tamanuki, M. Shinkawa, T. Baba

(*Yokohama Nat'l Univ./Japan*)

P-23

Lasing oscillation in silicon-based three-dimensional photonic crystal nanocavity embedding InAs quantum dots

D. Cao, A. Tandaechanurat, S. Nakayama, S. Ishida, S. Iwamoto, Y. Arakawa

(*Institute for Nano Quantum Information Electronics, Univ. Tokyo/Japan*)

P-24

Four-Wave Mixing in Dispersion-Controlled Silica-Clad Photonic Crystal Slow Light Waveguides

M. Moro, M. Shinkawa, T. Baba

(*Yokohama Nat'l Univ./Japan*)

P-25

High Efficient Layer-to-Layer Si Grating Coupler Sandwiched by Metal Reflectors for Intra-Chip Interconnection

J. Kang[1], Y. Atsumi[1], T. Sifer[1], Y. Hayashi[1], T. Amemiya[2], N. Nishiyama[1], S. Arai[1,2]

(*Tokyo Inst. Tech./Japan[1], QNERC, Tokyo Inst. Tech./Japan[2]*)

P-26

GaInAsP/SOI Hybrid Laser by N2 Plasma Activated Low Temperature Bonding

Yusuke HAYASHI[1], Ryo OSABE[1], Keita FUKUDA[1], Yuki ATSUMI[1], JoonHyun KANG[1], Nobuhiko NISHIYAMA [1], Shigehisa ARAI[1,2]

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P-27

Wavelength Trimming of Athermal Si Slot Wavelength Filters using Deep-ultraviolet Exposure

Y. Atsumi[1], T. Sifer[1], J. H. Kang[1], N. Nishiyama[1], S. Arai[1,2]

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P-28

Thermal Analysis of Self-heating Effect in LCI Membrane DFB Laser on Si Substrate

Kyohei Doi[1], Takahiko Shindo[1], Mitsuaki Futami[1], Tomohiro Amemiya[2], Nobuhiko Nishiyama[1], Shigehisa Arai[1,2]

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P-29

Ultralow-Loss Silicon Spot-Size Converter Fabricated by Photolithography

Ryohei Takei[1,2], Masao Suzuki[1,2], Emiko Omoda[1,2], Shoko Manako[1,2], Toshihiro Kamei[1,2], Masahiko Mori[1,2], Youichi Sakakibara[1,2]

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P-30

Metamaterial photonic devices toward nano-photonics

T. Amemiya[1], T. Kanazawa[1], A. Ishikawa[2], S. Myoga[1], E. Murai[1], J.H. Kang[1], N. Nishiyama[1], Y. Miyamoto[1], T. Tanaka[2], S. Arai[1]

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P-31

Growth of High Density InAs-Stacked Quantum Dots on Germanium-on-Insulator-on-Silicon Substrate Emitting at 1.3 um for Silicon Photonics

M. Rajesh, J. Tatebayashi, M. Nishioka, Y. Arakawa

(*Univ. Tokyo/Japan*)

P-32

All Optical Control of a Reflection Spectrum in a Quantum Dot-Photonic Crystal Nanocavity Coupled System

H. Takagi[1], Y. Ota[2], K. Watanabe[2], S. Ishida[3], S. Iwamoto[1,2], Y. Arakawa[1,2]

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P-33

Design of large-bandwidth single-mode operation waveguides in silicon woodpile structure using two guided modes

Jiapeng Fu[1], Aniwat Tandaechanurat [1,2], Satoshi Iwamoto[1,2], Yasuhiko Arakawa[1,2]

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P-34

High Speed and High Efficiency Si Optical Modulator with MOS Junction ,Using Large-Grain of Poly-Silicon Gate

J. Fujikata[1,2], M. Takahashi[1,3], S. Takahashi[1,2], T. Akagawa[1,2], M. Noguchi[1,2], T. Horikawa[1,3], T. Nakamura[1,2], Y. Akarawa[1,4]

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P-35

Time-resolved Photoluminescence study of Ge grown on Si

S. Kako[1], K. Oda[2,3,4], T. Okumara[2,3,4], Y. Suwa[2,3,4], S. Saito[2,3,4], T. Ido[2,3,4], Y. Arakawa[1]

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P-36

Direct modulation of silicon nanobeam photonic crystal nanocavity LED

Shigeru Nakayama[1,2], Satoshi Iwamoto[1,2], Hiroyuki Takagi[1,2], Satoshi Kako[1], Satomi Ishida[3], Yasuhiko Arakawa[1,2]

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P-37

A Study of Compact Matrix Optical Switches Based on Silicon Photonics

Shota Otsuka, Hong. C. Nguyen, Toshihiko Baba

(*Yokohama Nat'l. Univ. /Japan*)

P-38

Over-100-Channel Hybrid Integrated Light Source on a Silicon Waveguide Platform by Multichip Bonding Technology

T. Shimizu[1,2], M. Okano[1,3], N. Hatori[1,2], M. Ishizaka[1,2], Y. Urino[1,2], T. Yamamoto[1,2], M. Mori[1,3], T. Nakamura[1,2], Y. Arakawa[1,4]

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P-39

Q factor control of photonic crystal nanobeam cavity with MEMS

Ryuichi Ohta[1], Yasutomo Ota[2], Hiroyuki Takagi[1], Naoto Kumgai[2], Katsuaki Tanabe[2], Satomi Ishida[2], Satoshi Iwamoto[1,2], Yasuhiko Arakawa[1,2]

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P-40

Phase Demodulation with Silicon/silica-hybrid Delay Line Interferometer

R. Kou[1,2], H. Fukuda[1,2], T. Tsuchizawa[1,2], H. Nishi[1,2], T. Hiraki[1,2], K. Yamada[1,2]

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P-41

Numerical analysis of S-matrix for silicon-photonics

Tatsuya Usuki

(*PETRA/Japan*)

P-42

Role of buried heterostructure in photonic-crystal laser for high-temperature and high-output-power operation

T. Kakitsuka[1,3], T. Sato[1,3], K. Takeda[1,3], K. Hasebe[2,3], K. Nozaki[2,3], M. Notomi[1,3], S. Matsuo[1,3]

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P-43

16-ch x 10-Gb/s WDM receiver on Si-silica-Ge monolithic integration platform

Tatsurou Hiraki[1, 2], Tai Tsuchizawa[1, 2], Hidetaka Nishi[1, 2], Rai Kou[1, 2], Hiroshi Fukuda[1, 2], Kotaro Takeda[1], Yasuhiko Ishikawa[3], Kazumi Wada[3], Koji Yamada[1, 2]

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P-44

Mechanical Properties of Optomechanical System with Photonic Crystal Nanocavity

W. Shimizu[1], M. Nomura[1,2]

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P-45

Second Harmonic Generation in a Silicon Carbide Photonic Crystal Nanocavity

S. Yamada[1], B. S. Song[1,2], T. Asano[1], Y. Tanaka[1], S. Noda[1]

(*Kyoto Univ./Japan[1], Sungkyunkwan Univ./Korea[2]*)

P-46

Coupling of high-Q photonic nanocavities and its dynamic control

Takashi Asano, Yoshiya Sato, Yoshinori Tanaka, Susumu Noda

(*Kyoto Univ./Japan*)

P-47

Theoretical calculation of defects formation under thermal equilibrium in heavily n-type doped germanium

K. Takinai, Y. Ishikawa, K. Wada

(*Univ. Tokyo/Japan*)

P-48

1550-nm Germanium Light-Emitting Diode by Momentum Conservation Transport

Seongjae Cho[1], Stanley Cheung[2], Changjae Yang[3], Hyungjin Kim[4], Euijoon Yoon[3], S. J. Ben Yoo[2], Byung-Gook Park [4], and James S. Harris, Jr. [1]

(*Stanford Univ. /USA[1], Univ. California/USA [2], Dept. of Materials Science and Engineering [3], Dept. of Electrical Engineering and Computer Science [4], Seoul Univ./Korea*)