

Symposium Program

13th December (Monday)

Welcome Address (10:00-10:05)

S. Tahara (*PETRA*)

Session A: Opening (10:05-11:45)

10:05 A-1 (Keynote)

Progress in Photonic Electronic Convergence Technologies through National Projects in Japan

Y. Arakawa (*The University of Tokyo*)

10:25 A-2 (Plenary)

Pb/s I/O with Electronic-Photonic Integration

L. C. Kimerling (*Massachusetts Institute of Technology*)

11:05 A-3 (Plenary)

High Temperature Quantum Dot Laser Reliability on Si

J. Bowers (*University of California, Santa Barbara*)

11:45-14:00 Lunch break

Session B: Silicon Nanophotonics Devices & Systems I (14:00-15:30)

14:00 B-1 (Invited)

Scalable and Energy-Efficient 3D Electronic-Photonic Integrated Circuits for Future AI and Neuromorphic Computing (3D-EPIC-FAINCING)

S. J. B. Yoo (*University of California, Davis*)

14:35 B-2 (Invited)

Membrane III-V Photonic Devices Using Epitaxial Growth on Si Substrate

S. Matsuo (*NTT*)

15:10 B-3

High Performance and Low Energy Consumption Server Systems Equipped with FPGAs Interconnected by Optical Wiring

Y. Urino (*PETRA*)

15:30-15:40 Break

Session C: Silicon Nanophotonics Devices & Systems II (15:40-16:55)

15:40 C-1 (Invited)

**Toward Multi-Tbps Coherent Transceiver using Heterogeneous Integration on Si-platform
~New Project in PETRA for Distributed Computing~**

N. Nishiyama (*Tokyo Institute of Technology*)

16:15 C-2

Ring-cavity Laser Based on Valley Photonic Crystal Slow-light Waveguide Structure

S. Iwamoto (*The University of Tokyo*)

16:35 C-3

Advanced Manipulation of Photons using High-Q Photonic Crystal Nanocavities

T. Asano (*Kyoto University*)

14th December (Tuesday)

Session D: Silicon Nanophotonics Devices & Systems III (10 :30-12:00)

- 10:30 **D-1 (Invited)**
Energy efficient multi-terabit photonic connectivity for disaggregated computing
K. Bergman (*Columbia University*)
- 11:05 **D-2 (Invited)**
Efficient 100 Gbaud OOK and PAM4 modulation Using Hybrid Si and Electro-optic Polymer Modulator
S. Yokoyama (*Kyushu University*)
- 11:40 **D-3**
Silicon-Photonics-based Large-capacity Electronic-Photonic Integrated Interposer Technology utilizing Glass Substrate
Y. Tanaka (*PETRA*)

12:00-13:30 Lunch break

Poster Session (13:30-15:30)

- 13:30-14:30 **Poster of the first half (P-01 – P-24)**
- 14:30-15:30 **Poster of the last half (P-25 – P-47)**

15:30-15:40 Break

Session E: Silicon Nanophotonics Devices & Systems IV (15:40-16:55)

- 15:40 **E-1 (Invited)**
Programmable Silicon Photonic Circuits
W. Bogaerts (*IMEC, Ghent University*)
- 16:15 **E-2**
Evolution of PETRA Platform Technology for Large-scale Photonics Integration
T. Horikawa (*PETRA*)
- 16:35 **E-3**
Polymer Waveguide-coupled Co-packaged Silicon Photonics-die Embedded Package Substrate
T. Amano (*AIST*)

15th December (Wednesday)

Session F: Silicon Nanophotonics Devices & Systems V (10 :00-11:35)

- 10:00 **F-1 (Invited)**
Technology Requirements for Next Generation Silicon Photonics
P. De Dobbelaere (*Cisco*)
- 10:35 **F-2**
1.6-Tbps Interconnection Chip for Co-packaged Optics
T. Nakamura (*PETRA*)
- 10:55 **F-3**
Toward 1300nm-band InAs/GaAs Quantum Dot Wavelength Tunable Laser Integrated with Electro-Absorption Modulator Fabricated by Quantum Dot Intermixing Technology: Development of Elemental Technologies
K. Utaka (*Waseda University*)
- 11:15 **F-4**
Photonic Crystal Slow-Light Modulators --- Design and High-Speed Operation
T. Baba (*Yokohama National University*)

11:35-13:30 Lunch break

Session G: Silicon Nanophotonics Devices & Systems VI (13:30-15:05)

- 13:30 **G-1 (Invited)**
Packaging Technologies for Optical Interconnects
H. Nasu (*Furukawa Electric*)
- 14:05 **G-2**
Nonvolatile Magneto-optical Switches for Reconfigurable Photonic Integrated Circuits
Y. Shoji (*Tokyo Institute of Technology*)
- 14:25 **G-3**
Ultra-compact Optical Transceivers for 5G Mobile Network Utilizing Silicon Photonics Technology
H. Yaegashi (*PETRA*)
- 14:45 **G-4**
III-V CMOS Photonics Platform Based on Quantum Well Intermixing
M. Takenaka (*The University of Tokyo*)

Closing Address (15:05-15:10)

S. Noda (*Kyoto University*)

Poster session (Tuesday)

P-01

Proposal of Phased Array Type $1 \times N$ Wavelength Selective Switch by Silicon Photonics

Y. Hara¹, Y. Shoji^{1,2}, and T. Mizumoto¹

(1 Dept. of EEE, Tokyo Inst. Tech., 2 FIRST, Tokyo Inst. Tech.)

P-02

Robust Optimization of Programmable Unitary Optical Processors

R. Tang¹, H. Tang¹, K. Toprasertpong¹, S. Takagi¹, and M. Takenaka¹

(1 Univ. Tokyo)

P-03

112-Gb/s PAM4 Transmission using Active Optical Package Substrate for Next Generation Co-packaged Optics

S. Suda¹, T. Kurosu^{1,2}, A. Noriki^{1,2}, I. Tamai², Y. Ibusuki², A. Ukita², K. Takemura², D. Shimura², Y. Onawa², H. Yaegashi², T. Aoki², F. Nakamura^{1,2}, and T. Amano^{1,2}

(1 AIST, 2 PETRA)

P-04

Step-like Optical Beam Scanning in Slow-light FMCW LiDAR

J. Gondo¹, T. Tamanuki¹, and T. Baba¹

(1 Yokohama Nat'l Univ.)

P-05

Silicon-based Integrated High-performance TE Mode Magneto-optical Isolator

S. Liu¹, Y. Shoji^{1,2}, and T. Mizumoto¹

(1 Dept. of EEE, Tokyo Inst. Tech., 2 FIRST, Tokyo Inst. Tech.)

P-06

Wavefunction Observation of Topological Bulk & Edge States in Si Photonics SSH Structure

R. Nakamura¹, A. Balčytis^{1,2}, H. Ito¹, T. Baba¹, T. Ozawa³, Y. Ota⁴, and S. Iwamoto⁵

(1 Yokohama Nat'l Univ., 2 RMIT Univ., 3 Tohoku Univ., 4 Keio Univ., 5 Univ. Tokyo)

P-07

Acquisition of Point Cloud Image using LiDAR Chip Integrating Serial Array of Si Photonic Crystal Optical Antennas

R. Tetsuya¹, T. Tamanuki¹, H. Ito¹, and T. Baba¹

(1 Yokohama Nat'l Univ.)

P-08

3D Imaging and A Consideration on Sensitivity of Si Photonics Full-Integrated LiDAR Chip

M. Kamata¹, H. Abe¹, H. Ito¹, T. Tamanuki¹, R. Tetsuya¹, R. Kurahashi¹, and T. Baba¹

(1 Yokohama Nat'l Univ.)

P-09

Imaging of Electromagnetic-Waves using RoF System Based on Si Photonics Microring Modulator Array

L. Li¹, H. Arai¹, and T. Baba¹

(1 Yokohama Nat'l Univ.)

P-10

Optimization of Photonic Crystal Nanocavity Structure using Covariance Matrix Adaptation Evolution Strategy

K. Takahashi¹ and T. Baba¹

(1 Yokohama Nat'l Univ.)

P-11**Infrared Photodetection using Ultrathin InP MSM Structure on Si Waveguide**

T. Akazawa¹, K. Sumita¹, S. Monfray², F. Boeuf², K. Toprasertpong¹, S. Takagi¹, and M. Takenaka¹
(1 Univ. Tokyo, 2 STMicroelectronics)

P-12**Investigation of Tapered Coupling Structure between Diamond and Si₃N₄ Waveguides for Quantum Photonic Interface**

R. Fujishiro¹, H. Ito¹, and T. Baba¹
(1 Yokohama Nat'l Univ.)

P-13**Si Photonic Crystal Slow-light Waveguide Optimized by Informatics Technology**

K. Hirotsu¹, R. Shiratori¹, and T. Baba¹
(1 Yokohama Nat'l Univ.)

P-14**Directed Crystallization of Cubic (Er_{0.1}Y_{0.9})₂Zr₂O₇ on SiO₂ Alternating Digitally Processed DC Sputtering and Surface Oxidation toward Backend Photonics**

G. Fabiola¹, K. Takamura¹, Y. Zhang¹, Y. Tanaka^{1,2}, S. Saisho^{1,2}, S. Takagi¹, and H. Isshiki¹
(1 The University of Electro-Communications, 2 Shincron Co. Ltd.)

P-15**Integratable Traveling Salesman Problem Solver Using Light Pulse Delay Time**

S. Yajima¹ and Y. Shoji¹
(1 Tokyo Inst. Tech.)

P-16**Computational Analysis of Optical Phase Modulation using Graphene/III-V Hybrid MOS Capacitor**

T. Piyapatarakul¹, H. Tang¹, K. Toprasertpong¹, S. Takagi¹, and M. Takenaka¹
(1 Univ. Tokyo)

P-17**Numerical Analysis of Distributed Slab Capacitance in III-V/Si Hybrid MOS Phase Shifter**

H. Tang¹, R. Tang¹, K. Toprasertpong¹, S. Takagi¹, and M. Takenaka¹
(1 Univ. Tokyo)

P-18**Structural Optimization of Si Photonic Crystal Waveguide Beam Scanning Device Using Covariance Matrix Adaptation Evolution Strategy**

S. Suyama¹, R. Shiratori¹, and T. Baba¹
(1 Yokohama Nat'l Univ.)

P-19**High Density Passive Multi Fiber Assembly for Optical Interposers**

T. Aoki¹, A. Noriki^{1,2}, A. Ukita¹, K. Takemura¹, I. Tamai¹, Y. Ibusuki¹, T. Itatani^{1,2}, S. Suda^{1,2}, T. Kurosu^{1,2}, D. Mizutani¹, and T. Amano^{1,2}
(1 PETRA, 2 AIST)

P-20**Interconnect Demonstration Using a 1-Tbps Electrical/Optical Signal Conversion Board Deployed in a High-Performance Server**

Y. Nakasha^{1,2}, A. Sugama^{1,2}, T. Akiyama^{1,2}, D. Mizutani^{1,2}, and Y. Tanaka^{1,2}
(1 PETRA, 2 Fujitsu Ltd.)

P-21**Tunable Lasers with Hybrid Cavity Consisting of InP-based Two-storied Ridge Structure and Si-ring Filters**

T. Hiratani¹, N. Fujiwara^{1,2,3}, T. Kikuchi^{1,2}, N. Inoue¹, T. Ishikawa¹, T. Nitta^{1,2}, M. Eissa², Y. Oiso², N. Nishiyama², and H. Yagi^{1,3}

(1 Sumitomo Electric Industries, 2 Tokyo Inst. Tech., 3 OITDA)

P-22**Reduction of Optical Loss of Phase-change Phase Shifter Based on Ge₂Sb₂Te₅ Operating at Mid-infrared Wavelength**

Y. Miyatake¹, C. P. Ho¹, K. Makino², J. Tominaga², N. Miyata², T. Nakano², N. Sekine¹, K. Toprasertpong¹, S. Takagi¹, and M. Takenaka¹

(1 Univ. Tokyo, 2 AIST)

P-23**Hybrid Lasers Integrated with III-V SOA Regions and Si Filters using InP-based Two-storied Ridge Structure**

T. Kikuchi^{1,2}, T. Hiratani¹, N. Fujiwara^{1,2,3}, N. Inoue¹, T. Nitta^{1,2}, M. Eissa², T. Mitarai¹, Y. Oiso², N. Nishiyama², and H. Yagi^{1,3}

(1 Sumitomo Electric Industries, 2 Tokyo Inst. Tech., 3 OITDA)

P-24**E-band InAs/GaAs Tri-layer Quantum Dot Lasers with Low Threshold Current Densities**

W. Zhan¹, J. Kwoen¹, T. Imoto¹, S. Iwamoto^{1,2,3}, and Y. Arakawa¹

(1 NanoQuine, Univ. Tokyo, 2 IIS, Univ. Tokyo, 3 RCAST, Univ. Tokyo.)

P-25**Low Thermal Resistance of Membrane Distributed Feedback Laser Fabricated by Nano-film Assisted Room-temperature Surface Activated Bonding**

W. Fang¹, N. Takahashi¹, R. Xue¹, S. Katsumi¹, T. Amemiya^{1,2}, and N. Nishiyama^{1,2}

(1 Dept. of EEE, Tokyo Inst. Tech., 2 IIR Tokyo Inst. Tech.)

P-26**Parameter Dependence of a 1.3- μ m SiN Compact Wavelength MUX/DEMUX designed by Inverse Design Algorithm**

Y. Wang¹, Y. Oiso¹, T. Amemiya^{1,2}, and N. Nishiyama^{1,2,3}

(1 Dept. of EEE, Tokyo Inst. Tech., 2 IIR Tokyo Inst. Tech. 3 PETRA)

P-27**Measurement of Optical Dispersion Properties in Topological Photonic Crystals**

S. Okada¹, T. Amemiya^{1,2}, H. Kagami¹, Y. Wang¹, N. Nishiyama^{1,2}, and X. Hu³

(1 Dept. of EEE, Tokyo Inst. Tech., 2 IIR Tokyo Inst. Tech., 3 NIMS)

P-28**Investigation of Chip-on-wafer Direct Bonding Method for Hybrid Integration**

H. Onodera¹, T. Kikuchi¹, Y. Ohiso¹, T. Amemiya^{1,2}, and N. Nishiyama^{1,2}

(1 Dept. of EEE, Tokyo Inst. Tech., 2 IIR Tokyo Inst. Tech.)

P-29**Lasing Characteristics of GaInAsP Membrane Distributed-Reflector Laser on Si with Strong Lateral Optical Confinement Structure**

N. Takahashi¹, W. Fang¹, R. Xue¹, S. Katsumi¹, T. Amemiya^{1,2}, and N. Nishiyama^{1,2}

(1 Dept. of EEE, Tokyo Inst. Tech., 2 IIR Tokyo Inst. Tech.)

P-30**Scanning Laser Doppler Velocimeter and Vibrometer with Si Photonic Crystal Slow Light FMCW LiDAR**

S. Suyama¹, H. Ito¹, R. Kurahashi¹, H. Abe¹ and T. Baba¹

(1 Yokohama Nat'l Univ.)

P-31

Design of Topological Transmission Lines with Mode Selectivity by Band Tuning

H. Kagami¹, T. Amemiya^{1,2}, S. Okada¹, Y. Wang¹, N. Nishiyama^{1,2}, and X. Hu³

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P-32

E-band Quantum Dot Lasers on Metamorphic Buffer Layer

J. Kwoen¹, N. Morais¹, W. Zhan¹, T. Imoto¹, and Y. Arakawa¹

(1 NanoQuine, Univ. Tokyo)

P-33

Proposal and Characteristic Analysis of Lateral-Electric-Field Electro-Absorption Modulator with Insulation Region by H⁺ ion implantation

P. Yu¹, T. Ito¹, K. Atsugi¹, D. Qu¹, J. Kwoen², Y. Matsushima¹, H. Ishikawa¹, Y. Arakawa², and K. Utaka¹

(1 Waseda Univ., 2 NanoQuine, Univ. Tokyo)

P-34

Regional Control of InAs/GaAs Quantum Dot Composition Intermixing with Three-Regions and PL Spectrum Measurement

T. Ito¹, K. Atsugi¹, J. Kwoen², P. Yu¹, D. Qu¹, Y. Matsushima¹, H. Ishikawa¹, Y. Arakawa², and K. Utaka¹

(1 Waseda Univ., 2 NanoQuine, Univ. Tokyo)

P-35

Demonstration of a Transfer Printed Long-cavity InAs/GaAs Quantum Dot Laser on Silicon Substrate

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(1 NanoQuine, Univ. Tokyo, 2 Keio Univ.)

P-36

Non-volatility of Hybrid MOS Optical Phase Shifter using Si FeFET

K. Watanabe¹, H. Tang¹, K. Toprasertpong¹, S. Takagi¹, and M. Takenaka¹

(1 Univ. Tokyo)

P-37

Temperature- & Fabrication-Tolerant Crosstalk-Free Si PIC Dense WDM Demultiplexer Having Cascaded AMZ Triplet with a Fully-Integrated Controller ASIC

T. Akiyama^{1,2}, M. Nishizawa^{1,2}, A. Sugama^{1,2}, Y. Nakasha^{1,2}, S. Tanaka², Y. Tanaka^{1,2}, and T. Hoshida²

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P-38

Lateral SACM-APD with Butt-Coupled Structure in Ge Waveguide Absorber for Receiving 1600 nm Wavelength Based on Si Photonics Technology

H. Ono^{1,2}, H. Takahashi^{1,2}, Y. Onawa^{1,2}, T. Hasegawa^{1,2}, D. Shimura^{1,2}, H. Yaegashi^{1,2}, and H. Sasaki^{1,2}

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P-39

112-Gb/s PAM-4 (56 Gbaud) Silicon-Photonics Receiver Integrated with Linear TIA Based on SiGe-BiCMOS Technology

D. Okamoto¹, Y. Suzuki¹, K. Takemura¹, J. Fujikata¹, and T. Nakamura¹

(1 PETRA)

P-40

Tx Module with InP-Based Integrated LD Light Source for TWDM-PON

H. Takahashi^{1,2}, M. Itoh^{1,2}, D. Shimura^{1,2}, H. Yaegashi^{1,2}, and H. Sasaki^{1,2}

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P-41

Error-Free Operation for Fully Connected Wavelength-Routing Network among Eight FPGA Nodes with Four EOMs per Node

T. Shimizu¹, S. Nakamura¹, H. Yamaguchi¹, K. Takemura¹, K. Mizutani¹, T. Usuki¹, and Y. Urino¹
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P-42

Fabrication of Polymer Mirror with Si Photonics Integrated Chip for TWDM-PON ONU

I. Tamai¹, A. Noriki^{1,2}, Y. Ibusuki¹, A. Ukita¹, K. Takemura¹, T. Aoki¹, Y. Onawa¹, H. Takahashi¹, H. Ono¹, H. Okayama¹, T. Hasegawa¹, D. Shimura¹, H. Yaegashi¹, T. Amano^{1,2}, and H. Sasaki^{1,2}
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P-43

Numerical Analysis of Silicon Photonics by 3D Full-vector Simulation

T. Usuki¹
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P-44

Structure optimization of coupled photonic crystal nanocavities

R. Mitsuhashi¹, T. Asano¹, and S. Noda¹
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P-45

Process Improvement of Polymer Film Formation and Metallization for Silicon Photonics Integrated Chips Using a 300mm Wafer Platform for Optical Transceiver Application

M. Nishizawa¹, T. Aoki¹, Y. Nakasha^{1,2}, and Y. Tanaka^{1,2}
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P-46

Demonstration of Silicon Photonics WDM Optical Engine with Auto Controlled Multiplexers and Demultiplexers

A. Sugama^{1,2}, T. Akiyama^{1,2}, M. Nishizawa¹, Y. Nakasha^{1,2}, and Y. Tanaka^{1,2}
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P-47

Embedded Optical Transceiver Module Using Capacitor-Embedded Substrate for Co-Packaged and Near-Package Optics

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