ICNN

Monday, 19 April

[ICNN-1] 10:00-11:00
ICNN Session 1
Chair: Toshiharu SAIKI
Keio University

ICNN-Opening 10:00

Opening Remarks
Yasuhiko Arakawa
The University of Tokyo

ICNN-1-01 10:10 ***Invited***

Semiconductor Nanostructures for Optoelectronics Applications
Chennupati Jagadish
The Australian National University

In this talk, I will introduce the importance of nanowires and their potential applications and discuss about how these nanowires can be synthesized and how the shape, size and composition of the nanowires influence their structural and optical properties.

ICNN-1-02 10:45

Silicon Carbide Quantum Photonics in Triangular Geometry
Sridhar Majety, Pranta Saha, Marina Radulaski
University of California Davis

We explore triangular cross-section silicon carbide waveguides suitable for applications in quantum communications. Through simulations we optimize the waveguide geometry for maximum coupling efficiency of the color center emission to the fundamental transverse electric mode.

[ICNN-2] 11:20-12:05
ICNN Session 2
Chair: Toshiharu SAIKI
Keio University

ICNN-2-01 11:20 ***Invited***

Sb_2S_3 properties and application in displays and reprogrammable photonics
Robert Edward Simpson[1], Li Lu[1], Tingyu Teo[1], Alyssa Poh[1], Yunzheng Wang[1], Zhaogang Dong[2], Ramón Paniagua-Domínguez[2], Areniy I Kuznetsov[2], Joel KW Yang[1,2]
*[1]Singapore University of Technology and Design, [2]Institute of Materials Research and Engineering, A*STAR*

The objective of this presentation is to introduce Sb_2S_3 as a useful phase change material for reprogrammable visible and near infrared photonics. Several surprising results will be highlighted, including its birefringent nature.

ICNN-2-02 11:50

Si Perfect Absorber by Degenerate Critical Coupling in Visible Region
Rongyang Xu, Junichi Takahara
Osaka University

We propose a silicon perfect absorber based on degenerate critical coupling in the visible region. We also provide two methods to control loss so that the operational wavelength of the perfect absorber can be extended to the entire visible region.

[ICNN-3] 14:55-16:40
ICNN Session 3
Chair: Mark Holmes
The University of Tokyo

ICNN-3-01 14:55 ***Invited***

High Dimensional Quantum Meta-device
Din Ping TSAI
Hong Kong Polytechnic University

High dimensional quantum meta-device for entanglement light source is demonstrated by a 10 x 10 meta-lenses array. Two, three, and four-dimensional two-photon path-entanglement with different phase coded meta-lenses are demonstrated.

ICNN-3-02 15:25 ***Invited***

Optical metamaterial absorber and its application for spectroscopy
Takuo Tanaka[1,2]
[1]RIKEN, [2]Tokushima Univ.

Optical metamaterial consists of subwavelength structure were developed and studied for a versatile platform of ultra-sensitive detection of infinitesimal materials. Metamaterial IR absorber using metal-insulator-metal structure with a nanofluidic channel as an insulator layer was developed, and it dramatically improved the sensitivity of IR molecular spectrum compared to the conventional IR spectroscopies.

ICNN-3-03 15:55 ***Invited***

Efficient 120 Gbit/s OOK and 200 Gbit/s PAM4 transmitter using integrated silicon and polymer hybrid modulator
Shiyoshi Yokoyama[1], Guo-Wei Lu[1,2], Feng Qiu[1]
[1]Kyushu University, [2]Aizu University

The high efficient electro-optic polymer is used to demonstrate 120 Gbit/s OOK and 200 Gbit/s PAM4 modulations. The polymer is performed on the silicon Mach-Zehnder interferometer toward possible hybrid silicon and polymer photonic platform.

ICNN-3-04 16:25

Self-assembled liquid crystal metasurfaces for electro-optical control of light transmission, diffraction and anomalous refraction
Alena V. Mamonova[1], Maxim V. Gorkunov[1], Irina V. Kasyanova[1], Vladimir V. Artemov[1], Alexander A. Ezhov[1,2], Ivan V. Simdyankin[1], Sergei P. Palto[1]
[1]FSRC "Crystallography and Photonics", RAS, [2]Faculty of Physics, Lomonosov MSU

Liquid crystal metasurfaces are a new type of artificial soft matter systems exhibiting strong visible light diffraction. They can be efficiently optimized for various optical functionalities and allow millisecond-fast electro-optical switching between different regimes.

[ICNN-4] 17:00-18:20
ICNN Session 4
Chair: Tadashi Asano
Kyoto University

ICNN-4-01 17:00 ***Invited***

In-memory photonic computing approaches to photonic tensor cores
Harish Bhaskaran
Oxford University

ICNN-4-02 17:35 ***Invited***

Applications of low-loss adiabatic nano-focusing and nano-defocusing by hybrid gap plasmonic waveguides
Nicholas Gusken[1], Michael Nielsen[1,3], Xingyuan Shi[1], Paul Dichtl[1], Stefan Maier[1,2], Rupert F Oulton[1]
[1]Imperial College London, [2]Ludwig-Maximilians-Universität, [3]UNSW Sydney

We report integrated plasmonic elements for nano-focusing and nano-defocusing on a silicon photonics platform using hybrid gap plasmon waveguides. With 90% coupling efficiency to a 10 nm gap, we highlight potential applications through recent demonstrations.

ICNN-4-03 18:05

Directional Raman scattering coupled into plasmonic waveguide with near-unity couple efficiency
Fu Ming, Mónica Mota, Andrea Jacassi, Xiaofei Xiao, Rupert F. Oulton
Imperial College

We report directional broadband Raman scattering of light within a plasmonic slot waveguide. We demonstrate that 99% of the Raman photons produced couple directly into the waveguide mode due to enhanced spontaneous Raman scattering.

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[ICNN-5] 10:00-11:00
ICNN Session 5
Chair: Wakana Kubo
Tokyo University of Agriculture and Technology

ICNN-5-01 10:00 ***Invited***

Dirac Plasmon-Assisted Asymmetric Hot Carrier Generation for Room-Temperature Infrared Detection
Debashis Chanda
University of Central Florida

The talk will outline a novel strategy for uncooled, tunable, multispectral infrared detection. Due to the low photon energy, detection of infrared photons is challenging at room temperature. In this article, we demonstrate, for the first time, an asymmetric plasmon-induced hot-carrier Seebeck photodetection scheme at room temperature that exhibits a remarkable responsivity of 2900 V/W.

ICNN-5-02 10:30 ***Invited***

Improving the single photon emission properties of III-nitride quantum dots
Mark J Holmes, Sijia Xia, Tomoyuki Aoki, Kang Gao, Munetaka Arita, Yasuhiko Arakawa
The University of Tokyo

A review of our achievements on realising single photon emisison from III-nitride quantum dots.

[ICNN-6] 11:20-12:20
ICNN Session 6
Chair: Satoshi Iwamoto
The University of Tokyo

ICNN-6-01 11:20 ***Invited***

Electrically Pumped Photonic Topological Lasers
Qi Jie Wang
Nanyang Technological University

An electrically pumped topological laser with valley edge states, in a quantum cascade semiconductor laser platform, will be presented in this presentation. We have shown experimentally that photonic topological protected lasing states are realized in such designed photonic structures.

ICNN-6-02 11:50

Optical data transmission with a microresonator-based comb source
Soma Kogure[1], Tamiki Ohtsuka[1], Shun Fujii[1,2], Hajime Kumazaki[1], Koshiro Wada[1], Yosuke Hashimoto[3], Yuta Kobayashi[3], Tomohiro Araki[3], Kentaro Furusawa[4], Norihiko Sekine[4], Takasumi Tanabe[1]
[1]Keio University, [2]RIKEN, [3]JAXA, [4]NICT

Microcombs, or frequency comb generated in microresonator, have revolutionized photonics. In this talk we generate four types of microcombs including soliton comb and demonstrate data transmission with them to evaluate the signal integrity.

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ICNN-6-03 12:05

Non-Hermitian, Topological, and Lorentz Non-reciprocal Photonic Metamaterials

Wang Tat Yau, Kai Fung Lee, Kin Hung Fung
The Hong Kong Polytechnic University

Non-Hermitian, Topological, and Lorentz non-reciprocal photonic metamaterials have attracted intense attention due to their complexities. Strongly dispersive materials such as plasmonic and ferromagnetic materials lead to additional difficulties in defining topological modes. In this talk, I will introduce recent progress in my group and discuss the bands and edge modes in these low-symmetry photonic systems.

[ICNN-7] 15:00-16:35
ICNN Session 7
Chair: Shinji Matsuo
NTT

ICNN-7-01 15:00

Formation and optical characteristics of ZnO:Tm,Yb/ZnO nanowires towards photovoltaic applications

Jun Tatebayashi, Tokuhito Nakajima, Naoto Nishiyama, Dolf Timmerman, Shuhei Ichikawa, Yasufumi Fujiwara
Osaka University

We report on the formation and optical characteristics of Tm,Yb-codoped ZnO films on ZnO nanowires grown by sputtering-assisted metal organic chemical vapor deposition. We observe luminescence at 489 nm from Tm^{3+} ions which is essential for the down-conversion process by growing ZnO:Tm,Yb films on the nanowire configuration.

ICNN-7-02 15:15

Fabrication and Characterization of L3 Nanocavities Designed Using Machine Learning

Takeshi Shibata, Takashi Asano, Susumu Noda
Kyoto University

We fabricate and characterize L3 type photonic crystal nanocavities optimized based on machine learning. A high loaded (unloaded) experimental *Q* factor of 2.9 (4.3) million is obtained, which largely exceed previously reported values.

ICNN-7-03 15:30

Optimizing the Position of Quantum Dot Layers to Increase Absorption: Towards High-Efficiency Quantum Dot Solar Cells

Yusuke Oteki[1,2], Maxime Giteau[2], Kei Fukushima[1,2], Kento Kitahara[1,2], Naoya Miyashita[2], Ryo Tamaki[2], Yoshitaka Okada[1,2]
[1]School of Engineering, University of Tokyo, [2]RCAST, University of Tokyo

The limitation efficiency of single-junction solar cells can theoretically be overcome by embedding quantum dot (QD) layers within the absorber material. However, a single QD layer absorbs only a small fraction of the incident light. In this work, we explain the interest of optimizing the position of QD layers to increase absorption and validate it experimentally with Fabry-Perot resonances.

ICNN-7-04 15:45

A multiphysics cellular automata model for phase change materials photonics

Yunzheng Wang[1], Jing Ning[1,3], Michel Bosman[2,3], Robert Simpson[1]
[1]Engineering pillar of Design, Singapore University of Technology and Design, Singapore, [2]Agency for Science Technology and Research, Institute of Materials Research and Engineering, Singapore, [3]Department of Material Science and Engineering, National University of Singapore, Singapore

Combining non-isothermal laser heating, Gillespie's Cellular Automata approach, effective medium theory and Fresnel's laws, we present a multiphysics Cellular Automata-based framework to model the transient optical response of new phase-change photonics devices during crystallization and amorphization, which will be clearly important for designing novel photonic devices.

ICNN-7-05 16:00 ***Invited***

Ultra-Narrow Linewidth of Quantum Dot Distributed Feedback Lasers

Johann Peter Reithmaier[1], Gadi Eisenstein[2], Bernd Witzigmann[3]
[1]Institute of Nanostructure Technologies and Analytics, CINSaT, University of Kassel, Germany, [2]Departm. of Electrical Engineering and Russell Berrie Nanotechnology Institute (RBNI), Technion, Israel, [3]Computational Electronics and Photonics Group, CINSaT, University of Kassel, Germany

In this talk, an overview is given on the recent progress to utilize the huge impact of the gain material itself on the emission linewidths of distributed feedback lasers. With the substitution of QWs by appropriate quantum dot (QD) layers, the linewidth can be drastically reduced without restricting device designs. Linewidth reduction by nearly two order of magnitudes to 20 kHz was obtained mainly originated by a strong reduction of the linewidth enhancement factor.

[ICNN-8] 16:55-18:25
ICNN Session 8
Chair: Wakana Kubo
Tokyo University of Agriculture and Technology

ICNN-8-01 16:55 ***Invited***

Ultra coherent nano mechanical oscillators for room temperature quantum feedback

Tobias Kippenberg
EPFL

ICNN-8-02 17:25 ***Invited***

Metamaterial Enhanced Photodetection

Alexander Dorodnyy, Stefan Martin Koepfli, Raphael Schwanninger, Nikola Dordevic, Shadi Nashashibi, Arif Gungor, Jasmin Smajic, Juerg Leuthold
Institute of Electromagnetic Fields, ETH Zurich

Metamaterial enhancement allows to build novel faster and more sensitive photodetectors. Plasmonic metamaterials can provide extraordinary angular stability approaching a full hemisphere range whereas dielectric ones yield ultra-high quality-factors on the order of hundred thousand.

ICNN-8-03 17:55

Complete design of a fully integrated graphene-based plasmon coupler for the infrared

Aswani Natarajan, Guillaume Demésy, Gilles Renversez
Aix-Marseille University & CNRS Institut Fresnel

A fully integrated efficient and tunable surface plasmon coupler composed of a realistic non-tapered dielectric waveguide with graphene patches and sheet is designed for the infrared and optimized through rigorous numerical and theoretical studies.

ICNN-8-04 18:10

Nonlinear Pancharatnam-Berry Phase Metasurfaces beyond the Dipole Approximation

Sylvain D. Gennaro, Yi Li, P. Dichtl, Stefan A. Maier, Rupert F. Oulton
Imperial College

We demonstrate nonlinear gold-antenna metasurfaces exhibiting both 2nd and 3rd order nonlinear processes. They produce diffraction orders not predicted by the generalized law of refraction, and thus require consideration of higher order antenna modes.

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[ICNN-9] 10:00-11:00
ICNN Session 9
Chair: Takahiro Nakamura
PETRA

ICNN-9-01 10:00 ***Invited***

Progress in Photonic Crystals -From Fundamental to State of the Arts for Society 5.0 -

Susumu Noda
Kyoto University

In this talk, I will review such progress of photonic crystals from the fundamental to State of the Arts for Society 5.0.

ICNN-9-02 10:30 ***Invited***

Robust and Versatile Integrated Photonics For Green Exascale Computing

Di Liang[1], Zhihong Huang[1], Geza Kurczveil[1], Sudharsanan Srinivasan[1], Binhao Wang[1], Erwen Li[1], Yuan Yuan[1], Bassem Tossoun[1], Yang-Hang Fan[2], Xiaoge Zeng[1], Zhixin Liu[3], Marco Fiorentino[1], Samuel M. Palermo[2], Raymond G. Beausoleil[1]
[1]Hewlett Packard Labs, [2]Texas A&M University, [3]University College London

We review our progress on fully integrated transceivers with heterogeneous quantum-dot (QD) lasers, novel microring modulators and SiGe avalanche photodetectors on silicon substrate, aiming to achieve overall operation sweet spot in a harsh environment.

[ICNN-10] 11:25-12:20
ICNN Session 10
Chair: Yasutomo Ota
The University of Tokyo

ICNN-10-01 11:25

Surface Plasmon-Enhanced Fluorescence Biosensor for Repeated Measurement of Cardiac Marker

Koji Toma, Koki Oishi, Takahiro Arakawa, Kohji Mitsubayashi
Tokyo Medical and Dental University

A surface plasmon-enhanced fluorescence immunosensor was developed for sensitive and repeated measurement of cardiac markers. The enhanced field by surface plasmon polaritons allowed concentration dependent sensor output and potential for repeated use of the sensor.

ICNN-10-02 11:40

Near-IR concealed images by single crystalline Silicon Mie resonators

Hiroyuki Ishimaru, Junichi Takahara
Osaka University

Many researches have been reported on controlling the scattering of light using Mie resonators. Backscattering of light using crystalline-Silicon (c-Si) Mie resonators can be applied to structural color images with diffraction limit resolution. We aim to extend such structural colors to near infrared (IR) region. In this study, we demonstrate "concealed images" at near-IR by c-Si Mie resonators, which cannot be seen in visible region.

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ICNN-10-03 11:55

Single-base-resolved and millisecond SERS spectroscopy of DNA oligonucleotides using gold nanoparticle dimers spontaneously formed in aqueous suspension

Takumi Ikeda, Nozomi Hagiwara, Keiko Esashika, Toshiharu Saiki
Keio University

We develop a method to spontaneously form Au nanoparticle dimers, which sandwiches a single DNA oligonucleotide within a gap of less than 1 nm. SERS measurement of single AuNP dimers in aqueous suspension demonstrates single-base (sub-nanometer) resolution obtained within a 10-ms measurement period.

ICNN-Closing 12:10

Closing Remarks

Yasuhiko Arakawa
The University of Tokyo

Poster

[ICNN-P]
Poster Session

ICNN-P-01

Photoluminescence Enhancement by Plasmonic Resonance of Silver Nanoparticles on Bulk GaN Substrates

Seiya Kaito, Kohei Shimanoe, Tetsuya Matsuyama, Kenji Wada, Koichi Okamoto
Osaka Prefecture University

In the study, we used bulk GaN substrate as a sample to verify the PL enhancement using the quadrupole oscillation mode, and also tried to reproduce this effect of the PL enhancements based on electromagnetic field analysis calculation.

ICNN-P-02

Metamaterial Perfect Absorber as Heat Generator

Mahiro Horikawa, Wakana Kubo
Tokyo University of Agriculture and Technology

Metamaterial perfect absorber (MPA) is a nanostructure which shows near perfect light absorption for resonance wavelengths. In this study, we have examined the function of the MPA as a heat generator by installing the MPA to a plasmonic photo-thermoelectric device. We prooved that the MPA is an effective heat source compared to other simple plasmonic structures by both experimental and numerical approaches.

ICNN-P-03

Plasmonic Color Sensor using Random Ag Nano-Hemispheres on Mirror

Sayako Maeda, Koki Matsuda, Ryo Hasegawa, Tetsuya Matsuyama, Kenji Wada, Koichi Okamoto
Osaka Prefecture University

Recently, we have shown that random metal nano-hemispheres on a mirror substrate (NHoM) can be used as plasmonic metamaterials for controlling plasmonic color. In this study, we demonstrae that this structure achieves enhancement and sharpening of the resonance spectrum and enables high-sensitivity sensing with a large wavelength change range by calculations and experiments.

ICNN-P-04

Deep UV Surface Plasmon Resonance using Ga_2O_3 nano-particles on Al Substrate

Soshi Endo, Yuya Nakatsuka, Kohei Shimanoe, Tetsuya Matsuyama, Kenji Wada, Koichi Okamoto
Osaka Prefecture University

In this work, we propose a dielectric Ga_2O_3 nano-hemispherical structure on an Al substrate. This structure is expected to significantly reduce the incident light loss while having unique optical properties compared to Ga nano-particles.

ICNN-P-05

Enhancement in Output Power of Bi_2Te_3Thermoelectric Device by Infrared Metamaterial Absorber

Takuya Asakura, Kubo Wakana, Shohei Katsumata
Tokyo University of Agriculture and Technology

Metamaterial Perfect Absorber (MPA) is a metamaterial structure that absorbs almost 100% of incident light of a specific wavelength. In this study, we aimed to improve the output power of the thermoelectric conversion device by utilizing the local heat generated by the absorption loss of MPA.

ICNN-P-06

Mechanism of blue/green emission enhancement by surface plasmon resonance in polar/semi-polar InGaN/GaN quantum wells

Kento Ikeda[1], Kanata Kawai[1], Jun Kametani[1], Tetsuya Matsuyama[1], Kenji Wada[1], Narihito Okada[2], Kazuyuki Tadatomo[2], Koichi Okamoto[1]
[1]Osaka Prefecture University, [2]Yamaguchi University

QCSE can be reduced for QWs grown on semi-polar GaN substrates. In this study, surface plasmon enhanced light emissions were investigated for polar/semi-polar InGaN/GaN quantum wells by the micro PL and the time-resolved PL.