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OPTICS & PHOTONICS International Congress

# OPIC 2018

23-27 April 2018

PACIFICO YOKOHAMA | Yokohama, Japan

# Congress Program

- **Plenary Session**
- **Joint Sessions**
- **Specialized International Conferences**
  - ALPS 2018 : The 7th Advanced Lasers and Photon Sources
  - BISC 2018 : The 4th Biomedical Imaging and Sensing Conference
  - HEDS 2018 : International Conference on High Energy Density Science
  - ICNN 2018 : International Conference on Nanophotonics and Nanooptoelectronics
  - IoT-SNAP 2018 : IoT Enabling Sensing/Network/AI and Photonics Conference
  - LDC 2018 : Laser Display and Lighting Conference
  - LEDIA 2018 : The 6th International Conference on Light-Emitting Devices and Their Industrial Applications
  - LIC 2018 : The 6th Laser Ignition Conference
  - LSC 2018 : Conference on Laser and Synchrotron Radiation Combination Experiment
  - LSSE 2018 : Laser Solution for Space and the Earth
  - OMC 2018 : The 5th Optical Manipulation and Structured Materials Conference
  - PLD 2018 : Pacific Rim Laser Damage
  - SLPC 2018 : The 3rd Smart Laser Processing Conference
  - XOPT 2018 : International Conference on X-ray Optics and Applications

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# OPTICS & PHOTONICS International Congress 2018

**Date:** Monday 23 - Friday 27 April, 2018

**Organized by**
OPTICS & PHOTONICS International Council

**Specialized International Conference Organized by**
The Laser Society of Japan
SPIE – The International Society for Optics and Photonics
Institute for Nano Quantum Information Electronics, The University of Tokyo
The Graduate School for the Creation of New Photonics Industries
The Optical Society of Japan
Akasaki Research Center (ARC), Nagoya University
The Micro Solid-Sate Photonics Group of The Laser Society of Japan
High Energy Accelerator Research Organization (KEK)
Institute of Laser Engineering, Osaka University
The Executive Committee of Laser Solution for Space and the Earth
SIOM Chinese Academy of Science
Japan Laser Processing Society
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Ministry of Health, Labour and Welfare
Ministry of Land, Infrastructure, Transport and Tourism
KEIDANREN (Japan Business Federation)
Japan Science & Technology Agency (JST)
Japan Tourism Agency (JTA)

**In Cooperation with**
AEST – Atomic Energy Society of Japan
AIST – The National Institute of Advanced Industrial Science and Technology
Fraunhofer Institute for Laser Technology ILT (Germany)
ILT – Institute for Laser Technology
JPC – Japan Photonics Council
JSPF – The Japan Society of Plasma Science and Nuclear Fusion Research
NEDO – New Energy and Industrial Technology Development Organization
OITDA – Optoelectronic Industry and Technology Development Association
OSA – The Optical Society (USA)
Photonics Media (USA)
PIDA (Taiwan)
QST – National Institutes for Quantum and Radiological Science and Technology
RIKEN

# Welcome to OPIC 2018

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*OPIC 2018 Organizing Committee*

*Professor, Utsunomiya University*

**Yoshiaki Kato**

*Co-Chair*

*OPIC 2018 Organizing Committee*

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*President, The Laser Society of Japan*

**Shuji Sakabe**

*Chair*

*OPIC 2018 Steering Committee*

*Professor, Kyoto University*

OPIC (Optics and Photonics International Congress) and OPIE (Optics and Photonics International Exhibition) are the international forums to present and discuss the most up-to-date R&D and industrial activities in optics and photonics in the world and to exchange thoughts on the role of optics and photonics in our future society. The first OPIC/OPIE was started in 2012 under the organization of the Optics and Photonics International Council (OPI Council) and is held each year in Yokohama.

At the plenary session of OPIC 2018, four distinguished speakers will present on the following hot topics; 'VCSELs in every car, every home and every mobile device', 'Diamond electronics and photonics: Application to quantum sensors', 'Photoacoustic tomography: Deep tissue imaging by ultrasonically beating optical diffusion', and 'Experiments on laser plasma accelerators with the BELLA laser and exploring the path towards future applications'.

OPIC 2018 is composed of 14 professional conferences. We are very pleased to welcome IoT-SNAP (IoT Enabling Sensing/Network/AI and Photonics) to OPIC this year.

The OPI Council sincerely appreciates the authorized support of the Ministry of Education, Culture, Sports, Science and Technology (MEXT), the Ministry of Economics, Trade and Industry (METI), the Ministry of Agriculture, Forest and Fishery (MAFF), the Ministry of Health, Labor and Welfare (WHLW), the Ministry of Land, Infrastructure, Transport and Tourism (MLIT), and Keidanren (Japan Business Federation). We appreciate cooperation with the societies and agencies in Japan, USA, Germany, Taiwan, and Korea. Also we would like to thank the founding organizations and companies for their strong support of OPIC 2018.

# Program at a Glance

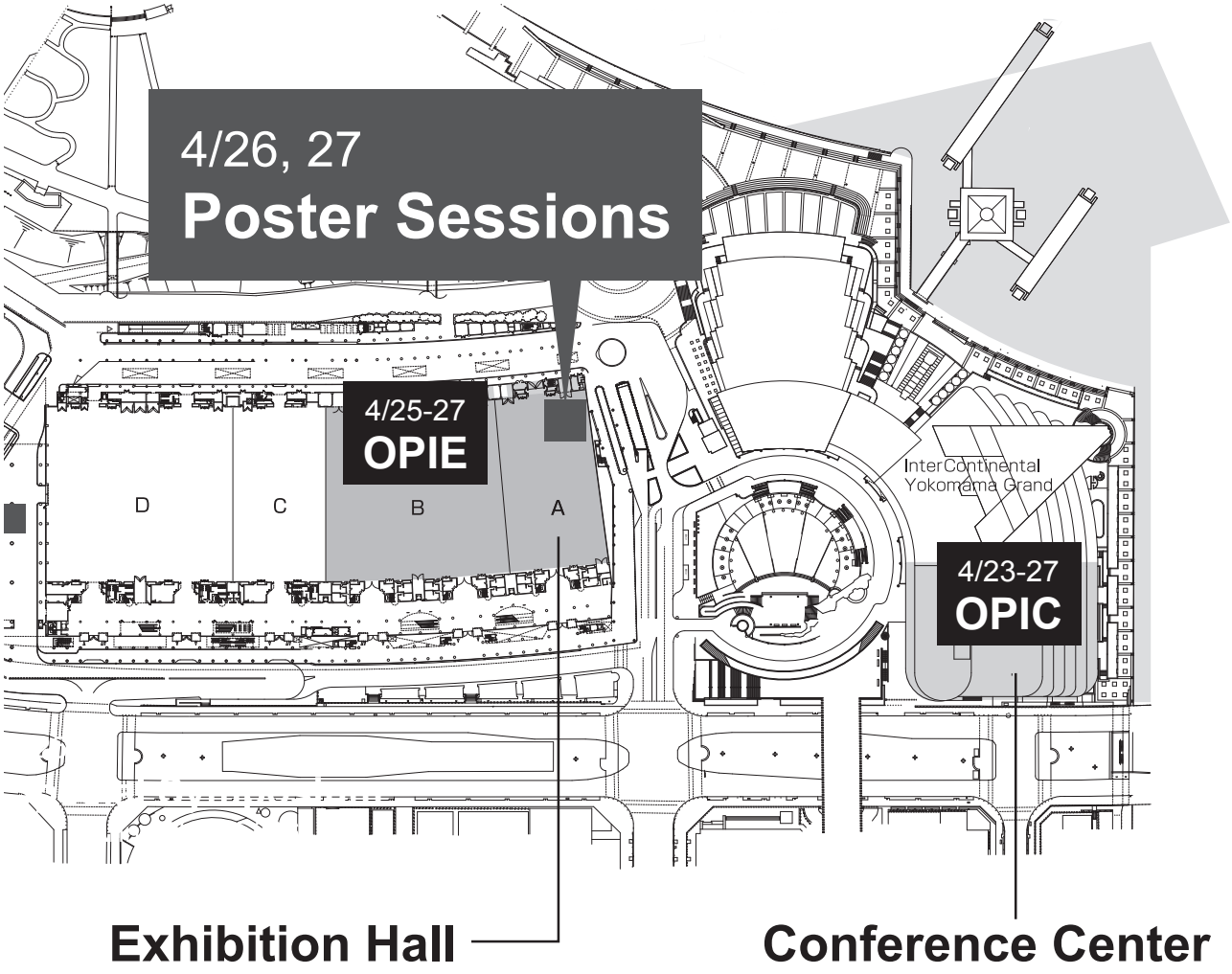
| Date | Time \ Room | HEDS Room311+312 | XOPT Room313+314 | ALPS Room303 | ALPS Room511+512 | LSSE Room316 | IoT-SNAP Room413 | LDC Room301 | LEDIA Room411+412 |
|---|---|---|---|---|---|---|---|---|---|
| Mon 23 Apr. | 9:00- | | | | | | | | |
| | 10:00- | HEDS1 (p.47) | | | | | | | |
| | | Break | | | | | | | |
| | 11:00- | HEDS2 (p.47) | | | | | | | |
| | 12:00- | Lunch | | | | | | | |
| | 14:00- | HEDS3 (p.47) | | | | | | | |
| | 15:00- | Break | | | | | | | |
| | 16:00- | HEDS4 (p.47) | | | | | | | |
| | 17:00- | | | | | | | | |
| | | 17:30 - 19:30 Get together (Ristorante ATTIMO) | | | | | | | |
| Tue 24 Apr. | 9:00- | HEDS5 (p.48) | XOPT1 (p.49) | ALPS1-B (p.48) | | | | LDC1 (p.49) | |
| | 10:00- | | Break | | | | IoT1 (p.48-) | | |
| | 11:00- | HEDS6 (p.50) | XOPT2 (p.51) | ALPS2-H (p.50) | ALPS3-A (p.50) | LSSE1 (p.49) | Break | Break | |
| | | | | | | LSSE2 (p.51) | IoT1 (p.48-) | LDC2 (p.51) | |
| | 12:00- | Lunch | | | | | | | |
| | 13:00- | | XOPT3 (p.52-) | ALPS4-E1 (p.52-) | ALPS5-I1 (p.52-) | Joint Session IoT-SNAP+LSSE (p.26, p.52-) | | LDC3 (p.53-) | |
| | 14:00- | HEDS7 (p.52-) | | | | | | | |
| | 15:00- | Break | | | | | | | |
| | 16:00- | HEDS8 (p.54-) | XOPT4 (p.55-) | ALPS6-E2 (p.54-) | ALPS7-I2 (p.54-) | Joint Session IoT-SNAP+LSSE (p.26, p.52-) | | LDC3 (p.53-) | |
| | | | | | | | | Break | |
| | 17:00- | | XOPT5 (p.57) | | | | | LDC4 (p.57-) | |
| Wed 25 Apr. | 9:00- | Plenary Session<Room 501+502> (p.16-) | | | | | | | |
| | 12:10- | Lunch | | | | | | | |
| | 13:00- | | | | | | | | |
| | 14:00- | Joint Session ALPS+HEDS+XOPT (p.26, p.58) | | | ALPS9-G1 (p.59-) | LSSE3 (p.59-) | Joint Session LDC+LEDIA+IoT-SNAP (p.26, p.58) | | |
| | 15:00- | Break | | | | | | | |
| | 16:00- | HEDS9 (p.60-) | XOPT6 (p.60) | ALPS10-D1 (p.60-) | ALPS11-G2 (p.63-) | LSSE3 (p.59-) | Joint Session LDC+LEDIA+IoT-SNAP (p.26, p.58) | | |
| | | | XOPT7 (p.64) | | | | | | |
| | 17:00- | | | | | | | | |
| | 18:00- | 18:00 - 20:00 OPIC Reception <Ballroom, 3rd floor InterContinental Yokohama Grand> | | | | | | | |
| Thu 26 Apr. | 9:00- | HEDS10 (p.68-) | XOPT8 (p.71-) | ALPS12-C1 (p.68-) | ALPS13-D2 (p.68-) | | IoT2 (p.69) | LDC5 (p.69-) | LEDIA1 (p.69-) |
| | 10:00- | | | Break | | | Break | | |
| | 11:00- | HEDSp11 (p.72-) | XOPTp9 (p.75-) | ALPS14-C2 (p.72-) | ALPS15-F1 (p.72-) | LSSEp4 (p.74-) | IoT3 (p.73-) | LDC5 (p.73-) | LEDIAp2 (p.73) |
| | 12:00- | Lunch | | | | Lunch | | | |
| | 13:00- | | | ALPSp (p.76-) | | | | | LEDIAp2 (p.77-) |
| | 14:00- | HEDS12 (p.80) | XOPT10 (p.79-) | | | LSSE5 (p.78-) | IoT4 (p.77-) | LDC6 (p.77-) | |
| | 15:00- | Break | | | | Break | | | LEDIA3 (p.81-) |
| | | | XOPT11 (p.87) | | | | | | Break |
| | 16:00- | HEDS13 (p.84-) | XOPT12 (p.88-) | | | LSSE6 (p.86-) | IoT4 (p.77-) | LDC7 (p.85-) | LEDIA4 (p.85-) |
| | 17:00- | | | | | | | | |
| Fri 27 Apr. | 9:00- | | | | ALPA16-F2 (p.92-) | LSSE7 (p.94-) | IoT5 (p.93) | LDC8 (p.93) | |
| | | | | | | | IoTp6 (p.93) | LDCp9 (p.93-) | LEDIA5 (p.93-) |
| | 10:00- | | | | Break | | Break | | Break |
| | 11:00- | | | | ALPS17-C3 (p.96-) | LSSE8 (p.98-) | IoTp6 (p.93-) | LDCp9 (p.97-) | LEDIA6 (p.97-) |
| | 12:00- | | | | | | Lunch | | |
| | 13:00- | | | | | | | LDC10 (p.101-) | LEDIA7 (p.101-) |
| | 14:00- | | | | | LSSE8 (p.98-) | IoT7 (p.101-) | | |
| | 15:00- | | | | | | | LDC11 (p.109) | Break |
| | 16:00- | | | | | | | LDC12 (p.113) | LEDIA8 (p.109-) |
| | 17:00- | | | | | | | | LEDIA9 (p.113) |

Plenary Joint Poster

| SLPC Room416+417 | LIC Room302 | PLD Room212 | ICNN Room414+415 | LSC Room213 | BISC Room419 | OMC Room418 | Special Event | Room / Time |
|---|---|---|---|---|---|---|---|---|
| | | | | | | | | 9:00- |
| | | | | | | | | 10:00- |
| | | | | | | | | 11:00- |
| | | | | | | | | 12:00- |
| | | | | | | | Lecture for Students | 14:00- |
| | | | | | | | | 15:00- |
| | | | | | | | | 16:00- |
| | | | | | | | | 17:00- |
| 17:30 - 19:30 Get together (Ristorante ATTIMO) | | | | | | | | |
| SLPC1 (p.49) | | | | | | | | 9:00- |
| Break | | | | | | | | 10:00- |
| SLPC2 (p.51) | | | | | | | | 11:00- |
| Lunch | | | | | | | | 12:00- |
| SLPC3 (p.53-) | | | | | | | SPIE Short Course | 13:00- |
| Break | | | | | | | | 14:00- |
| SLPC4 (p.55-) | | | | | | | | 15:00- |
| | | | | | | | | 16:00- |
| | | | | | | | | 17:00- |
| Plenary Session<Room 501+502> (p.16) | | | | | | | | 9:00- |
| Lunch | | | | | | | | 12:10- |
| Joint Session SLPC+LIC+PLD (p.27, p.58-) | | | ICNN1 (p.59-) | LSC1 (p.59-) | Joint Session BISC+OMC (p.27, p.58-) | | | 13:00- |
| | | | Break | | | | | 14:00- |
| Joint Session SLPC+LIC+PLD (p.27, p.58-) | | | ICNN2 (p.63-) | LSC2 (p.63) | Joint Session BISC+OMC (p.27, p.58-) | | | 15:00- |
| | | | | LSC3 (p.67) | | | | 16:00- |
| | | | | | | | | 17:00- |
| 18:00 - 20:00 OPIC Reception <Ballroom, 3rd floor InterContinental Yokohama Grand> | | | | | | | | 18:00- |
| SLPC7 (p.71) | LIC1 (p.70-) | PLD3 (p.71-) | ICNN3 (p.69-) | LSC4 (p.70) | BISC1 (p.68-) | OMC1 (p.70-) | | 9:00- |
| Break | | | | LSC5 (p.74) | | | | 10:00- |
| SLPCp8 (p.75-) | Break | | Break | | Break | | | |
| | LIC2 (p.74-) | PLD4 (p.75-) | ICNN4 (p.73-) | LSC5 (p.74-) | BISC1 (p.68-) | OMC2 (p.74-) | | 11:00- |
| Lunch | | | | | | | | 12:00- |
| SLPC9 (p.79-) | LIC3 (p.78-) | PLD5 (p.79-) | ICNNp5 (p.77-) | LSCp6 (p.78) | BISC2 (p.76-) | OMC3 (p.78-) | [OPIE] Fraunhofer Photonic Research Cooperation Workshop [Exhibition Hall B] | 13:00- |
| | | | ICNN6 (p.81-) | LSC7 (p.82-) | | | | 14:00- |
| Break | | | Break | | Break | OMC4 (p.86-) | | 15:00- |
| SLPC10 (p.87-) | LIC4 (p.86-) | PLD6 (p.87-) | ICNN7 (p.85-) | LSC8 (p.86-) | BISC3 (p.84-) | Break | | 16:00- |
| | | | | LSC9 (p.90) | | OMC5 (p.90) | | 17:00- |
| | LIC5 (p.94-) | PLD7 (p.95-) | ICNN8 (p.93-) | LSC10 (p.94) | BISC4 (p.92-) | OMC6 (p.94-) | | 9:00- |
| | Break | | | LSC11 (p.98-) | | | | 10:00- |
| | LIC5 (p.94-) | PLD8 (p.99-) | Break | | Break | | | |
| | | | ICNN9 (p.97-) | LSC11 (p.98-) | BISC5 (p.96-) | OMC7 (p.98-) | | 11:00- |
| | Lunch | | | | | | | 12:00- |
| | LICp6 (p.102) | PLD9 (p.103) | ICNN10 (p.101-) | LSC12 (p.102-) | BISCp6 (p.100-) | OMCp (p.102) | | 13:00- |
| | LIC7 (p.106-) | | | | Break | OMC8 (p.106-) | | 14:00- |
| | Break | | Break | | | | | |
| | LIC7 (p.106-) | PLD10 (p.111) | ICNN11 (p.109-) | Break | BISC7 (p.108-) | Break | | 15:00- |
| | | | | LSC13 (p.110-) | | OMC9 (p.110-) | | 16:00- |
| | | | | | | | | 17:00- |

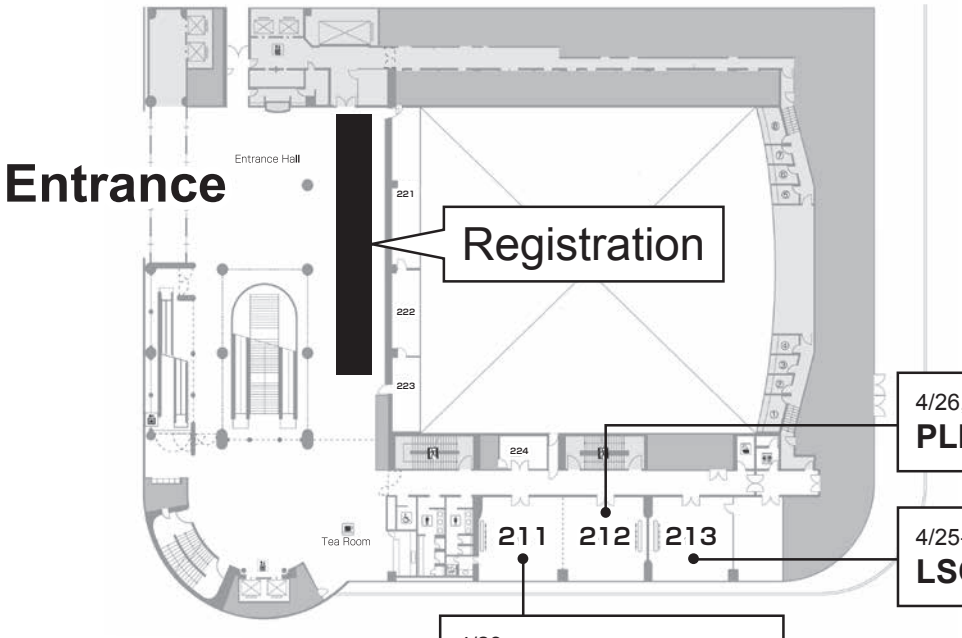
# Floor Plan

## Pacifico Yokohama



Conference Center

**2F**



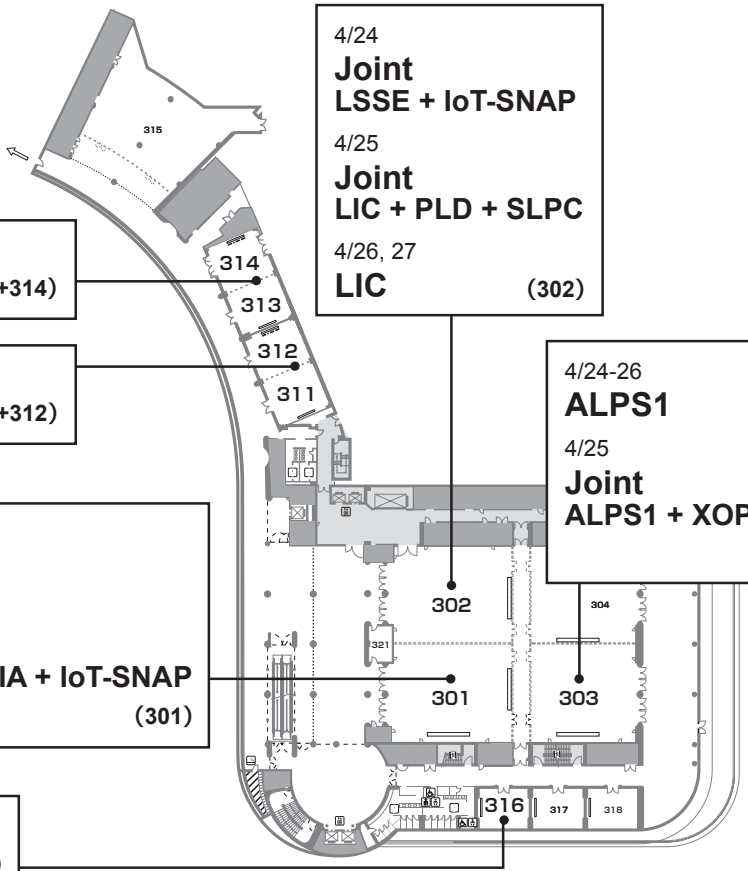

4/26, 27
**PLD (212)**

4/25-27
**LSC (213)**

4/23
**Student course (211)**

Conference Center

**3F**




4/24
**Joint**
**LSSE + IoT-SNAP**
4/25
**Joint**
**LIC + PLD + SLPC**
4/26, 27
**LIC (302)**

4/24-26
**XOPT (313+314)**

4/23-26
**HEDS (311+312)**

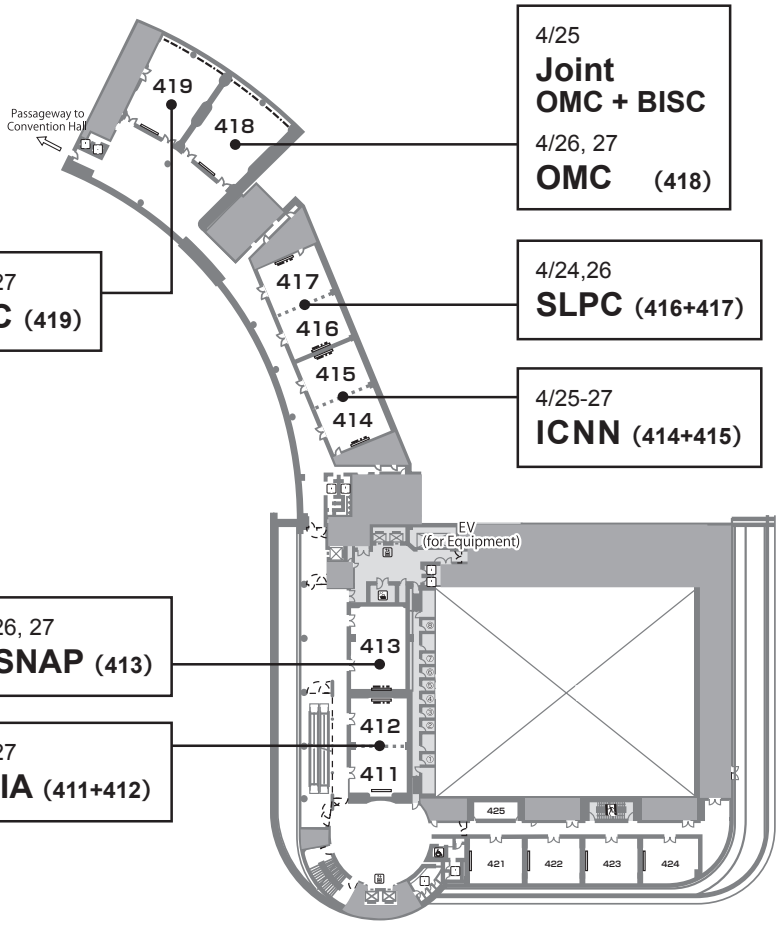
4/24-26
**ALPS1**
4/25
**Joint**
**ALPS1 + XOPT + HEDS**
**(303)**

4/24, 26, 27
**LDC**
4/25
**Joint**
**LDC + LEDIA + IoT-SNAP**
**(301)**

4/24AM, 25-27
**LSSE (316)**

Conference Center

**4F**




4/25
**Joint**
**OMC + BISC**
4/26, 27
**OMC** **(418)**

4/26, 27
**BISC** **(419)**

4/24,26
**SLPC** **(416+417)**

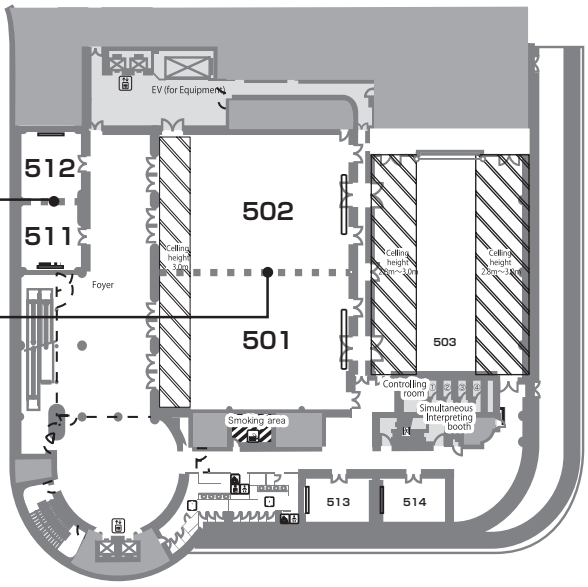
4/25-27
**ICNN** **(414+415)**

4/24, 26, 27
**IoT-SNAP** **(413)**

4/26, 27
**LEDIA** **(411+412)**

Conference Center

**5F**




4/24-27
**ALPS2** **(511+512)**

4/25 9:00-12:10
**Plenary Session**
**(501+502)**

# OPIC 2018 Committee Members

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**Masahiro Tsukamoto** *Osaka University, SLPC*
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# Schedule-at-a-Glance

| | Monday 23 April | Tuesday 24 April | Wednesday 25 April | Thursday 26 April | Friday 27 April |
|---|---|---|---|---|---|
| **GENERAL** | | | | | |
| Registration | 11:30-16:30 | 8:00-16:30 | 8:00-16:30 | 8:00-16:30 | 8:00-14:00 |
| Coffee Breaks | 10:30-11:00<br>15:00-15:30 | 10:30-11:00<br>15:00-15:30 | 10:30-11:00<br>15:00-15:30 | 10:30-11:00<br>15:00-15:30 | 10:30-11:00<br>15:00-15:30 |
| **OPIC Technical Programing** | | | | | |
| Technical Sessions | 9:30-17:00 | 9:00-18:00 | 13:30-17:30 | 9:00-18:00 | 9:00-18:00 |
| Plenary Sessions | | | 9:00-12:10 | | |
| Joint Session<br>IoT-SNAP+LSSE<br>ALPS+HEDS+XOPT<br>LDC+LEDIA+IoT-SNAP<br>SLPC+LIC+PLD<br>BISC+OMC | | 13:15-16:45 | 13:30-15:00<br>13:30-17:15<br>13:30-17:20<br>13:15-17:00 | | |
| Poster Sessions <Exhibition Hall A> | | | | 10:30-12:00<br>13:00-14:30 | 10:30-12:00<br>13:00-14:30 |
| SPIE Short Courses | | 13:00-17:00 | | | |
| Lecture for Students | 14:00-16:30 | | | | |
| **OPIE AND SHOW FLOOR ACTIVITIES** | | | | | |
| OPIE <Exhibition Hall A,B> | | | 10:00-17:00 | 10:00-17:00 | 10:00-17:00 |
| Market Focus Program<br><Exhibition Hall A,B> | | | 10:40-13:30 | | |
| Fraunhofer Photonic Research Cooperation Workshop<br><Exhibition Hall A,B> | | | | 13:00-16:30 | |
| Poster Sessions Lunch | | | | 12:00-13:00 | 12:00-13:00 |
| **SPECIAL EVENTS** | | | | | |
| SPIE OPIC Night<br><Ristorante ATTIMO> | 17:30-19:30 | | | | |
| Conference Reception<br><InterContinental Ballroom, 3rd floor InterContinental Yokohama Grand> | | | 18:00-20:00 | | |
| Exhibitor Reception | | | | 17:00-19:00 | |
| ZEN Meditation Experience | | 9:00-12:00 | | | |

# General Information

### Registration

*Pacifico Yokohama, Conference Center 2F Lobby*

| Registration Hours | |
|---|---|
| Monday, 23 April | 11:30 - 16:30 |
| Tuesday, 24 April | 8:00 - 16:30 |
| Wednesday, 25 April | 8:00 - 16:30 |
| Thursday, 26 April | 8:00 - 16:30 |
| Friday, 27 April | 8:00 - 14:00 |

### Exhibition

*Exhibition Hall A,B*

The OPI Exhibition is open to all registered attendees. Schedule plenty of time to roam the halls, visit with the hundreds of companies represented and see the latest products and technologies. For more information about what's happening on the exhibit floor, see pages 134-135.

| Exhibition Hours | |
|---|---|
| Wednesday, 25 April | 10:00 - 17:00 |
| Thursday, 26 April | 10:00 - 17:00 |
| Friday, 27 April | 10:00 - 17:00 |

### Congress Reception

Sponsored by Japan Laser, SPIE

*InterContinental Ballroom,*

*3rd floor InterContinental Yokohama Grand*

| | |
|---|---|
| Wednesday, 25 April | 18:00 - 20:00 |

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### Free High-Speed Wireless LAN (Wi-Fi)

### Access Areas

- **Conference Center**

  Meeting rooms, inside of the hall, Foyers (1F - 5F), Bay Bridge Cafeteria, Tearoom

- **Exhibition Hall**

  Halls A/B/C/D, Harbor Lounges, Meeting rooms (2F), Concourses (1F/2F)

- **National Convention Hall of Yokohama**

  Inside of the hall, Entrance Lobby, Marin Lobby, Seaside Lobby

- **Annex Hal**

  Inside of the hall, Foyer

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*Exhibition Hall B1F*

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*Conference Center 1F and Exhibition Hall 2F*

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*Exhibition Hall 2F*

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*Exhibition Hall 1F*

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Exhibition Hall: In front of First Aid Room (1F) and at Security Office (B1F)

## Coin Lockers

| Conference Center | Size | Price / day |
|---|---|---|
| 1F | Small | ¥300 |
| 2F | Small | ¥300 |
| | Medium | ¥400 |
| | Large | ¥600 |

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*National Convention Hall of Yokohama 1F, Convention Center 1F/3F/5F, Annex Hall*

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*Exhibition Hall 2F* (9:00 to 18:00 Occasionally closed)

Available Yamato Transport Service at Daily YAMAZAKI (Exhibition Hall 1F)

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Providing information on facilities, events, sight-seeing, etc.

*Conference Center 2F*

TEL: +81-45-221-2155 (9:00 to 18:00)

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# OPIC 2018 Plenary Session

**Wednesday, April 25, 2018**
**Pacifico Yokohama Congress Center, Fifth Floor (Room 501+502)**

**9:00 - 9:15**

## Greeting by Congress Chair

**Sadao Nakai,** *Congress Chair, Professor Emeritus, Osaka University, Japan*

**Ruxin Li,** *Congress Chair, Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences, China*

## Plenary Speech

**9:15 - 10:35**

### < First session >

**Chair, Reinhart Poprawe,** *Congress Chair, Fraunhofer Institute for Laser Technology ILT, Germany*

1) **VCSELs in every car, every home and every mobile device**
   **Joseph Pankert,** *General Manager Philips Photonics Philips Group Innovation*
2) **Diamond Electronics and Photonics: Application to Quantum Sensors**
   **Mutsuko Hatano,** *Tokyo Institute of Technology, Professor, Graduate School of Engineering, Department of electrical engineering*

**----- 10:35-10:50 Break -----**

**10:50 - 12:10**

### < Second session >

**Chair, Christopher Barty,** *Congress Chair, University of California Irvine, USA*

1) **Photoacoustic Tomography: Omniscale Imaging from Organelles to Patients by Ultrasonically Beating Optical Diffusion**
   **Lihong V. Wang,** *Bren Professor, Medical and Electrical Engineering at California Institute of Technology*
2) **Experiments on laser plasma accelerators with the BELLA laser and exploring the path towards future applications**
   **Wim Leemans,** *Director, Accelerator Technology and Applied Physics Division, Director, BELLA Center Lawrence Berkeley National Laboratory*

**18:00 – 20:00**

## OPIC 2018 Reception

InterContinental Ballroom, 3rd floor InterContinental Yokohama Grand

# Plenary Session

## Opening Remarks of OPIC 2018

**9:00 - 9:15**

### Greetings

**Prof. Sadao Nakai**
*Osaka University, Japan*

Representing the Congress Chairs, we welcome you to the Optics and Photonics International Congress, OPIC 2018. This is the 7th OPIC which has been organized to be held at the same place, Pacifiko Yokohama, together with the OPIE, exhibition, since the first OPIC.

The 7th OPIC is now opened. Seven years are just a short history, but steady progress has been made. I would like to introduce the history and the features. OPIC started as a brand new activity in Japan. Therefore the dedication and contribution of the Congress Chairs were important and essential to build the foundation.

The first congress chairs were Professor Koichi Shimoda and Professor Robert Byer. You may know them. Professor Shimoda worked together with Professor Charles Townes in investigating on the born of the laser. Professor Byer was the president of the American Physical Society around the startup time of OPIC. They are really the pioneers of laser science and the world authorities in the field of Photonics.

OPIC has been glowing according with the progresses of Photonics, and Laser science and engineering. It has become a worldwide event, getting increasing contributions of Europe and this year China.

This year, the OPIC 2018, 14 Conferences were organized. They cover almost all fields of human activities such as

· Food and Agriculture
· Medicine and medical applications
· Manufacturing and civil engineering and architecture
· Information and intelligence, sensing and security, computers and communication
· Energy and environment
· Laser solutions for the space and earth.

Photonics and lasers are the enabling technologies for the future of human society. Therefore the scientists and engineers should consider where we are going. Therefor the direct personal exchange among the leading researchers will stimulate brand new concepts.

I hope you enjoy the gathering of this meeting and the beautiful spring of Japan.

### Greetings

**Prof. Ruxin Li**
*Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences, China*

The Optics and Photonics International Congress (OPIC) has become one of the few leading events for the international community of optics and photonics. We have witnessed the rapid and remarkable growth in the number of participants and its scientific and societal impact worldwidely in only 7 years since the first congress. No only scientists and engineers, but also photonics industries have benefited from the high-quality topical conferences and the high-standard co-located Optics and Photonics International Exhibition.

It is my great honor and pleasure to serve as one of the congress chairs. I am sure that you would like the newest edition of OPIC, enjoying and being stimulated by the brainstorming in the presentations and discussions, establishing and enhancing the collaboration ties with other participants, bridging the fundamental researches and commercial applications, cultivating the friendship among different nations and cultures.

# First Session

## Plenary Speech

**9:15 - 9:55**

## VCSELs in every car, every home and every mobile device

**Dr. Joseph Pankert**
*Philips Photonics*
*joseph.pankert@philips.com*

## Abstract

Vertical Cavity Surface Emitting Lasers ("VCSELs") have been first demonstrated more than 40 years ago by Kenichi Iga. First commercial applications in optical data transmission were introduced more than 20 years ago, but it appears that true mass adoption of VCSELs is happening only now. The main drivers for this development are widespread use of VCSEL in optical sensors in mobile devices (proximity, auto-focus, identification) and the ever-increasing data traffic that requires optical interconnects even for consumer devices. Industrial robots and autonomous vehicles will drive another wave of optical sensors that most likely will rely on VCSELs. Moreover, industrial thermal processing may largely benefit from increased VCSEL proliferation in other areas.

The first part of the talk will cover the basic properties of VCSELs and its main applications. The second part will address current developments and new fields that VCSEL technology may conquer in the future.

## Introduction

A VCSEL is a (micro-) laser; it is monochromatic, coherent, and has a beam shape that conveniently couples into optical fibers. The small cavity allows for fast modulation, thereby lending itself well to high-speed data transmission or short pulse operation.

However, the one outstanding additional property that sets VCSELs apart from any other laser is its compatibility to electronics manufacturing flows. VCSELs are processed and tested on wafer scale, and conveniently integrate into printed circuit boards just like almost any other electronics component. This has enabled a supply chain for high volume devices such as time-of-flight sensors or optical transceivers with unmatched price points.

## Main present day applications:

### Optical interconnects

Optical interconnects with distance range of up to a few 100m today mostly employ VCSELs to transmit data. Transmission rates gradually moved from 1Gbps to 25Gbps over the last decade, and soon will reach 50-100Gbps through pulse amplitude modulation schemes (PAM4). Parallel operation of a manifold of transmission channels has enabled transceivers with more than 1Tbps bandwidths. Today, VCSEL based transceivers are widely used in large data centers, but the technology is at the brink of also penetrating consumer applications.

### Optical sensors

Optical depth sensors based on the time-of-flight (ToF) principle are one of the fastest growing VCSEL applications. Fig. 1 shows one embodiment of so-called direct ToF wherein a VCSEL creates a short light pulse (or a sequence of pulses) and triggers a single photon avalanche diode (SPAD) detector. The distance of an object is measured by the time the light pulse travels from the VCSEL to the object and back to the detector.

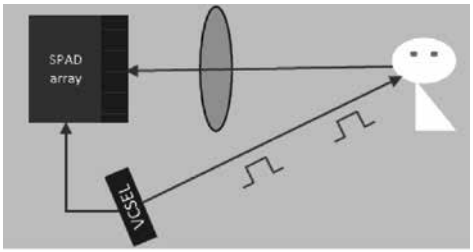


Fig.1: Time of flight detector principle

The main reason for using VCSELs as the light source of choice is the narrow spectral range, which allows equally narrow filtering of ambient light from reaching the detector. Moreover, VCSEL, unlike LEDs, provide focused light beams, can be modulated at high

frequency and can easily be integrated into a very compact optical package. All of this has led to a large penetration of VCSEL ToF sensors into smart phones for either proximity sensing or autofocus assist.

The next wave of ToF applications will extend single point distance measurement to full 3D depth maps. Smartphones, laptops, drones, robots and cars increasingly embed functions to map the 3D space around them for reasons of AR/VR, identification or navigation. The applications range all the way to LIDAR systems in autonomous cars resolving small obstacles more than a hundred meters ahead. Again, VCSELs will be the light source of choice for most of these devices, however combined with detection schemes that provide lateral spatial resolution, like scanning systems or ToF cameras.

VCSEL arrays have recently also been widely used for cw illumination. In combination with optical elements like diffusors and dot pattern generator, this is used for identification in smart phones and soon also in cars.

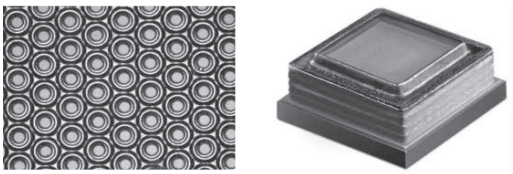

Fig.2: Picture of a VCSEL array (left), and an automotive grade package (right).

### Industrial thermal processing

Although individual VCSEL emitters have a few 10mWs of power only, arrays combine many of these emitters to provide power densities of several Watts/mm$^2$ emitted from the chip surface. Tiling many of these chips in large-scale systems opens up new ways to do industrial thermal processing. In Fig.3 a picture shows a VCSEL system of a width of 20 cm that provides 10kW of optical power. Power densities are orders of magnitude higher than what can be achieved with e.g. halogen lamps. One of the early applications of this technology is rapid thermal processing of semiconductors, solar cell manufacturing or plastic processing in general.

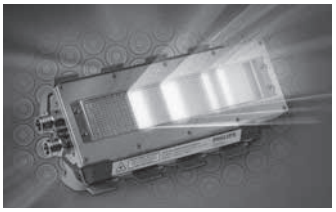

Fig.3: High power VCSEL system with 10kW optical power

Next to power density, proper wiring of the individual chips allows to generate complex heat patterns on a work piece, which opens up new options for what is sometimes called "digital thermal processing". Fig 4 shows an example of 32 individually addressable chips with 1.5W optical power each integrated with the electronic driver.

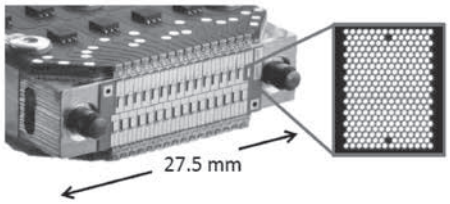


Fig.4: Pixelated high power device with 32x1.5W power

## Future development trends

The author believes that functional integration will be a main driver of innovation in the coming years. Already today, designs make use of the wafer scale technology, e.g. in datacom chips, where several VCSEL channels are placed next to each other on the same chip. Further functional integration is likely to come in the near future. Fig.5 shows an example, where micro lenses are integrated on wafer scale onto the VCSEL chips. Other optical functions for polarization and mode control have been demonstrated already.

Integration and mass production will bring the VCSEL into more and more new applications and make it the most popular diode laser 40 years after its invention. VCSELs will be everywhere.

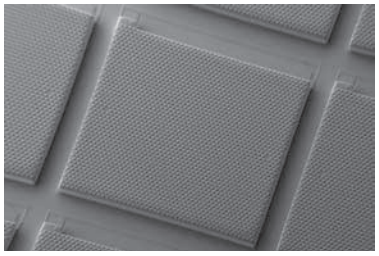

Fig.5: Integrated polymer lenses on top of a VCSEL array

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**Dr. Joseph Pankert** studied Physics at the universities of Leuven, Aachen and Oxford and received his PhD from Aachen University in 1987. In 1988, he joined Philips Research and ever since contributed to many Philips innovations. Since 2001 his professional focus is on new business development in the area of special light sources like EUV or lasers. He is currently general manager of **Philips Photonics** which is a business group entirely dedicated to VCSEL design and manufacturing, and VCSEL based modules and systems.

**Plenary Speech**

**9:55 - 10:35**

# Diamond Electronics and Photonics: Application to Quantum Sensors

**Prof. Mutsuko Hatano**
*Tokyo Institute of Technology, Japan*
*hatano.m.ab@m.titech.ac.jp*

## Abstract

Nitrogen-vacancy (NV) centersin diamond have superior physical properties at room temperature for quantum sensing of magnetic field, electronic field, temperature, and pressure with scalable applications from atomic-scale to macroscopic range. We would like to introduce highly sensitive diamond sensors by applying advanced nano-device technologies, quantum sensing protocols and module system. For application, we will show the biological imaging, nano-scale NMR, and the device sensing. Advanced technologies for photonics and electronics are needed for higher performance.

## Content

NV center in diamond is one of the most promising candidates for quantum sensors[1-6]. Spin state (S=1) of electrons localized at the NV center can be initialized and read out optically. In conjunction with spin state manipulation using microwave radiation, optically detected magnetic resonance (ODMR) can be performed. Table 1 shows comparison of the three quantum sensors: diamond NV centers, SQUID, and atomic vapor cells. The diamond sensor has superior performance at room temperature in solid materials and special function of the vector imaging. Figure1 shows the potential on the applications. Atomic size NV centers can be brought in proximity to nanoscale targets or it can be packed at enormous density for macroscale applications. Therefore, scalable applications from nanoscale such as protein, cell and neurons activities to macroscale applications such as measurement of heart and brain activity, are all possible with this atomic size NV center.

Table 1 Comparison of the quantum magnetic sensors

| Quantum sensor | Diamond sensor (NV centers) | SQUID | Atomic vapor |
|---|---|---|---|
| Sensitivity (/Hz$^{1/2}$) | < 1 pT | ~ fT | < fT |
| Resolution | 10-300 nm | μm-mm | mm |
| Temp. | RT | LT | >RT |
| Vector imaging | ○ | × | × |

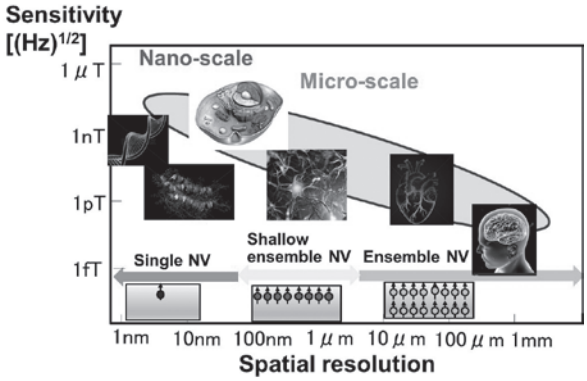


Fig.1 Potential on the scalable application of diamond quantum sensors

We developed negatively charged NV ensemble centers with longer coherence time. Magnetic detection sensitivity $\delta B$ (minimally detectable filed) is expressed in following equation,

$$\delta B \approx \frac{1}{g_s \mu_B R A \sqrt{\eta}} \frac{1}{\sqrt{N T_2}}$$

where $g_s$ is the NV- electronic Landé factor, R is measurement contrast, $A$ is alignment ratio of the NV axes of magnetic field direction, $\eta$ is detection efficiency, $N$ is the number of NV centers, and $T_2$ is the spin coherence time. We obtained diamond films containing high density (> $10^{16}$ cm$^{-3}$) ensemble NV centers with selectively aligned along the [111] direction (> 99%) by nitrogen-doped microwave plasma CVD (Fig.2) [7,8]. For the alignment of the orientation of the ensemble NV centers, it was found that the off direction of the diamond substrate along $<\bar{1}\,\bar{1}\,2>$ or $<1\,1\,\bar{2}>$ is a key factor.

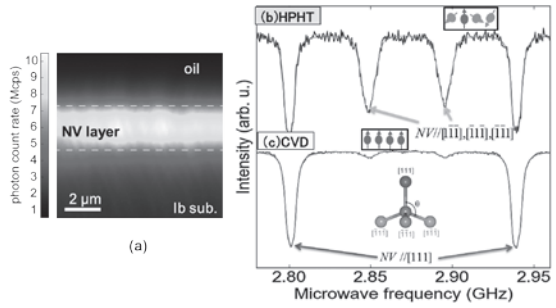


Fig.2 Properties of aligned ensemble NV centers by CVD
(a) Cross-sectional confocal microscopy image
(b) ODMR spectra: Comparison between non-aligned HPHT and aligned CVD samples.

We confirmed the magnetic sensitivity by AC magnetic field measurements is higher than 30 $nTHz^{-1/2}$ of 300 nm scale. In a large sensor volume ($8.5x10^{-4}$ $mm^3$), the sensitivity would reach 0.14 $pTHz^{-1/2}$. This high estimated sensitivity originates from the high contrast because of the perfectly aligned NV ensembles.

As for AC magnetic field measurements, NMR measurement will enable the direct observation of cells or bio-molecules without marking modifications. As a first step, NMR signals from proton and fluorine were confirmed with 10 nm shallow (delta-doped) ensemble NV centers [9]. We developed that a highly aligned high-density shallow NV centers ensemble is formed by step-flow growth using MPCVD growth on (111) substrates. More than $10^{16}$ $cm^{-3}$ NV centers are detected from confocal scan. The results demonstrate highest NV density in the vicinity of the surface with a perfect alignment of more than 99%. Surface sensitive magnetic field measurements were performed by observing the thin layer of proton and fluorine contained in Fomblin oil by nanoscale NMR using the XY8-80 pulse sequence (Fig. 3). The single NV center approximation indicates that the depth of the NV centers is approximately 9–10.7 nm from the surface with the error of less than 0.8 nm.

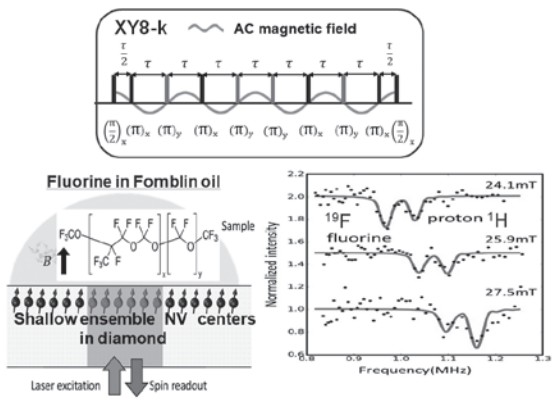


Fig.3 Nano-scale NMR signals from proton and fluorine in oil for different magnetic fields

Moreover, we will discuss on the importance of advanced technologies for both photonics and electronics to improve the performance of the diamond sensors and practical applications.

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**Prof. Mutsuko Hatano**, a professor, Department of electrical and electronic engineering, Tokyo Institute of Technology. She received the Ph.D. degree from Keio University, Japan. She was a Chief Researcher and a head of the environment electronics project at Central Research Laboratory, Hitachi, Tokyo (1983-2010). She was a visiting researcher, University of California, Berkeley (1998-2000). In 2010, joined Tokyo Institute of Technology as a professor. She is a member, Science Council of Japan, a fellow, Japan Society of Applied Physics, a director of Academy for Co-creative Education of Environment and Energy. Research interests focus on developing carbon-based devices for sustainable energy and environmental applications: (1) SiC and diamond power electronics for smart grid society; (2) diamond quantum sensing devices for medical/life science and IoT applications.

# Second Session

**Plenary Speech**

**10:50 - 11:30**

## Photoacoustic Tomography: Omniscale Imaging from Organelles to Patients by Ultrasonically Beating Optical Diffusion

**Prof. Lihong V. Wang**

*Caltech Optical Imaging Laboratory, Andrew and Peggy Cherng Department of Medical Engineering, Department of Electrical Engineering, California Institute of Technology, Pasadena, USA*

*LVW@Caltech.edu*

## Abstract

Photoacoustic tomography (PAT) has been developed for in vivo functional, metabolic, molecular, and histologic imaging by physically combining optical and ultrasonic waves. Broad applications include early-cancer detection and brain imaging. High-resolution pure optical imaging—such as confocal microscopy, two-photon microscopy, and optical coherence tomography—is limited to superficial imaging within the optical diffusion limit (~1 mm in the skin) in scattering tissue. By synergistically combining light and sound, PAT in the form of either photoacoustic computed tomography or photoacoustic microscopy provides deep penetration at high ultrasonic resolution and high optical contrast. PAT is the only modality capable of imaging across the length scales of organelles, cells, tissues, and organs (or small-animal organisms) with consistent contrast. The annual conference on PAT has become the largest in SPIE's 20,000-attendee Photonics West since 2010. Also, wavefront engineering and compressed ultrafast photography (world's fastest camera) will be touched upon.

## Content

In photoacoustic computed tomography, a pulsed broad laser beam illuminates the biological tissue to generate a small but rapid temperature rise, which leads to emission of ultrasonic waves due to thermoelastic expansion. The unscattered pulsed ultrasonic waves are then detected by ultrasonic transducers. High-resolution tomographic images of optical contrast are then formed through image reconstruction. Endogenous optical contrast can be used to quantify the concentration of total hemoglobin, the oxygen saturation of hemoglobin, and the concentration of melanin. Exogenous optical contrast can be used to provide molecular imaging and reporter gene imaging as well as glucose-uptake imaging.

In photoacoustic microscopy, a pulsed laser beam is delivered into the biological tissue to generate ultrasonic waves, which are then detected with a focused ultrasonic transducer to form a depth resolved 1D image. Raster scanning yields 3D high-resolution tomographic images. Super-depths beyond the optical diffusion limit have been reached with high spatial resolution. The following image of a mouse brain was acquired in vivo with intact skull using optical-resolution photoacoustic microscopy.

The annual conference on photoacoustic tomography has become the largest in SPIE's 20,000-attendee Photonics West since 2010.

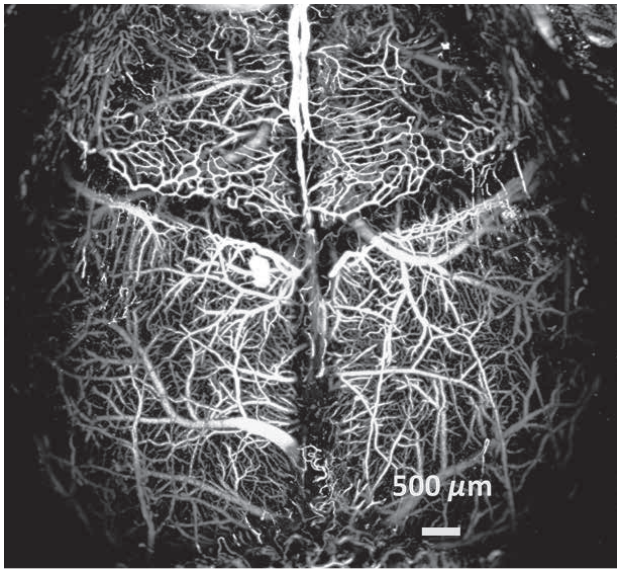


Figure 1. A representative image of a mouse brain acquired in vivo using a photoacoustic microscope.

## Selected publications


1. Nature Biotechnology 21, 803 (2003).
2. PRL 92, 033902 (2004).
3. PRL 96, 163902 (2006).
4. Nature Biotechnology 24, 848 (2006).
5. Nature Protocols 2, 797 (2007).
6. PRL 99, 184501 (2007).
7. Nature Photonics 3, 503 (2009).
8. Nature Materials 8, 935 (2009).
9. Nature Photonics 5, 154 (2011).
10. Nature Materials 10, 324 (2011).
11. Nature Photonics 5, 154 (2011).
12. Science 335, 1458 (2012).
13. Nature Medicine 18, 1297 (2012).
14. PNAS 110, 5759 (2013).
15. PRL 111, 204301 (2013).
16. PNAS 111, 21 (2014).
17. PRL 112, 014302 (2014).
18. PRL 113, 174301 (2014).
19. Nature 516, 74 (2014).
20. Nature Photonics 8, 931 (2014).
21. Nature Photonics 9, 126 (2015).
22. Nature Communications 6, 5904 (2015).
23. Nature Methods 12, 407 (2015).
24. Nature Methods 13, 67 (2016).


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**Prof. Lihong Wang** earned his Ph.D. degree at Rice University, Houston, Texas under the tutelage of Robert Curl, Richard Smalley, and Frank Tittel. He is Bren Professor of Medical Engineering and Electrical Engineering at California Institute of Technology. His book entitled "Biomedical Optics: Principles and Imaging," one of the first textbooks in the field, won the 2010 Joseph W. Goodman Book Writing Award. He also edited the first book on photoacoustic tomography and coauthored a book on polarization. He has published 470 peer-reviewed articles in journals, including Nature (Cover story), Science, PNAS, and PRL, and has delivered 460 keynote, plenary, or invited talks. His Google Scholar h-index and citations have reached 115 and 55,000, respectively. His laboratory was the first to report functional photoacoustic tomography, 3D photoacoustic microscopy (PAM), photoacoustic endoscopy, photoacoustic reporter gene imaging, the photoacoustic Doppler effect, the universal photoacoustic reconstruction algorithm, microwave-induced thermoacoustic tomography, ultrasound-modulated optical tomography, time-reversed ultrasonically encoded (TRUE) optical focusing, nonlinear photoacoustic wavefront shaping (PAWS), compressed ultrafast photography (10 trillion frames/s, the fastest camera in the world), Mueller-matrix optical coherence tomography, and optical coherence computed tomography. In particular, PAM broke through the long-standing diffusion limit on the penetration of optical microscopy and reached super-depths for noninvasive biochemical, functional, and molecular imaging in living tissue at high resolution. He is a Fellow of the AIMBE (American Institute for Medical and Biological Engineering), Electromagnetics Academy, IEEE (Institute of Electrical and Electronics Engineers), OSA (Optical Society of America), and SPIE (Society of Photo-Optical Instrumentation Engineers). He is the Editor-in-Chief of the Journal of Biomedical Optics. He chairs the annual conference on Photons plus Ultrasound, and was a chartered member of an NIH Study Section. Wang serves as the founding chairs of the scientific advisory boards of two companies that have commercialized photoacoustics. He received the NIH's FIRST, NSF's CAREER, NIH Director's Pioneer, and NIH Director's Transformative Research awards. He also received the OSA C.E.K. Mees Medal, IEEE Technical Achievement Award, IEEE Biomedical Engineering Award, SPIE Britton Chance Biomedical Optics Award, and Senior Prize of the International Photoacoustic and Photothermal Association for "seminal contributions to photoacoustic tomography and Monte Carlo modeling of photon transport in biological tissues." An honorary doctorate was conferred on him by Lund University, Sweden.

**Plenary Speech**

**11:30 - 12:10**

# Experiments on laser plasma accelerators with the BELLA laser and exploring the path towards future applications

**Dr. Wim Leemans**
*Lawrence Berkeley National Laboratory, USA*
*wpleemans@lbl.gov*

## Abstract

We will discuss the progress on building laser powered, plasma based particle accelerators where electrons surf on waves and can reach energy levels in a fraction of a meter that, if one relies on conventional methods, would require machines multiple football fields long. Although many challenges remain, this new technology is at the brink of offering a profoundly different way in which we may build particle accelerators such as those used in light sources, compact gamma ray sources, medical cancer therapy devices, and even colliders.

## Content

In 1979, a new method for particle acceleration was proposed that relies on the excitation of large amplitude plasma waves with intense laser beams. In the past ten to fifteen years, lasers became available that produce intense short laser pulses with duration of tens of femtoseconds and peak power in the tens to now even a thousand terawatt at higher and higher repetition rates. This rapid progress in laser technology has enabled rapid progress in the field of laser plasma accelerator science. A little more than a decade ago, laser plasma accelerators were demonstrated that could produce high quality beams (Nature 2004), followed by generation of GeV beams (Nature Physics 2006). Based on these early results, concepts have been proposed to build high energy colliders of the future, free electron lasers driven by compact accelerators, table top x-ray sources, gamma ray sources and medical accelerators. For example, a conceptual lay-out of a multistage laser plasma based collider is shown in Figure 1.

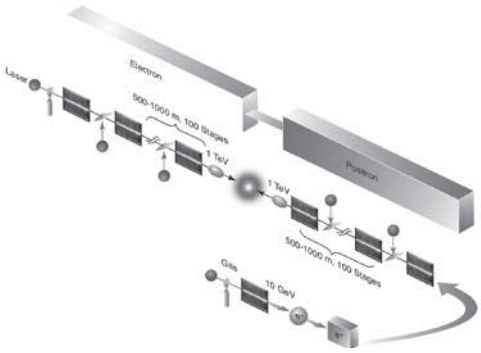


Figure 1. Conceptual diagram of a 2 TeV electron-positron collider based on laser driven plasma acceleration. The machine might be less than 1 km long and could be a string of 100 acceleration modules each powered by their own laser pulse. [Adapted from W. Leemans and E. Esarey, Physics Today, March 2009].

Since the mid-nineties, the approach followed at LBNL's BELLA Center towards the realization of such a future collider, relies on a similar paradigm as used in conventional accelerators, where the machine consists of an injector module, guiding structures that shape the accelerating fields and a power source. In the case of a laser plasma accelerator the injectors are typically relying on self-trapping, downramp or shock injection, ionization injection or laser triggered injection. The structures that guide intense laser pulses are pre-formed plasma channels and the power sources are intense laser pulses to excite large amplitude electric fields in these waveguides, via efficient coupling of high power laser pulses. Experiments have been conducted to understand how to guide ultra-intense laser pulses ($>10^{19}$ W/cm$^2$) over extended distances in preformed plasma channels and how to generate high energy electron beams from such structures. An example of a 9 cm long plasma waveguide that is formed through a capillary discharge in hydrogen gas is shown in Figure 2. These devices are used in experiments that are carried out using the Petawatt class BELLA laser, that can deliver up to 49 J on target in about 33 fs, at a repetition rate of 1 Hz. In the present experiments, the laser beam is focused with a long focal length off-axis paraboloid to a 53 micron spot size.

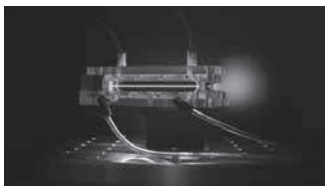

Figure 2. A 9 cm long capillary discharge structure that is used to guide high intensity laser beams for producing relativistic electron beams. The pink glow is from the hydrogen plasma. Such structures are capable of guiding ultra-intense laser beams and have been used to generate multi-GeV electron beams.

Figure 3 shows an example of a multi-GeV electron beam produced in a 9 cm plasma structure that was powered by a 310 TW peak power laser pulse

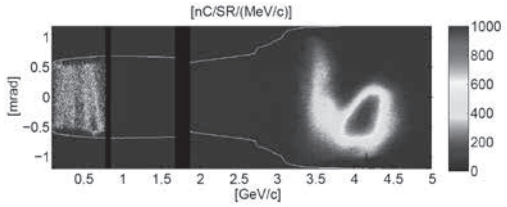


Figure 3. Electron beam spectrum vs. opening angle produced from a 9 cm long plasma channel powered by a 40 fs, 310 TW peak power laser pulses. [From W.P. Leemans et al., Phys. Rev. Lett. 113, 245002 (2014)].

In our quest to achieve 10 GeV electron beams from a single laser plasma accelerator stage, we have recently used up to 20 cm long plasma channels using the full power of the BELLA lasers and new results will be presented at the meeting.

Another major challenge that is being addressed is the staging of two or more consecutive accelerator modules that are powered by independent laser pulses. Electron beams from a first module are accelerated in a second module to higher energy without generating a second new bunch. The conceptual layout is shown in Figure 4 and a succesful proofof- principle experiment was published in Nature in 2016 [S. Steinke et al., Nature 530, 190 (2016)].

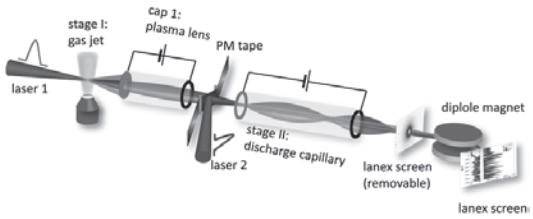


Figure 4. Conceptual lay-out of a proof of principle staging experiment. The first laser creates and accelerates an electron beam in the first stage and a second laser pulse is coupled into the second stage off a plasma mirror. An active plasma lens is used to increase the capture efficiency in the second stage by focusing the electron beam from stage 1 on the entrance of stage 2. By adjusting arrival timing between the two second laser pulse and the arrival of the electron bunch in the second stage, acceleration or deceleration can be obtained.

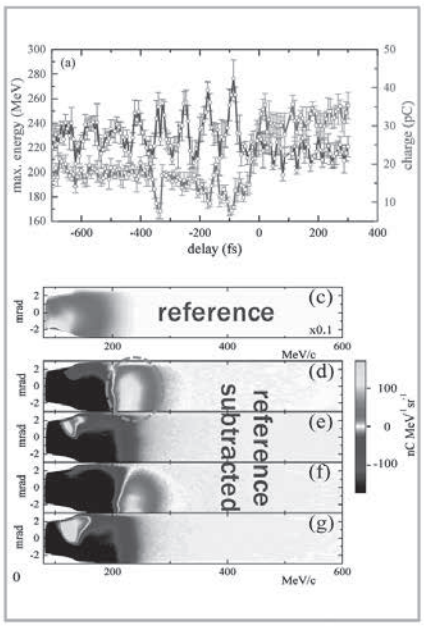


Figure 5 Electron spectra vs. arrival time of the second stage laser beam and electron beam. [From S. Steinke et al., Nature 530, 190 (2016)]

We are planning to upgrade the first staging experiment that operated with relatively low peak power pulses (10-20TW) and achieved roughly a 100 MeV boost per stage, to experiments on the petawatt class BELLA laser to achieve 5 GeV/stage.

Shorter term applications are being explored that use electron beams at the few 100-1,000 MeV level for XUV radiation generation from an LPA powered free electron laser and for gamma ray generation via Thomson scattering. Significant progress is being made on the development of higher average, high peak power lasers that will enable production of beams at sufficiently high repetition rate, i.e., high average power.

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**Dr. Wim Leemans** got his PhD from UCLA in 1991 and joined the Lawrence Berkeley National Laboratory. He is the Director of the Accelerator Technology and Applied Physics (ATAP) Division and Director of the BELLA (Berkeley Lab Laser Accelerator) Center at LBNL. He has received numerous awards including the 2005 USPAS Prize, the 2009 E.O. Lawrence Award from the Department of Energy, the 2012 Advanced Accelerator Concepts prize, the 2014 DOE Secretary Award and the 2016 IEEE PAST prize. He is a Fellow of the APS, IEEE, and AAAS.

# OPIC 2018 Joint Session

## Joint Session of IoT-SNAP and LSSE Nondestructive Sensing for Topical Problems

**April 24, Tue 13:15 - 16:45 <Room 302>**

**Chairs**
**Katsuhiro Ishii** *The Graduate School for the Creation of New Photonics Industries, Japan*
**Akihiko Nishimura** *Japan Atomic Energy Agency, Japan*

**13:15 Opening Remarks**
**Kenichi Kitayama**
*The Graduate School for the Creation of New Photonics Industries, Japan*

**13:30 Toward highly advanced social infrastructure by utilizing 3D laser measurement and IoT**
**Nobuyoshi Yabuki**
*Osaka Univercity, Japan*

**14:00 Nondestructive testing of aging phenomena by using electromagnetic waves**
**Kaori Fukunaga[1], Richard Hills[2], Nicholas Whyborn[3], Masumi Yamada[1]**
*[1]National Astronomical Observatory of Japan, Japan, [2]Univercity of Cambridge, UK, [3]Joint ALMA Office, Chile*

**14:30 Application of microwave-photonics technologies to high-frequency Radio Astronomy**
**Hitoshi Kiuchi**
*National Astronomical Observatory of Japan, Japan*

**15:00 Break**

**15:30 Visualization of radioactive substances by integrating radiation measurement and 3D optical measurement inside the Fukushima Daiichi Nuclear Power Station**
**Yuki Sato, Yuta Tanifuji, Yuta Terasaka, Yuki Morishita, Hiroshi Usami, Masaaki Kaburaki, Kuniaki Kawabata**
*Advanced Telecommunications Research Institute International, Japan*

**16:00 Social touch in human-human telecommunication mediated by a robot**
**Hidenobu Sumioka**
*RIKEN, Japan*

**16:30 Closing Remarks**
**Toshikazu Ebisuzaki**
*RIKEN, Japan*

## Joint Session ALPS+HEDS+XOPT

**April 25, Wed 13:30 - 15:00 <Room 303>**

**Chair**
**Ryosuke Kodama** *Osaka University, Japan*
**Hitoki Yoneda** *Institute for Laser Science, The University of Electro-Communications (UEC), Japan*
**Makina Yabashi** *RIKEN SPring-8 Center, Japan*

**13:30 Manipulating Electrons with Intense Laser Pulses**
**Victor Malka[1,2]**
*[1]Laboratoire d'Optique Appliquée, France, [2]Weizmann Institute of Science, Israel*

**14:00 Development and Commissioning of a 20 fs, 4 PW Laser**
**Junghun Shin[1], Hyung Taek Kim[1,2], Seong Ku Lee[1,2], Jae Hee Sung[1,2], Hwang Woon Lee[1], Jin Woo Yoon[1,2], Cheonha Jeon[1], Chang Hee Nam[1,3]**
*[1]Center for Relativistic Laser Science (CoReLS), Institute for Basic Science (IBS), Korea, [2]Advanced Photonics Research Institute, Gwangju Institute of Science and Technology (GIST), Korea, [3]Department of Physics and Photon Science, GIST, Korea*

**14:30 European XFEL – New Opportunities for X-ray Science**
**Robert Feidenhans'l**
*European XFEL, Germany*

## Joint Session IOT+LDC+LEDIA

**April 25, Wed 13:30 - 17:15 <Room 301>**

**Chairs**
**Atsushi Kanno** *IoT-SNAP, National Institute of Information and Communications Technology, Japan*
**Sunao Kurimura** *LDC, Natinal Institute of Material Science, Japan*
**Ryuji Katayama** *LEDIA, Osaka University, Japan*

**13:30 Opening Talk**
**Hiroshi Murata**
*Osaka University, Japan*
**Kenichi Kitayama**
*The Graduate School for the Creation of New Photonics Industries, Japan*
**Ryuji Katayama**
*Osaka University, Japan*

**13:45 IoT Revolution and Business Opportunities in Emerging Market in ASEAN Region**
**Huei Ee Yap**
*LP-Research Inc., Japan*

**14:15 Fiber-optic-based Life Cycle Monitoring of Aerospace Composite Structures: Toward Digitalization of Next Generation Aircraft**
**Shu Minakuchi, Nobuo Takeda**
*University of Tokyo, Japan*

**14:45 Break**

**15:15 Laser Diode Based Underwater Optical Wireless Communication**
**Takao Sawa[1], Koji Tojo[2], Naoki Nishimura[2], Shin Ito[3]**
*[1]JAMSTEC, Japan, [2]Shimadzu Corp., Japan, [3]SAS Co., Ltd., Japan*

**15:45 Recent Progress of Retinal Imaging Laser Technology**
**Mitsuru Sugawara, Makoto Suzuki, Manabu Ishimoto, Kinya Hasegawa**
*QD Laser, Japan*

**16:15 III-nitride Semiconductor Light Emitting Transistors**
**Kazuhide Kumakura, Junichi Nishinaka, Hideki Yamamoto**
*NTT Corporation, Japan*

**16:45 High Photosensitivity HFET-type Nitride Based Photosensors**
**Motoaki Iwaya[1], Tetsuya Takeuchi[1], Satoshi Kamiyama[1], Isamu Akasaki[1,2]**
*[1]Meijo University, Japan, [2]Nagoya University, Japan*

## Joint Session LIC+PLD+SLPC

**April 25, Wed 13:30 - 17:20 <Room 302>**

**Chair**
**Kunihiko Washio** *Paradime Research, Japan*
**Takahisa Jitsuno** *Osaka University, Japan*

**13:30 Opening Remarks**
**Masahiro Tsukamoto**
*Osaka Univ., Japan*
**Takahisa Jitsuno**
*Osaka Univ., Japan*
**Takunori Taira**
*Inst. material Science, Japan*

**13:45 Ab-initio large-scale simulation for initial stage of laser damage in transparent nano-materials**
**Kazuhiro Yabana[1], Mitsuharu Uemoto[1], Shunsuke A. Sato[2], Yuta Hirokawa[3], Taisuke Boku[1]**
*[1]Univ. of Tsukuba, Japan, [2]Max Planck Institute, Germany, [3]University of Tsukuba, Japan*

**14:15 High throughput surface texturing of embossing rollers with fs-laser and polygon line scanner in fully synchronized mode**
**Beat Jaeggi[1,2], Adrian Stirnimann[1], Guido Hennig[3], Beat Neuenschwander[1]**
*[1]Institute for Applied Laser, Photoncis and Surface technolpogies ALPS, Bern University of Applied Sciences, Switzerland, [2]LASEA Switzerland, Switzerland, [3]Daetwyler-Graephics AG, Switzerland*

**14:45 Mechanisims of laser damage in optical components for PW-class laser systems**
**Stavros G Demos, Alexei A Kozlov, Kyle Kafka, James B Oliver, Semyon Papernov, Brittany Hoffman, Terrance J Kessler, Sheryl M Gracewski, John C Lambropoulos**
*University of Rochester, USA*

**15:15 Break**

**15:45 UV-induced aging leading to laser damage in the bulk of fused silica**
**Frank R Wagner, Alexandre Beaudier, Jean-Yves Natoli**
*Aix Marseille Univ, CNRS, Centrale Marseille, Institut Fresnel, France*

**16:15 Ultrafast laser direct writing of periodic nanostructure in bulk semiconductor crystals**
**Yasuhiko Shimotsuma**
*Department of Material Chemistry, Graduate School of Engineering, Kyoto University, Japan*

**16:45 One-shot 3D giant-pulse micro-laser processing by LCOS direct control**
**Yasuki Sakurai[1,2], Yuji Hotta[1], Ryohei Otowa[1], Masashi Nishitateno[1], Lihe Zheng[2], Hiroshi Yamamoto[2], Takunori Taira[2]**
*[1]Santec corporation, Japan, [2]Institute of molecular science, Japan*

**17:15 Closing of Joint Session**

## Joint Session OMC and BISC

**April 25, Wed 13:15 - 17:00 <Room 418>**

**Chair**
**Takashige Omatsu** *Chiba University, Japan*
**Osamu Matoba** *Kobe University, Japan*

**13:30 Opening Remarks**
**Takashige Omatsu**
*Chiba University, Japan*

**13:35 High Temporal and Spatial Pattern Stimulation to Manipulate Brain Function**
**Hiroaki Wake[1], Koichiro Haruwaka[1], Xiangyu Quan[2], Osamu Matoba[2]**
*[1]Kobe University of Graduate School of Medicine, Japan, [2]Kobe University, Japan*

**14:05 Femtosecond Laser Trapping, Assembling, and Ejection Dynamics of Dielectric Nanoparticles in Solution**
**Hiroshi Masuhara[1], J. Chen[1], W. Chiang[1,2], A. Usman[3], T. Sugiyama[1,4], J. Hofkens[2]**
*[1]National Chiao Tung University, Taiwan, [2]Katholieke Universiteit Leuven, Belgium, [3]Universiti Brunei Darussalam, Brunei Darussalam, [4]Nara Institute of Science and Technology, Japan*

**14:35 Monitoring Ruffling Cells by Lattice Light-sheet Microscopy**
**Wei-Chun Tang, Peilin Chen, Bi-Chang Chen**
*Academia Sinica, Taiwan*

**15:05 Break**

**15:30 Computational Imaging and Reconstruction in Digital Holographic Microscopy**
**Edmund Y.M. Lam**
*University of Hong Kong, Hong Kong*

**16:00 Observation of Immunostained Microtubules Using Three-Dimensional Superresolution Microscope with Two-Color Annular Wave Plate**
**Yoshinori Iketaki[1], B. Nandor[2], D. Okada[3], H. Kumagai[4]**
*[1]Olympus Corp, Japan, [2]Budapest University of Technology and Economics, Hungary, [3]Kitasato University, School of Medicine, Japan, [4]Kitasato University, School of Allied Health Sciences Physics, Japan*

**16:15 Optical Trapping of Quantum-Dot Conjugated AMPA-type Receptors Depened on Initial Assembling States**
**Tatsunori Kishimoto[1,2], Y. Maezawa[1], S. N. Kudoh[2], T. Taguchi[3], C. Hosokawa[1,2,4]**
*[1]National Institute of Advanced Industrial Science and Technology (AIST), Japan, [2]Kwansei Gakuin University, Japan, [3]National Institute of Information and Communications Technology (NICT), Japan, [4]Advanced Photonics and Biosensing Open Innovation Laboratory, AIST-Osaka University, Japan*

**16:30 Enhanced Collection Efficiency of Vesicles in A Suspension by Optical Pressure Using Gold Nanoparticles**
**Takashi Kaneta, M. Kuboi, N. Takeyasu**
*Okayama University, Japan*

**16:45 Rotational Dynamics of Bacteria in An Optical Tweezer**
**Sharath Ananthamurthy**
*University of Hyderabad, India*

## Shaping Light, with applications in Advanced Microscopy and Optical Manipulation (SC1043)

Date: 24th (Tue) 13:00-17:00

Shaping the transverse dimension of an optical field is an important topic in many areas. This course will cover: the basic Gaussian beam, the need for other beams such as: Hermite-Gaussian and Laguerre-Gaussian laser modes, Bessel beams, Airy beams, and other notable beams and how they may be generated. In addition, we will cover some approaches used for adaptive optics / wavefront correction, often termed complex photonics which aims to increase the depth penetration of optical fields. We will consider uses of Deformable Mirror Arrays, Spatial Light Modulators, Acousto-Optic Deflectors, etc. Applications include sub-diffraction imaging / super-resolution microscopy, OCT, optical manipulation, multi-photon microscopy, and light sheet imaging at a more intermediate/advanced level.

- **LEARNING OUTCOMES**
  This course will enable you to:
  assess a variety of approaches to beam shaping and wavefront correction explain simple alignment protocols for optimizing some optical beam types of broad interest describe various aspects of data acquisition and analysis when using shaped light identify key options for enhanced degrees of beam control, resolution, and sensitivity for both imaging and manipulation
- **INTENDED AUDIENCE**
  This material is appropriate to researchers who are considering work in a wide variety of areas where wavefront correction or generation of novel beams is of interest.
- **COURSE LEVEL:** Intermediate to Advanced
- **COURSE LENGTH:** Half-day; 3.5 hours
- **INSTRUCTOR:**
  Kishan Dholakia is the 2016 winner of the OSA R. W. Woods Prize, the 2017 winner of the Institute of Physics Thomas Young Medal and Prize, a Professor of Physics at the University of St. Andrews (Scotland) and co-Chair of the Conference on Optical Trapping and Optical Micromanipulation at the SPIE Optics and Photonics Meeting. He is a Fellow of the Royal Society of Edinburgh, of OSA, and of SPIE.

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## Precision Laser Micromanufacturing (SC689)

Date: 24th (Tue) 13:00-17:00

This course is a comprehensive look at laser technology as applied to precision micromanufacturing. A brief background discussion on laser history, technology and definition of important terms will be presented. Then, available laser sources will be compared and contrasted including $CO_2$, excimer, Nd:YAG, fiber and short pulse lasers. IR and UV material/photon interaction, basic optical components and system integration are also crucial to getting good processing results and these will all be examined in detail. Finally, real applications from the medical, microelectronics, aerospace and other fields will be presented.

This course has been greatly expanded to include detailed discussions on short pulse lasers (ps and fs) and their applications, both present and future. Also, MicroManufacturing includes technologies such as welding, joining and additive technologies. While the main emphasis of the course is still MicroMachining (material removal), additive technologies will be discussed also – especially 3D LAM (Laser Additive Manufacturing).

- **LEARNING OUTCOMES**
  This course will enable you to:
  compare UV, IR and other laser sources to each other and learn where each is best applied describe and be familiar with several kinds of microprocessing lasers on the market describe material/photon interaction and why and how UV lasers for instance are different than IR lasers analyze a potential manufacturing application to identify it as a possible candidate for laser processing familiarize yourself with 'real world' opportunities for laser micromanufacturing identify marketplace growth opportunities
- **INTENDED AUDIENCE**
  The course will benefit anyone with an interest in small-scale industrial laser processing and achieving the best part quality, highest resolution and cost effectiveness. Engineers will benefit from the technical discussions. Project Managers will benefit from cost considerations and risk reduction scenarios.
- **COURSE LEVEL:** Introductory
- **COURSE LENGTH:** Half-day; 3.5 hours
- **INSTRUCTOR:**
  Ronald Schaeffer is Chief Executive Officer of PhotoMachining, Inc. He has been involved in laser manufacture and materials processing for over 30 years, working in and starting small companies. He has over 150 publications, has written monthly web and print columns and is on the Editorial Advisory Board of Industrial Laser Solutions magazine where he also writes an ongoing BLOG. He is the author of the textbook "Fundamentals of Laser Micromachining". He is also a past member of the Board of Directors of the Laser Institute of America and is affiliated with the New England Board of Higher Education. He has a Ph.D. in Physical Chemistry from Lehigh University and did graduate work at the University of Paris, after which he worked for several major laser companies. He is a US Army veteran of the 172nd Mountain Brigade and the 101st Airborne division. In his spare time he farms, collects antique pocket watches, plays guitar and rides a motorcycle.

# OPIC 2018

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# The 7th Advanced Lasers and Photon Sources ALPS 2018

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Conference Chair **Hitoki Yoneda**

*Institute for Laser Science, University of Electro-Communications*



We are delighted to welcome you to the 7th Advanced Lasers and Photon Sources (ALPS 2018) conference in Yokohama, Japan.

The ALPS conference aims to provide a fruitful opportunity to exchange information and discuss recent progress in lasers and photon sources, and related basic research and industrial applications. The ALPS conference is organized as part of the OPTICS & PHOTONICS International Congress (OPIC 2018), which consists of fourteen optics-related scientific conferences. In the ALPS 2018, we will have 23 excellent invited talks and more than 100 contributed papers, which cover novel optical materials, high average power lasers, high peak power lasers, novel solid-state, fiber, diode lasers, shorter wavelength light sources, terahertz devices, novel optical devices, optical frequency combs and their applications. The ALPS 2018 will collaborate with the International Conference on X-ray optics, and applications 2018 (XOPT 2018), and the International Conference on High Energy Density Sciences 2018 (HEDS 2018) to hold a special joint session on higher photon energy coherent light and ultra-intense lasers and their applications.

In addition, the OPTICS & PHOTONICS International Exhibition (OPIE 2018) is held jointly at the congress site. We encourage you to actively participate in all aspects of the Congress and Exhibition and hope that you will find these interactions to be beneficial.

We hope that you enjoy your time at the conference, and that you will also take this opportunity to explore the rest of Yokohama.

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# The 4th Biomedical Imaging and Sensing Conference BISC 2018

Sponsored by
**SPIE.**

Conference Chair **Toyohiko Yatagai**

*Center for Optical Research and Education, Utsunomiya University*



On behalf of the organizing committee and program committee, it is our great pleasure that the 4th Biomedical Imaging and Sensing Conference in Yokohama is going to open successfully, within the framework of the OPTICS & PHOTONICS International Congress (OPIC 2018). In biomedical optics and photonics, optical tools are employed for the understanding and treatment of diseases, from the cellular level to macroscopic applications. At the cellular level, highly precise laser applications allows the manipulation, operation or stimulation of cells, even in living organisms or animals. Optical microscopy has been revolutionized by a thorough understanding of the different markers and their switching behavior. Maker-free microscopy, like CARS, SHG or THG-microscopy is spreading into multiple biological and clinical imaging applications. OCT is continuously broadening its clinical applicability by even higher resolution, higher speed and more compact and the use of Doppler and polarization sensitivity for functional imaging.

In the field of optics and photonics, biomedical imaging and sensing areas are most quickly progressing and expanding. Techniques developed in these areas could bring us great steps in advances of physical, engineering and biological knowledge as well as optics and photonics technology. This Conference aims at covering several aspects from the fundamental studies at cellular level to clinical applications of various optical technologies.

Finally we hope the 4th Biomedical Imaging and Sensing Conference contributes to the progress in this fields and we hope you enjoy fruitful discussions in the Conference.

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# The 7th High Energy Density Sciences HEDS 2018

Sponsored & Organized by
**ImPACT Program JST, and The Laser Society of Japan**

Conference Chair **Tomonao HOSOKAI**

*Associate Professor, Graduate School of Engineering, Osaka University*
*Team Leader, Laser Accelerator R&D Team,*
*Innovative Light Sources Division, RIKEN SPring-8 Center*



We are glad to welcome you to the 7th International Conference on High Energy Density Science 2018 (HEDS 2018) in Pacifico Yokohama, Japan.

The HEDS 2018 goals are to provide a broad international discussion on recent progress in high energy density sciences and related technologies such as laser particle acceleration, including basic researches and industrial applications. Leading scientists from Japan, USA, Europe and Asia will share results of their recent researches on investigation of relativistic plasma created by PW class laser pulses, experimental and theoretical study of kinetic and radiative properties of such plasma as well as on utilization of fundamental knowledge for practical heeds. In the HEDS 2018, we will have 4 outstanding plenary and 12 excellent invited talks, and more than 40 contributed papers. The HEDS 2018 will collaborate with the International Conference on X-ray optics and applications 2018 (XOPT 2018), and the 7th Advanced Lasers and Pho ton Sources Conference (ALPS 2018) to hold a special joint session on higher photon energy coherent light and ultra-intense lasers and their applications.

In addition, the OPTICS & PHOTONICS International Exhibition (OPIE 2018) is held jointly at the congress site. We encourage you to actively participate in all aspects of the Congress and Exhibition and believe that you will find these interactions to be beneficial.

We hope that you enjoy your time at the conference, and that you will also take this opportunity to get better acquainted with Yokohama.

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# International Conference on Nano-photonics and Nano-optoelectronics ICNN 2018

Sponsored & Organized by
**Institute for Nano Quantum Information Electronics, The University of Tokyo**

The General Chair **Yasuhiko Arakawa**
*The University of Tokyo*



We warmly welcome you to the Second International Conference on Nano-photonics and Nano-optoelectronics (ICNN 2018). The development of nanoscale devices is an area of research making great strides in both academic and industrial laboratories around the world. ICNN has been organized for the purpose of bringing together likeminded researchers working in the areas of nano-photonics and nano-optoelectronics, and to provide ample opportunities for peer interaction, inspiring presentations, exciting discussions, and invigorating debates. We are pleased to organize the second ICNN as one of the international scientific meetings of the Optics & Photonics International Congress 2018 (OPIC 2018).

The 3-day program of ICNN 2018 consists of 10 oral sessions and 1 poster session, including 10 invited talks, 32 contributed oral talks, and 22 poster presentations. In particular, in ICNN 2018 we will be discussing recent advances in nano-photonics and nano-optoelectronics featured by our 10 distinguished invited scientists; Professors Connie Chang-Hasnain (USA), Jonathan Finley (Germany), Jean-Michel Gérard (France), Sven Hoefling (Germany), Johann Peter Reithmaier (Germany), Carsten Schuck (Germany), Mitsuru Takenaka (Japan), Hiroki Takesue (Japan), and Robert Taylor (UK).

As the General Chair of ICNN 2018, I would like to express my sincere gratitude to all invited speakers, oral speakers, and poster presenters for their presentations. Moreover, I thank the organizing committee members, the steering committee members, and the program committee members who have contributed greatly to the success of INCNN 2018.

We wish that all of you enjoy fascinating presentations and discussion at ICNN 2018, together with the beautiful bay area in Yokohama.

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# IoT Enabling Sensing/Network/AI and Photonics Conference IoT-SNAP 2018

Sponsored & Organized by
**The Graduate School for the Creation of New Photonics Industries (GPI)**

Conference Chair
**Norihiro Hagita**
*ATR Intelligent Robotics and Communication Labs., Japan*

Conference Chair
**Ronald Freund**
*Fraunhofer Heinrich Hertz Institute, Germany*



Welcome to the first IoT-SNAP 2018 in a beautiful harbor town, Yokohama, Japan !

The Internet of Things (IoT) smart objects on the planet are predicted to reach 200 billion entities by 2020, and by 2022 M2M traffic is expected to constitute almost a half of the whole Internet traffic. IoT offers a great market opportunity both for sensor device and M2M communication platformer as well as Over-The-Top (OTT) players or the application platformers.

This IoT-SNAP conference has been inaugurated this year, which covers multi-disciplinary technologies such as sensing, telecommunications, robotics and AI, a wide variety of applications with their use cases, and not at least photonic technologies.

The participants from various sectors over the world, including the industries and academia can expect to hear the cutting-edge technology of IoT as well as the novel use cases and exchange opinions on the IoT perspectives.

Category 1
Core Technologies
- Cyber security
- IoT wired/wireless networks
- AI/machine learning
- Cyber physical systems
- Computing/processing
- IoT devices
- Internet of robotic things(IoRT)
- Human-robot interaction

Category 2
Applications and use cases
- Smart city/home/society
- Healthcare and biomedical applications
- Smart mobility
- Precision/smart agriculture
- Smart/flexible factory
- Smart civil engineering, construction and monitoring
- Field trial and social implementation

Category 3
Photonics Technologies
- Sensor/Sensing
- Imaging
- Devices
- LIDAR
- Others

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# The 7th Laser Display and Lighting Conference LDC 2018

Sponsored by
**The Optical Society of Japan**

Conference Co-chair
**Prof. Kazuo Kuroda**
*Utsunomiya Univ.*

Conference Co-chair
**Prof. Hiroshi Murata**
*Osaka Univ.*

Welcome to the 7th Laser Display and Lighting Conference, LDC 2018.

The LDC is an international conference on laser displays, laser lighting, and related technologies. The 1st, 2nd, 4th, and 6th LDC were held in Yokohama, Japan in 2012, 2013, 2015, and 2017 respectively, the 3rd in Taichung, Taiwan in 2014, and the 5th in Jena, Germany in 2016. The 7th LDC, LDC 2018 is being held from 24th to 27th April 2018 at Pacifico Yokohama, Yokohama, Japan. LDC 2018 is sponsored by the Optical Society of Japan, in cooperation with several academic societies and associations, and is operated by the Laser Display Research Group, the Optical Society Japan,

LDC 2018 is intended to provide a central forum for the update and review of scientific and technical information on laser display and lighting covering a wide range of fields from fundamental research to systems and applications.

A total of 63 papers will be presented during the 4-day conference, consisting of 2 plenary talks, 30 invited papers (including joint/special sessions), and 31 contributed papers. A few post-deadline papers may be accepted. In LDC 2018, the Joint Session on laser displays/imaging, advanced semiconductor visible-light devices, and IoT systems is being held with the cooperation to LEDIA and IoT-SNAP, where we are having stimulating invited talks from 6 expert speakers on 25th April. Two exciting special sessions entitled 'Hyper-Realistic Displays 2018' and 'Visible Lasers Connecting Automotive and Human' are also being held with a number of distinguished speakers on 24th and 26th April, respectively. In the first special session of the Hyper-Realistic Displays, the state-of-the-art 3D display and imaging technology with high quality and high resolutions will be presented and discussed. In the second special session, applications connecting the automotive and the human utilizing recent advanced visible laser technologies will be presented and discussed. After all the technical sessions, a ceremony for the LDC Best Paper Award and the LDC Student Award will be held for exceptional papers commended for their outstanding achievement.

We would like to extend our sincere thanks to all the presenters and participants of LDC 2018 for their contribution to the success of the conference. We also express our sincere thanks to the Takano-Eiichi Hikari-Kagaku-Kikin (Optical Science Foundation), the Japanese Society of Applied Physics, for the financial support. We hope that all the attendees enjoy the conference.

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# The 6th International Conference on Light-Emitting Devices and Their Industrial Applications LEDIA 2018

Sponsored by
**Akasaki research Center (ARC), Nagoya University**

Steering Committee, Chair, LEDIA 2018 **Yoshinao Kumagai**

*Professor, Department of Applied Chemistry,*
*Tokyo University of Agriculture and Technology*



On behalf of committee members, it is my great pleasure to welcome you to the 6th International Conference on Light-Emitting Devices and Their Industrial Applications (LEDIA 2018), which is a part of the international specialized conferences of OPTICS & PHOTONICS International Congress 2018 (OPIC 2018).

LEDIA has been designed to maximize exchange of scientific knowledge between academic, industrial and government scientists for challenges of fabrication and characterization of light-emitting devices, exploitation of new materials for light-emitting devices, and industrial utilization of light-emitting devices.

As for the LEDIA 2018, we have a joint session with Laser Display and Lighting Conference 2018 (LDC 2018) and IoT Enabling Sensing/Network/AI and Photonics Conference 2018 (IoT-SNAP 2018) to discuss device application. On the other hand, in usual session of LEDIA, we direct our attention to fabrication of devices, and have some invited talks. So, you can get and discuss the latest information on growth and characterization of crystals, novel materials for light-emitting devices, fabrication and characterization of light-emitting devices, and industrial application of light-emitting devices.

Finally, we welcome you again to LEDIA 2018 and hope all of the participants get an outcome at the conference.

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# The 6th Laser Ignition Conference LIC 2018

Sponsored by
**Micro Solid-Sate Photonics Group of the Laser Society of Japan**

Conference Chair **Takunori Taira**

*Institute for Molecular Science*

Welcome to the 6th Laser Ignition Conference 2018 (LIC 2018). This is the international forum to discuss all aspects of laser induced ignition: advances in novel giant pulse micro-lasers, new insights into the phenomena of laser induced breakdown, and advanced combustion systems enabled by laser ignition. Moreover, the high-brightness nature of giant-pulse micro-laser promises the smart and powerful light-matter interactions in the pulse-width gap region between the conventional Q-switched lasers and mode-lock ultrafast lasers. Since the invention of lasers, many researchers attempted "laser ignition" toward the ideal combustion engine. Recently, several kinds of laser ignition, from gas cogeneration to vehicle and space locket engines, have been demonstrated to solve for future energy crisis. In addition, its high-brightness nature of ionization, ablation, and caused shock wave will open the new phenomena to bring the fruitful applications. The purpose of this meeting is to share information on laser ignition and related sciences and technologies. The conference will be held at Pacifico Yokohama, Yokohama, Japan, on April 24-27, 2018 with the sponsorship from ***Micro Solid-Sate Photonics Group*** of the Laser Society of Japan (LSJ) in cooperation with several academic societies and associations.

A total of 52 papers will be presented during the conference, consisting of 6 LIC/PLD/SLPC joint session invited talks, 3 LIC opening talks, 9 invited papers, and 19 contributed papers, 12 poster papers including the joint session of laser damages. After an introduction of LIC2019, the Award Ceremony will be held at which several papers will be commended for their outstanding achievement. Laser ignition systems promise better fuel efficiency and lower pollution than conventional systems. The door of "Laser Ignitions for Future Energy and New Science" should be opened by "***Giant Micro-photonics***". The future may herald new photonics.

We would like to extend our thanks to all the presenters and participants of LIC 2018 for their contribution to the success of the conference. We also express our thanks to the endorsement and sponsor groups.

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# Conference on Laser and Synchrotron Radiation Combination Experiment LSC 2018

Sponsored and Organized by
**High Energy Accelerator Research Organization (KEK)**
**Osaka University Institute of Laser Engineering**

Conference Chair **Nobuhiko Sarukura**

*Osaka University, Japan*

We are pleased to welcome you to the Conference on Laser and Synchrotron Radiation Combination Experiment (LSC) 2018. As part of the OPTICS & PHOTONICS International Congress (OPIC), LSC aims to converge all scientists and engineers who are working on laser and synchrotron experiments all over the world. The conference features invited talks and presentations on the recent developments, activities, and/or trends in lasers and synchrotron sources, instrumentation, experimental techniques, and applications. This year, LSC is also held jointly with the OPTICS & PHOTONICS International Exhibition (OPIE), one of the largest gatherings of light-based technology and laser product manufacturers. We then hope that you will find all the LSC, OPIC, and OPIE activities interesting, engaging, and beneficial. We are very grateful for your participation, and we wish you a great time at the conference and during your stay here in Japan.

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# The 3rd Laser Solutions for Space and the Earth LSSE 2018

Sponsored & Organized by
**the executive committee of Laser Solution for Space and the Earth**

Conference Chair **Toshikazu Ebisuzaki**

*RIKEN*



We are pleased that you have joined in Yokohama to attend to Laser Solutions for Space and the Earth (LSSE 2018)

This is the 3rd conference of LSSE organized as a part of the OPTICS & PHOTONICS International Congress (OPIC 2018). The aim of "Laser Solution for Space and the Earth" is to discuss the application of emerging laser technologies to solve various problems for sustainable developments of space and the Earth. We decided to start the Joint Session with IoT-SNAP2018 for the application of the laser technology to the information science and technology. We also take into account of rapidly growing fields, such as, "Agri-Photonics", "Infrastructure (Nondestructive Testing and 3-D Imaging)", "Energy Production and Transmission", as the featured topics of the year 2018. Fortunately, we will have keynote lectures of three distinguished scientists: Dr. Hiroki Takesue (NTT Corporation) for a Coherent Ising machine, Prof. Naoshi Kondo (Kyoto University) and Prof. Sakae Shibusawa (Tokyo University of Agriculture and Technology) for the agri-business applications of photonics and robotics. Poster session is prepared for various industrial applications with OPIE activities. We hope you could enjoy the inspiring discussions in the many research fields in our conference, as we did in the last two conferences. We are looking forward to seeing you at Yokohama, Japan in April.

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# Optical Manipulation and Structured Materials Conference 2018 OMC 2018

Sponsored by
**SPIE.**

OMC 2018 Conference Chair **Takashige Omatsu**

*Chiba Univ.*
*omatsu@faculty.chiba-u.jp*

Since the first demonstration of an optical tweezer based on optical radiation forces (scattering and gradient forces) created by a tightly focused laser beam, optical tweezers have been widely investigated in a variety of research fields, including biology, physics, and chemistry.

Conventional optical tweezers have been mostly adopted to dielectric particles with a dimension range from hundreds of nanometers to tens of micrometers. However, they do not always enable us to efficiently trap metallic particles.

In recent years, plasmonic tweezers based on enhanced radiation forces owing to surface plasmon polaritons in metallic nanostructures have been successfully demonstrated to efficiently trap and manipulate both nanosacle-sized dielectric and metallic particles. Furthermore, recent progress in metamaterials will open new avenues for optical manipulation on the sub-wavelength scale that exceed the capabilities of conventional bulk-optical approaches.

Also, structured lights, such as higher order Laguerre-Gaussian and Bessel beams carry optical angular momenta, and they provide unique tweezing abilities, for instance, for inducing an orbital motion of the trapped particles without employing mechanical systems. Such structured optical fields may explore new interaction with matters to yield new physical effects, such as spin-orbital momentum coupling.

The OMC'17 successfully collected over 65 attendees. The OMC 2018 conference, the fifth optical manipulation and structured materials conference, aims to present and discuss up-to-date scientific subjects, new technologies, and applications related to the fields of optical tweezers, the manipulation of nanostructures, structured optical fields, structured materials such as plasmonics and metamaterials and their satellite topics.

We hope that this conference will also facilitate scientific and professional networking as well as scientific inspiration through discussions.

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# The 7th Pacific-rim Laser Damage Conference PLD 2018

Sponsored by
**SPIE.**

Conference Chair **Takahisa Jitsuno**

*Institute of Laser Engineering, Osaka University*

Pacific-rim Laser damage (PLD) was initiated by Prof. Jianda Shao of Shanghai Institute of Optics and Fine Mechanics in China at 2009. This conference was held as a satellite meeting of SPIE Laser Damage Symposium at Boulder. The purpose of this meeting is the communication between researchers especially in Pacific-rim area in the field of laser damage and related phenomena. PLD meeting was held biyearly at Shanghai in China, and intermediate year, at 2014 and 2016, the meeting was held in Yokohama. In 2018, PLD 2018 will be held in Japan again as a part of OPIC conferences, a large congress of 14 international conferences held at the same place with a large laser exhibition; OPIE 2018. PLD 2018 is a good opportunity to discuss about active topics in Laser Induced Damage phenomena.

PLD2018 will include 7 sessions as follows.
1) Joint session; PLD/LIC (Laser Ignition Conference)/SLPC (Smart Laser Processing Conference)
2) Plenary session
3) High Power Laser Damage
4) Poster session
5) Nonlinear crystals, laser ceramics and fiber laser
6) High laser damage resistant coating
7) Defect, contamination, polishing and surface damage

PLD 2018 will have following Plenary/ Invited talks.
Plenary talk: Prof. J. D. Shao, SIOM China
"Toward "defect-free" optics: a pioneering comprehensive metrology method"
Invited talks:
1. Dr. Stavros Demos, Laboratory for Laser Energetics, Univ. of Rochester
"Mechanisms of laser damage in optical components for PW-class laser systems"
2. Dr. Frank Wagner, Institute Fresnel, France
"UV induced aging leading to laser damage in the bulk of fused silica"
3. Dr.Laurent Lamaignere, CEA France
"Laser damage metrology in the sub-ps range for the PETAL facility"
4. Prof. Meipin Zhu, SIOM China
"Investigation on the multilayer coating with co-evaporated interface"
5. Dr. Daniel Ursescu, ELI-NP Romania
"Progress at the High Power Laser System of ELI-NP facility"
6. Dr. Jacob Mackenzie, Univ. of Southampton, Optoelectronics Research Centre (ORC), UK
"Functional crystal films fabricated by Pulsed Laser Deposition"
7. Dr. Uwe Gribner, Max Born Institute Berlin
"Generation of few-cycle millijoule pulses at 5 μm employing a ZnGeP2-based OPCPA pumped with GW peak power pulses at 2 μm"
8. Dr.Valentin Petrov, Max Born Institute Berlin
"Highly-efficient Ho:KY(WO4)2 thin-disk lasers at 2.06 μm"
9. Prof. Masashi Yoshimura, Inst. of Laser Engineering, Osaka Univ. Japan
"UV laser-induced degradation of nonlinear optical borate crystals"

We expect 50 papers in PLD2018. I hope we will have useful discussions and mutual communications. Special contribution of SPIE, and SIOM should be mentioned. This conference is supported by Chinese Academy of Science as Japan-China Bilateral Forum.

**Conference Chairs**
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# The Third Smart Laser Processing Conference SLPC 2018

Organized by
**Japan Laser Processing Society (JLPS)**

Conference Chair
**Masahiro Tsukamoto**
*JWRI, Osaka University, Japan*

Conference Chair
**Reinhart Poprawe**
*M. A., Fraunhofer Institute for Laser Technology, Germany*



On behalf of the organizing committee, it's our great pleasure to welcome you to The Third Smart Laser Processing Conference (SLPC 2018), organized by Japan Laser Processing Society (JLPS). The SLPC 2014 (the first SLPC) and SLPC 2016 were launched with generous supports from scientists and engineers in the fields of laser materials processing. They were the great successes with some of the fine scientists and engineers attending, and the third SLPC conference is held at Pacifico Yokohama to encourage rapid development of laser processing technologies.

SLPC 2018 deals with science and technology of smart laser materials processing including micro- and macro-processing. SLPC 2018 aims at providing a forum for discussion of fundamental aspects of lasermatter interaction, and the state-of -the-art of smart laser processing, in addition to fostering nextgeneration concepts and innovation by collaboration among participants including scientists, end users and laser manufacturers.

The program for the 3-day event consists of a plenary session, joint sessions with Laser Ignition Conference 2018 (LIC 2018) and Pacific-rim Laser Damage Conference (PLD 2018), regular oral sessions, and poster session, collaborating with other 13 professional conferences in Optics & Photonics International Congress 2018 (OPIC 2018). We are convinced that SLPC 2018 will stimulate fruitful discussions and useful exchanges.

The conference site, Yokohama, is one of the famous port towns in Japan, and many technologies had been spread all countries in Japan through here. We wish smart laser processing technologies also spread all over the world through this conference.

We would like to express our sincere thanks to all the presenters, in particular the plenary and the invited speakers, cooperating societies, media partners, and our sponsors. We would also like to thank the chairs and the members of program committee, steering committee, international advisory committee, and the secretariat. Thank you very much for attending, and we sincerely hope you enjoy your time at the good season of fresh green leaves.

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# International Conference on X-ray Optics and Applications XOPT 2018

Sponsored by
**RIKEN SPring-8 Center**
**Research Center for Ultra-Precision Science & Technology. Osaka Univ.**
**Technical Committee for Ultraprecision Machining of JSPE**



Conference Co-chair
**Tetsuya Ishikawa**
*RIKEN*

Conference Co-chair
**Kazuto Yamauchi**
*Osaka University*

We are pleased to host the International Conference on X-ray Optics and Applications (XOPT 2018) as part of the Optics and Photonics International Congress 2018 (OPIC 2018) in Yokohama, Japan.

X-rays have played a vital role in a number of breakthrough scientific discoveries in recent years. Continuous innovations in X-ray optics, methodologies, and beamline instruments have laid the foundation for these achievements. For this conference, we are inviting leading experts in these fields from around the world to share the latest status of X-ray technology and developments and to discuss their plans for the future. One important topic we would like to discuss is how state-of-the-art X-ray optics can contribute to exploring the potential of the DLSR (Diffraction-Limited Synchrotron Radiation) sources that are currently emerging.

We are happy to welcome you to participate in and enjoy the conference.

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**Akihisa Takeuchi** *JASRI/SPring-8, Japan*
**Wataru Yashiro** *Tohoku University, Japan*

# OPIC 2018 Conferences Program



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## *Lecture and Training of English Poster Design and Presentation for Students*

Date: 23th (Mon) 14:00-16:30

OPTICS & PHOTONICS International Congress (OPIC) holds a lot of student participant whose native language is not English. Details of presentation technique and constitution of posters have different appearances in each language. In this course, Professor Reinhart Poprawe (Fraunhofer Institute for Laser Technology ILT, Germany) gives a lecture for a general guideline on the appearance, formats, content organization and the presentation of poster in English language. The goal is to give students a practical guideline for designing, discussing and presenting their poster, including a practical exercise of a 1-minute short presentation in OPIC 2018.

- **LEARNING OUTCOMES**
  This course will enable you to:
  Receive and understand and a general guideline on the appearance and contents of a poster.
  Present your poster along with general rules for suitable explanation.

- **INTENDED AUDIENCE**
  This lecture is appropriate to students who want to learn basics of English Poster design and presentation.

- **COURSE LEVEL / Requirements:**
  Students, prepare a 1 Minute 1-2 power point slide-presentation of your current poster

- **COURSE LENGTH:** 2 hours

- **INSTRUCTOR:**
  Dr. Reinhart Poprawe(Fraunhofer Institute for Laser Technology ILT, Germany)


SPIE.

SPIE Welcomes
you to
**OPIC 2018 NIGHT**

Ristorante ATTIMO, 2F Pacifico Yokohama 1-1-1,
minatomirai, nishi-ku, Yokohama

Hour: Monday, 23 April 17:30 – 19:30

Free for OPIC2018 attendees. Badge must be worn
and are required to enter the Get-Together.

# Oral, Monday, 23 April

## HEDS <Room 311+312>

**[Opening Remarks] 9:30-9:35**
Tomonao Hosokai
*Graduate School of Engineering, Osaka University/RIKEN SPring-8 Center, Laser Accelerator R&D Team, Japan*

**[HEDS1] 9:35-10:30**
**Mon-A1**
Chair: Tomonao Hosokai
*Graduate School of Engineering, Osaka University/RIKEN SPring-8 Center, Laser Accelerator R&D Team, Japan*

**HEDS1-1 9:45** ***Plenary***

**Latest Results in Advances in HEDS with Lasers and Particle Beams**
Chandrashekhar Joshi
*University of California Los Angels, USA*
I will present some latest results on our work on several topics related to high energy density science with intense but ultra short laser and charged particle beam pulses.

----- Break 10:30-11:00 -----

**[HEDS2] 11:00-12:00**
**Mon-A2**
Chair: Masaki Kando
*KPSI, QST, Japan*

**HEDS2-1 11:00** ***Invited***

**From plasma acceleration to plasma accelerators? Status of PW laser driven experiments in Dresden**
Ulrich Schramm
*Helmholtz-Zentrum Dresden-Rossendorf, Germany*
Status of Petawatt laser driven and application oriented particle acceleration is presented.

**HEDS2-2 11:30** ***Invited***

**Laser wakefield electron acceleration with multi-PW laser pulses**
Hyung Taek Kim[1,2], Jung hun Shin[1], C. Aniculaesei[1], B. S. Rao[1], V. B. Pathak[1], M. H. Cho[1], C. Hojbota[1,3], S. K. Lee[1,2], J. H. Sung[1,2], H. W. Lee[1], J. W. Yoon[1,2], K. Nakajima[1], Chang Hee Nam[1,3]
*[1]Center for Relativistic Laser Science, Institute for Basic Science (IBS), Korea, [2]Advanced Photonics Research Institute, GIST, Korea, [3]Department of Physics and Photon Science, GIST, Korea*
We present the recent progress in LWFA research with multi-PW laser at the Center for Relativistic Laser Science in IBS Korea, and the plan to develop 10-GeV electron beam in near future.

----- Lunch 12:00-14:00 -----

**[HEDS3] 14:00-15:15**
**Mon-P1**
Chair: Chandrashekhar Joshi
*University of California, Los Angeles, USA*

**HEDS3-1 14:00** ***Invited***

**Outlook for laser wakefield acceleration technology in the Japanese national program ImPACT**
Yuji Sano
*JST, Japan*
TBD

**HEDS3-2 14:25** ***Invited***

**Status of ImPACT Program aiming for repeatable GeV-class LWFA**
Tomonao Hosokai[1,2], Takamitsu Otsuka[3], Yasuo Sakai[1,2], Junpei Ogino[4], Naveen Pathak[1,2], Alexei Zhidkov[1,2], Keiichi Sueda[1], Hirotaka Nakamura[1,2], Zhang Jin[1], Akihiro Ueno[1], Hakujun Toran[1], Yusuke Tanizawa[1], Ryosuke Kodama[2,3], Kai Huang[5], Noboru Nakanii[5], Michiaki Mori[5], Hideyuki Kotaki[5], Yukio Hayashi[5], Izuru Daito[5], Yasuhiro Miyasaka[5], Timur Esirkepov[5], James Koga[5], Sergei Bulanov[5], Masaki Kando[5], Shin-ichi Masuda[6], Shigeru Yamamoto[6]
*[1]Graduate School of Engineering, Osaka University, Japan, [2]RIKEN SPring-8 Center, Laser Accelerator R&D Team, Japan, [3]Graduate School of Engineering, Utsunomiya University, Japan, [4]Institute of Laser Engineering, Osaka University, Japan, [5]Kansai Photon Science Institute, National Institute for Quantum and Radiological Science and Technology (QST), Japan, [6]High Energy Accelerator Organization (KEK), Japan*
A laser wakefield acceleration (LWFA) research under the ImPACT program in Japan, that aims for table-top sized free-electron laser (FEL) will be reviewed.

**HEDS3-3 14:50** ***Invited***

**Plasma and Beam Diagnostics for LAPLACIAN Project**
Masaki Kando
*KPSI, QST, Japan*
We are developing laser based electron accelerator aiming a future compact X-ray free-electron laser and the development status for the beam diagnostics will be given.

----- Break 15:15-15:45 -----

**[HEDS4] 15:45-16:55**
**Mon-P2**
Chair: Ulrich Schramm
*Helmholtz-Zentrum Dresden-Rossendorf, Germany*

**HEDS4-1 15:45** ***Invited***

**Gamma ray emission from wakefield accelerated electrons wiggling in laser filed**
Liming Chen
*Institute of Physics, CAS, China*
we present a method for high energy radiation via the accelerated electrons wiggling in an additional laser field whose intensity is one order higher than the self generation transverse field of the bubble.

**HEDS4-2 16:15**

**Slow wave excitation using head-on two-color TW laser pulses toward plasma ion accelerator**
Yoshitaka Mori, Yoneyoshi Kitagawa
*GPI, Japan*
We have investigated experiments of plasma wave excitation for ion acceleration. Using double-line TW laser system (200 mJ/150 fs): BEAT, we have counter irradiated two-color (787 nm and 813 nm) ultra-intense laser pulses into a hydrogen gas jet flow to excite a plasma wave of slow-wave branch.

**HEDS4-3 16:35**

**Current Sheet and Plasmoid Formation in Relativistic Magnetic Reconnection via Laser-Plasma Interaction**
Yanjun Gu[1,2], Sergei V. Bulanov[1,3,4]
*[1]Institute of Physics of ASCR, ELI-Beamlines, Czech Republic, [2]Institute of Plasma Physics of the CAS, Czech Republic, [3]Kansai Photon Research Institute, National Institutes for Quantum and Radiological Science and Technology, Japan, [4]Prokhorov General Physics Institute, Russian Academy of Sciences, Russia*
3D PIC simulations of relativistic magnetic reconnection via laser-plasma interactions are reported. Magnetic field lines variation and plasmoids are obtained. The magnetic islands are clearly shown. The inductive electric field grows and accelerates the electrons.

# Oral, Tuesday, 24 April AM

## ALPS <Room 303>

**[Opening Remarks] 9:00-9:15**
Hitoki Yoneda
*Institute for Laser Science, The University of Electro-Communications (UEC), Japan*

**[ALPS1-B] 9:15-10:30**
**High power lasers**
Chair: Fumihiko Kannari
*Department of Electronics and Electrical Engineering, Keio University, Japan*

**ALPS1-B-1 9:15** *Invited*

**High Average Power and High Energy Ultrafast Thin-Disk Amplifiers**
Catherine Y. Teisset[1], Christoph Wandt[1], Marcel Schultze[1], Sandro Klingebiel[1], Stephan Prinz[1], Sebastian Stark[1], Christian Grebing[1], Jan-Philipp Negel[2], Helge Höck[2], Michael Scharun[2], Thomas Dietz[2], Dominik Bauer[2], Aleksander Budnicki[2], Christian Stolzenburg[2], Dirk Sutter[2], Alexander Killi[2], Thomas Metzger[1]
*[1]TRUMPF Scientific Lasers GmbH + Co. KG, Germany, [2]TRUMPF Laser GmbH, Germany*
Our commercial picosecond thin-disk regenerative amplifiers are available with up to 200 mJ-pulses and 1 kW of average power. Preliminary scaling results in multipass show potential for multi-kW systems.

**ALPS1-B-2 9:45** *Invited*

**Graphene and Voltage Reconfigurable Graphene Devices for Femtosecond Pulse Generation in the Near Infrared**
Alphan Sennaroglu[1,2], Isinsu Baylam[2], Ferda Canbaz[1], Nurbek Kakenov[3], Coskun Kocabas[3], Umit Demirbas[4], Sarper Ozharar[5]
*[1]Laser Research Laboratory, Departments of Physics and Electrical-Electronics Engineering, Koç University, Turkey, [2]Koç University Surface Science and Technology Center (KUYTAM), Koç University, Turkey, [3]Department of Physics, Bilkent University, Turkey, [4]Department of Electrical and Electronics Engineering, Antalya Bilim University, Turkey, [5]College of Engineering and Natural Sciences, Bahçeşehir University, Turkey*
By using graphene and voltage reconfigurable graphene-based fast saturable absorbers, we describe femtosecond pulse generation experiments performed with $Cr^{3+}$:LiSAF, $Cr^{4+}$:forsterite, and $Ti^{3+}$:sapphire tunable solid-state lasers over the 800-1250 nm region.

**ALPS1-B-3 10:15**

**Kumgang laser: stimulated Brillouin scattering phase conjugate mirrors (SPC-SBS-PCM) for high repetition rate lasers towards the coherent beam combining**
Hong Jin Kong, Seongwoo Cha
*Department of physics, KAIST, Korea*
The recent status of the development of a self-phase-controlled stimulated Brillouin scattering phase conjugate mirror (SPC-SBS-PCM) for the high repetition rate and high output energy laser system will be presented.

----- Break 10:30-11:00 -----

## ALPS <Room 511+512>

## HEDS <Room 311+312>

**[HEDS5] 9:00-10:40**
**Tue-A1**
Chair: Victor Malka
*Laboratoire d'Optique Appliquée, France*

**HEDS5-1 9:00** *Plenary*

**TBD**
Ralph Asmann
TBD

**HEDS5-2 9:40** *Invited*

**A step towards laser plasma electron based free electron laser : undulator radiation observed after an electron beam manipulation line**
Couprie Marie Emmanuelle
*SOLEIL, France*
Towards laser plasma acceleration qualification with a free electron laser application, undulator spontaneous emission measurement after a manipulation electron beam line is reported. The measured undulator radiation provides an insight on the electron beam properties.

**HEDS5-3 10:10** *Invited*

**LUX - A Laser-Plasma Driven Undulator Beamline**
Andreas R. Maier
*Center for Free-Electron Laser Science (CFEL), Germany*
We present experimental results from the LUX Beamline, that recently generated first x-rays at few-nm wavelength from a plasma-driven undulator. We report on stable laser and beamline operation and discuss first experiments.

----- Break 10:40-11:10 -----

## IoT-SNAP <Room 413>

**[Opening Remarks] 9:50-10:00**
Norihiro Hagita
*ATR Intelligent Robotics and Communicatuon Laboratories, Japan*
Ronald Freund
*Fraunhofer Heinrich Hertz Institute, Germany*

**[IoT1] 9:50-11:45**
**Applications and use cases**
Chairs: Ken-ichi Kitayama
*The Graduate School for the Creation of New Photonics Industries, Japan*
Itsuro Morita
*KDDI R&D Laboratories Inc., Japan*

**IoT1-1 10:00** *Invited*

**Plant phenotyping using agricultural IoT with multi optical spectroscopic sensing for digital agriculture**
Takaharu Kameoka, Shinichi Kameoka, Atsushi Hashimoto
*Mie University, Japan*
Plant phenotyping was proceeded using IoT with multi optical spectroscopic sensing such as X-ray fluorescent and mid-infrared spectroscopy for digital agriculture. Wireless sensor network was deployed for the Growing environment information acquisition at the field.

----- Break 10:30-10:45 -----

Oral Program

# Oral, Tuesday, 24 April AM

## LDC <Room 301>

**[LDC1] 9:00-10:45**
**LDC Plenary**
Chairs: Kazuo Kuroda
*Utsunomiya University, Japan*
Hiroshi Murata
*Osaka University, Japan*

**Opening Talk 9:00-9:15**
Kazuo Kuroda
*Utsunomiya University, Japan*

**LDC1-1 9:15** *Plenary*

**Recent Researches and Activities of Korean 3D Display Society**
Byoungho Lee
*Seoul National University, Korea*
I introduce the latest research trends of 3D displays in Korea including super multi-view display and holographic display based on GIGA KOREA project. Also introduced are researches on augmented reality.

**LDC1-2 10:00** *Plenary*

**IR/R/G/B Laser Diodes for Multi-Wavelength Applications**
Hidenori Kawanishi
*Sharp Corporation, Japan*
This paper describes the history of Sharp laser diode development and recent progress in offering a wide wavelength portfolio as a one stop laser supplier for multi-wavelength applications.

----- Break 10:45-11:00 -----

## LSSE <Room 316>

**[Opening] 10:15-10:30**
**Opening Remarks**
Toshikazu Ebisuzaki
*RIKEN, Japan*

**[LSSE1] 10:30-11:30**
**Nishina Award Memorial Lecture**
Chair: Toshikazu Ebisuzaki
*RIKEN, Japan*

**LSSE1-1 10:30** *Invited*

**A coherent Ising machine for solving combinatorial optimization problems**
Hiroki Takesue, T. Inagaki, K. Inaba, T. Ikuta, T. Honjo
*NTT Basic Research Laboratories, Japan*
We briefly review the recent progress of coherent Ising machine, an Ising model solver based on a network of degenerate optical parametric oscillators.

## SLPC <Room 416+417>

**[SLPC1] 9:00-9:10**
**SLPC 2018 Opening Remark**
Masahiro Tsukamoto
*JWRI, Osaka University, Japan*

**[SLPC1] 9:10-10:30**
**SLPC 2018 Plenary Talks**
Chair: Reinhart Poprawe
*Fraunhofer Institute for Laser Technology, Germany*

**SLPC1-1 9:10** *Plenary*

**Laser processing in flexible electronics**
Andreas Ostendorf, Maren Kasischke
*Applied Laser Technologies, Ruhr-University Bochum, Germany*
Laser pulses are a versatile tool in microelectronics and recently have become attractive in flexible electronics. New processes have been developed to selectively ablate or modify the thin films used in this application area.

**SLPC1-2 9:50** *Plenary*

**Blue diode laser development for advanced materials processing**
Masahiro Tsukamoto
*Joining and Welding Research Institute, Osaka University, Japan*
We have developed a high power blue diode laser with the wavelength of 450 nm. Output power of the laser was 100W. The laser was installed in a 3D printing system based on selective laser melting.

----- Break 10:30-11:00 -----

## XOPT <Room 313+314>

**[Opening] 8:55-9:00**
**Opening Remarks**
Tetsuya Ishikawa
*RIKEN SPring-8 Center, Japan*

**[XOPT1] 9:00-10:30**
**XFEL facilities**
Chair: Aymeric Robert
*SLAC National Accelerator Laboratory, USA*

**XOPT1-1 9:00** *Invited*

**Status and Developments in Crystal Optics at the Linac Coherent Light Source**
Diling Zhu[1], Abdullah Ahmed[1], Roberto Alonso-Mori[1], Drew Barada[1], Sebastien Boutet[1], Matthieu Chollet[1], Daniele Cocco[1], Yiping Feng[1], Paul Fuoss[1], Jerome Hastings[1], Justin James[1], Tyler Johnson[1], Karl Gumerlock[1], Kazutaka Nakahara[1], Taito Osaka[2], Aymeric Robert[1], Takahiro Sato[1], Donald Schafer[1], Matthew Seaberg[1], Hongliang Shi[1], Sanghoon Song[1], Yanwen Sun[1], Mark Sutton[3], Nan Wang[1], Makina Yabashi[2], Lin Zhang[1]
*[1]SLAC National Accelerator Laboratory, USA, [2]RIKEN SPring-8 Center, Japan, [3]McGill University, Canada*
We review the operation status of various crystal optics-based beamline components at LCLS and present recent developments in hard x-ray split-delay optics and their first application in experiments.

**XOPT1-2 9:30** *Invited*

**Hard X-ray focusing optics and applications at the PAL-XFEL**
Jangwoo Kim
*Pohang Accelerator Laboratory, Korea*
In this paper, we describe the main optical components for the hard XFEL beamline, the optical configuration of the microfocusing KB mirror system, and the current studies using the focused XFEL beam at the PAL-XFEL.

**XOPT1-3 10:00** *Invited*

**Recent Progress of SACLA**
Taito Osaka
*RIKEN SPring-8 Center, Japan*
Recent developments of x-ray optical devices at SACLA, such as a speckle-free channel-cut crystal monochromator, a nano-focusing mirror system with a large spatial acceptance, and a micro-channel-cut crystal monochromator for a self-seeding scheme, are presented.

----- Break 10:30-11:00 -----

# Oral, Tuesday, 24 April AM

## ALPS <Room 303>

**[ALPS2-H] 11:00-12:00**
**Biomedical Imaging and Sensing**
Chair: Masayuki Suzuki
*Faculty of Medicine, Aichi Medical University, Japan*

**ALPS2-H-1 11:00** ***Invited***

**Development of depth-sensitive optical spectroscopy**
Quan Liu, Joshua Su Weiming, Chao-Mao Hsieh
*School of Chemical and Biomedical Engineering, Nanyang Technological University, Singapore*
We will review the development of depth sensitive optical spectroscopy techniques from earlier fiber-optic based probes to non-contact axicon lens based probes in our group and the corresponding numerical methods for optimization.

**ALPS2-H-2 11:30**

**3D high-resolution spectral-domain optical coherence microscopy at 1700 nm spectral band for deep tissue imaging**
Naoki Hayakawa[1], Masahito Yamanaka[1], Hiroyuki Kawagoe[1], Shuichi Makita[2], Yoshiaki Yasuno[2], Norihiko Nishizawa[1]
*[1]Dept. Electronics, Nagoya University, Japan, [2]Computational Optics Group, University of Tsukuba, Japan*
1700 nm spectral band is useful for deep tissue imaging. We developed spectral-domain optical coherence microscopy (SD-OCM) at 1700 nm spectral band, and demonstrated high-resolution deep tissue imaging of tissue specimens.

**ALPS2-H-3 11:45**

**Mid Infrared Cavity Ring-Down Spectroscopy for Radiocarbon Analysis toward Medical Applications**
Ryohei Terabayashi[1], Volker Sonnenschein[1], Hideki Tomita[1], Noriyoshi Hayashi[1], Kato Shusuke[1], Shin Takeda[1], Lei Jin[1], Masahito Yamanaka[1], Norihiko Nishizawa[1], Atsushi Sato[2], Kenji Yoshida[2], Kohei Nozawa[2], Tetsuo Iguchi[1]
*[1]Graduate School of Engineering, Nagoya University, Japan, [2]Drug Development Solutions Center, Sekisui Medical Co. Ltd., Japan*
Radiocarbon analysis based on Cavity Ring-Down Spectroscopy ($^{14}$C-CRDS) for the applications of drug development has been developed. An overview, status of our current system and some experimental results of $^{14}$C-CRDS will be shown.

----- Lunch 12:00-13:00 -----

## ALPS <Room 511+512>

**[ALPS3-A] 10:45-12:00**
**Novel optical materials/structures and application**
Chairs: Sunao Kurimura
*National Institute for Materials Science, Japan*
Yoichi Sato
*Institute for Molecular Science, National Institutes of Natural Sciences, Japan*

**ALPS3-A-1 10:45** ***Invited***

**QPM devices in KTP isomorphs: linear, nonlinear absorption properties and extreme domain aspect-ratios**
Carlota Canalias, Andrius Zukauskas, Staffan Tjörnhammar, Anne-Lise Viotti, Charlotte Liljestrand, Valdas Pasiskevicius, Fredrik Laurell
*Applied Physics department, KTH Royal Institute of Technology, Albanova University Center, Sweden*
We demonstrate QPM devices in KTP isomorphs with extreme ferroelectric-domain aspect-ratios. The performance of these devices, as well as their linear and nonlinear absorption, are discussed.

**ALPS3-A-2 11:15**

**Mg:SLT-based nonlinear optical light sources for down conversion**
Sunao Kurimura[1], Ryo Okamoto[2], Shigeki Takeuchi[2]
*[1]National Institute for Materials Science, Japan, [2]Kyoto University, Japan*
Bright light sources with nonlinear parametric process in Mg:SLT are presented with blue-violet light pumping. Combination between GaN laser diodes and waveguide nonlinear devices will be discussed for future compact light sources.

**ALPS3-A-3 11:30**

**Design of magnetic anisotropy in micro domains for Yb:Fluoroapatite Laser Ceramics**
Yoichi Sato, Jun Akiyama, Takunori Taira
*Institute for Molecular Science, National Institutes of Natural Sciences, Japan*
According to microdomain designed by quantum mechanical calculations transparent polycrystalline Yb:FAP laser ceramics was synthesized under rotational magnetic field of 1.4T. Small scattering loss of anisotropic ceramics suggests the significance of the orientation control technology.

**ALPS3-A-4 11:45**

**Vertical cavity lasing from $CH_3NH_3PbCl_3$ microcrystals under multiphoton excitation**
Decheng Yang, Chao Xie, Feng Yan, Siu Fung Yu
*Department of Applied Physics, The Hong Kong Polytechnic University, China*
Photoluminescence (PL) property of $CH_3NH_3PbCl_3$ microcrystals under single- and multi-photon excitation is studied. The microcrystal is a natural vertical cavity and can support lasing action at orthorhombic phase under multiphoton excitation.

----- Lunch 12:00-13:00 -----

## HEDS <Room 311+312>

**[HEDS6] 11:10-12:00**
**Tue-A2**
Chair: Couprie Marie Emmanuelle
*SOLEIL, France*

**HEDS6-1 11:10** ***Invited***

**Applications of light sources driven by laser-wakefield acceleration**
Felicie Albert
*Lawrence Livermore National Laboratory, USA*
We will review hard x-ray light sources driven by laser wakefield acceleration (betatron X-ray radiation, Compton scattering, bremsstrahlung) developed at LLNL in the self-modulated and blowout regimes.

**HEDS6-2 11:40**

**High quality X-ray/gamma-ray radiation from a plasma undulator**
Jingwei Wang
*Helmholtz Institute Jena, Germany*
TBD

----- Lunch 12:00-14:00 -----

## IoT-SNAP <Room 413>

**IoT1-2 10:45** ***Invited***

**IoT Directory Service for Realtime and Secure Vehicular Communication**
Ved P Kafle, Yusuke Fukushima, Hiroaki Harai
*National Institute of Information and Communications Technology, Japan*
This paper presents an IoT directory system capable of storing a huge number of records of IoT device profile and providing the records to querying IoT application clients in very low lookup latency.

**IoT1-3 11:15**

**UV measurements for medical applications using SiC photodiodes**
Niklas Papathanasiou, Gabriel Hopfenmueller, Tilman Weiss
*sglux GmbH, Germany*
We report about SiC based UV photodiodes as the core component of smart UV sensors for various medical applications.

**IoT1-4 11:30**

**FashionTechnology and WearableTechnology Use Cases**
Lisa Lang
*ThePowerHouse, Germany*
In a world of IOT, clothes will also become more and more 'things' which we can connect with other items. How would that work?

----- Lunch 11:45-13:15 -----

# Oral, Tuesday, 24 April AM

## LDC <Room 301>

**[LDC2] 11:00-12:00**
**Scanning Systems**
Chairs: Masafumi Ide
*Magic Leap, Japan*
Fergal Shevlin
*DYOPTYKA, Ireland*

**LDC2-1 11:00** ***Invited***

**Laser Holographic Head Up Displays**
Jamieson Christmas
*Envisics Ltd., UK*
Laser holographic display technology offers a compelling solution to the challenges of AR-HUD offering larger, brighter displays with low power consumption in a more compact package.

**LDC2-2 11:30**

**MEMS-Driven Laser Beam Scanning LiDAR: The Future of Variable Spatial Resolution Sensing and Foveated Ranging**
Jari O. Honkanen, P. Selvan Viswanathan
*MicroVision, Inc., USA*
This paper explores why LBS technology is especially well suited for LiDAR applications, and how MEMS-driven LBS LiDAR systems offer compelling advantages such as dynamic variable spatial resolution and foveated depth sensing.

**LDC2-3 11:45**

**Multi-purpose IoT Station Using Scanning Visible Laser Diodes Common to Smart Lighting and LiDAR**
Masato Ishino[1], Toshiyuki Kitamura[2], Akira Takamori[1], Masahide Okazaki[3], Hiroshi Murata[4], Junichi Kinoshita[1], Noboru Hasegawa[2], Masaharu Nishikino[2], Kazuhisa Yamamoto[1]
*[1]Osaka University, Japan, [2]National Institute for Quantum and Radiological Science and Technology, Japan, [3]Screen Holdings Co., ltd, Japan, [4]Graduate School of Engineering Science, Osaka University, Japan*
A new concept of IoT station using visible LD-scan technology common to smart lighting and LiDAR-sensing is proposed. The feasibility of this system is verified using a simply-configured prototype system.

----- Lunch 12:00-13:00 -----

## LSSE <Room 316>

**[LSSE2] 11:30-12:00**
**Post Deadline paper**
Chair: Akihiko Nishimura
*Japan Atomic Energy Agency, Japan*

**LSSE2-1 11:30**

**TBD**
TBD
TBD

----- lunch 12:00-13:15 -----

## SLPC <Room 416+417>

**[SLPC2] 11:00-12:00**
**Digital Production (AM and IoT) I**
Chairs: Masahiro Tsukamoto
*JWRI, Osaka University, Japan*
Masahito Katto
*University of Miyazaki, Japan*

**SLPC2-1 11:00** ***Invited***

**Latest trends of IoT and additive laser manufacturing**
Bastian Becker[1], Antonio Candel-Ruiz[1], Stephan Manz[1], Dirk Wagner[2]
*[1]Sales Services, Lasertechnology, TRUMPF Laser- und Systemtechnik GmbH, Germany, [2]TRUMPF Laser GmbH, Germany*
Internet of Things and Industry 4.0 are common words in today's industry. Connecting and getting data and information out of machines and lasers. Making data transparent for analysis, resulting in measures to increase productivity and availability of the production.

**SLPC2-2 11:30** ***Invited***

**Toward cool laser manufacturing**
Yohei Kobayashi, Shuntaro Tani
*The University of Tokyo, Japan*
The laser manufacturing is getting more and more important to realize a smart society. Here we discuss how to make an automatic system to optimize a parameters of the laser machining.

----- Lunch 12:00-13:30 -----

## XOPT <Room 313+314>

**[XOPT2] 11:00-12:00**
**Optics I (refractive)**
Chair: Lahsen Assoufid
*APS, Argonne National Laboratory, USA*

**XOPT2-1 11:00** ***Invited***

**X-ray refractive beam-conditioning and beam-shaping optics for coherent microscopy applications**
Anatoly Snigirev
*Immanuel Kant Baltic Federal University, Russia*
X-ray refractive beam-conditioning and beam-shaping optics for coherent microscopy applications

**XOPT2-2 11:30**

**2D focusing kinoform lenses produced by 3D direct printing**
Thomas Roth[1], Frieder Koch[2], Sebastien Berujon[1], Rafael Celestre[1], Thomas Zinn[1], Christian David[2], Raymond Barrett[1]
*[1]European Synchrotron Radiation Facility, France, [2]Paul Scherrer Institut, Switzerland*
We report on the use of 3D direct printing of a polymer, with sub-micron resolution, allowing the manufacturing of 2D focusing kinoform lenses. These lenses were characterised using x-ray speckle based wavefront sensing and SAXS.

**XOPT2-3 11:45**

**Characterisation of refractive focusing lenses**
Lucia Alianelli, Oliver Fox, Kawal Sawhney
*Diamond Light Source Ltd, UK*
High resolution x-ray imaging is used to characterize the refractive lenses. The beam profile out of focus gives an integrated signal effect from lens inhomogeneities, in addition to the focusing effect from the curved surfaces

----- Lunch 12:00-13:30 -----

# Oral, Tuesday, 24 April PM

## ALPS <Room 303>

**[ALPS4-E1] 13:00-15:00**
**Extreme Light Infrastructure 1**
Chair: Katsumi Midorikawa
*RIKEN Center for Advanced Photonics, Japan*

**ALPS4-E1-1 13:00** *Invited*

**Paving the Way towards Novel Applied and Fundamental Sciences with ELI-Beamlines**
Sergei V. Bulanov[1,2]
*[1]Institute of Physics AS CR, v.v.i (FZU), ELI-Beamlines, Czech Republic, [2]National Institutes for Quantum and Radiological Science and Technology (QST), Kansai Photon Science Institute, Japan*
The ELI-BL aspires to install and run the world's most intense laser system. These beamlines will enable ground-breaking research in the fields of physics and material science, in biomedicine, in fundamental science and laboratory astrophysics.

**ALPS4-E1-2 13:30** *Invited*

**Laser-based research technologies at ELI-ALPS**
Karoly Osvay, A. Borzsonyi, D. Charalambidis, E. Cormier, L. Fulop, M. Kalashnikov, Ch. Kamperidis, B. Kiss, R. Lopez-Martens, G. Sansone, Z. Várallyay, K. Varju
*ELI-ALPS, ELI-HU Non-Profit Ltd., Hungary*
Laser systems operating in the 100W average power regime provide ELI-ALPS with TW-to-PW peak power pulses for generation of secondary light sources with a duration of tens of attosecond for basic and applied researches.

**ALPS4-E1-3 14:00** *Invited*

**ELI-NP Status and Plan**
Kazuo A. Tanaka
*ELI-NP/IFIN-HH, Romania*
ELI-NP has been in the implementation phase now as of 2018. The installation of high-power laser system has been on time.

## ALPS <Room 511+512>

**[ALPS5-I1] 13:00-15:00**
**Optical Frequency Comb (Light Source)**
Chair: Hajime Inaba
*National Institute of Advanced Industrial Science and Technology, Japan*

**ALPS5-I1-1 13:00** *Invited*

**Optical frequency combs: From lab-scale to chip-scale**
Scott A. Diddams[1,2]
*[1]National Institute of Standards and Technology, USA, [2]Department of Physics, University of Colorado, USA*
We report on the latest developments in laboratory and chip-scale optical frequency combs and our application to atomic timekeeping, spectroscopy, frequency synthesis and exoplanet searches.

**ALPS5-I1-2 13:30**

**Er-doped Bi-directional Dual-comb Fiber Laser With Single-walled Carbon Nanotube Film**
Shuto Saito[1], Lei Jin[1], Yoichi Sakakibara[2], Emiko Omoda[2], Hiromichi Kataura[2], Norihiko Nishizawa[1]
*[1]Department of Electronics, Nagoya University, Japan, [2]National Institute of Advanced Industrial Science and Technology (AIST), Japan*
Bi-directional, Er-doped dual-comb fiber laser was demonstrated using polyimide film dispersed with single-walled carbon nanotube (SWNT). Difference of repetition frequency was temporally stable and it could be tuned continuously by pump power control.

**ALPS5-I1-3 13:45**

**Evaluation of Broadband Coherence of Bidirectional Mode-Locked Er-Fiber Laser with Two Saturable Absorber Mirrors**
Yoshiaki Nakajima[1,2], Yuya Hata[1], Kaoru Minoshima[1,2]
*[1]Department of Engineering Science, Graduate School of Informatics and Engineering, the University of Electro-Communications, Japan, [2]Japan Science and Technology Agency (JST), ERATO MINOSHIMA Intelligent Optical Synthesizer (IOS) Project, Japan*
The broadband coherence of bidirectional mode-locked Er-fiber laser with two saturable absorption mirrors is evaluated. We obtain a signal-to-noise ratio of 35 dB between the narrow linewidth single frequency laser and output.

**ALPS5-I1-4 14:00**

**All-Polarization-Maintaining Dual-wavelength mode-locked Er-fiber laser with nonlinear amplifying loop mirror**
Yoshiaki Nakajima[1,2], Yuya Hata[1], Kaoru Minoshima[1,2]
*[1]Department of Engineering Science, Graduate School of Informatics and Engineering, the University of Electro-Communications, Japan, [2]Japan Science and Technology Agency (JST), ERATO MINOSHIMA Intelligent Optical Synthesizer (IOS) Project, Japan*
All-polarization-maintaining dual-wavelength mode-locked fiber laser with nonlinear amplifying loop mirror has been demonstrated for realizing simple and robust dual-comb spectroscopy using two mutually coherent combs with slightly different repetition rates emitted from the laser cavity.

## HEDS <Room 311+312>

**[HEDS7] 14:00-15:00**
**Tue-P1**
Chair: Felicie Albert
*Lawrence Livermore National Laboratory, USA*

**HEDS7-1 14:00**

**Electro-optic spatial decoding on the spherical-wavefront Coulomb fields of plasma electron sources**
Kai Huang
*Kansai Photon Science Institute, QST, Japan*
The Coulomb field of electron beams near the source position has been found to have spherical shape, which is different with previously widely used model. A new temporal mapping relationship was established.

## IoT-SNAP & LSSE <Room 302>

**[NSTP] 13:15-16:45**
**Joint Session of IoT-SNAP and LSSE Nondestructive Sensing for Topical Problems**
Chairs: Katsuhiro Ishii
*The Graduate Schiool for the Creation of New Photonics Industries, Japan*
Akihiko Nishimura
*Japan Atomic Energy Agency, Japan*

**[Opening Remarks] 13:15-13:30**
Kenichi Kitayama
*The Graduate Schiool for the Creation of New Photonics Industries, Japan*

**NSTP-1 13:30** *Invited*

**Toward highly advanced social infrastructure by utilizing 3D laser measurement and IoT**
Nobuyoshi Yabuki
*Osaka Univercity, Japan*
After reviewing the current problems and research efforts in 3D laser measurement of civil infrastructures, the author describes the foresight on the application of 3D laser measurement, IoT and recognition technologies to civil infrastructures.

**NSTP-2 14:00** *Invited*

**Nondestructive testing of aging phenomena by using electromagnetic waves**
Kaori Fukunaga[1], Richard Hills[2], Nicholas Whyborn[3], Masumi Yamada[1]
*National Institute of Information and Communications Technology, Japan*
Condition based maintenance of social infrastructure requires advanced data processing to extract useful information for diagnosis from data obtained by various sensing systems.

# Oral, Tuesday, 24 April PM

## LDC <Room 301>

**[LDC3] 13:00-16:30**
**Hyper-Realistic Displays 2018**
Chairs: Hirotsugu Yamamoto
*Utsunomiya University, Japan*
Daisuke Miyazaki
*Osaka City University, Japan*

**LDC3-1 13:00** ***Invited***

**Introductory Talk: 3D Displays from PyeongChang to Tokyo**
Hirotsugu Yamamoto[1,2]
*[1]Utsunomiya University, Japan, [2]JST, ACCEL, Japan*
This talk gives an overview of the hyper-realistic displays in 2018. One of the most significant topics is the application of 3D displays for PyeongChang 2018 Olympics. In Japan, aerial displays are becoming popular.

**LDC3-2 13:15** ***Invited***

**Development of Digital Holographic Display Technology in Giga KOREA Project**
Minsik Park, Chi-Sun Hwang, Jinwoong Kim
*ETRI, Korea*
We will discuss the technology development of table-top digital holographic display that enables user to consume the realistic 3D media for tele-experience service in Giga KOREA Project

**LDC3-3 13:45** ***Invited***

**HOPTECH: hologram printing technology and applications**
Ryutaro Oi, Koki Wakunami, Boaz Jackin, Yasuyuki Ichihashi, Makoto Okui, Kenji Yamamoto
*National Institute of Information and Communications Technology, Japan*
Wavefront printer is useful to make an optical elements. A hologram printing method that includes holographic optical elements fabrication, duplication of holograms and overlap printing method for better view of holograms is described.

## SLPC <Room 416+417>

**[SLPC3] 13:30-15:00**
**Digital Production (AM and IoT) II**
Chairs: Bastian Becker
*TRUMPF Laser- und Systemtechnik GmbH, Germany*
Hitoshi Nakano
*Kindai University, Japan*

**SLPC3-1 13:30**

**Development of sputter-free selective laser melting for titanium plate fabrication**
Yuji Sato[1], Masahiro Tsukamoto[1], Takahisa Shobu[2], Takaya Nishi[3], Yorihiro Yamashita[4], Ritsuko Higashino[1], Hitoshi Nakano[3], Nobuyuki Abe[1]
*[1]JWRI, Osaka University, Japan, [2]Japan atomic energy agency, Japan, [3]Graduate School of Science and Engineering, Kindai University, Japan, [4]Industrial Research Institute of Ishikawa, Japan*
Titanium plates were fabricated by SLM in vacuum owing to reduce of amount of sputter generation. It was found that the sputtering was inhibited when the T the base plate temperature was raised.

**SLPC3-2 13:45**

**Development of selective laser melting system applied to fabricate controllable thin-walled metal microstructures**
Chung-Wei Cheng[1], Siang-Yang Wu[1], Mi-Ching Tsai[2]
*[1]Department of Mechanical Engineering, National Chiao Tung University, Taiwan, [2]Department of Mechanical Engineering, National Cheng Kung University, Taiwan*
This study developed a laboratory selective laser melting (SLM) system, presented thin-walled metal microstructures from maraging steel powders with different geometric shapes by sequentially layering different single laser melted tracks in a vertical direction.

**SLPC3-3 14:00**

**Advanced beam diagnostics for additive manufacturing laser scanner systems**
Andreas Koglbauer, Stefan Wolf, Otto Märten, Reinhard Kramer
*Research & Development, PRIMES GmbH, Germany*
Via a novel beam diagnostic approach for 3D scanners, we are able to determine not only the beam width, but reconstruct the scanned path (orientation, position, and length) of the laser in the measurement plane.

## XOPT <Room 313+314>

**[XOPT3] 13:30-15:00**
**Imaging I**
Chair: Satoshi Matsuyama
*Osaka University, Japan*

**XOPT3-1 13:30** ***Invited***

**Coherent X-ray Diffractive Imaging of Topological Defects in Operando Energy Storage Materials**
Oleg G. Shpyrko[1], Andrej Singer[1,2], Shirley Meng[1]
*[1]University of California San Diego, USA, [2]Cornell University, USA*
I will report three-dimensional imaging of dislocation dynamics in individual battery cathode nanoparticles of LiNiMnO as well as Lithium-rich layered oxides under operando conditions using Bragg coherent diffractive x-ray imaging.

**XOPT3-2 14:00** ***Invited***

**Multi-Scale 3D Imaging of Strains and Structures with Dark-Field X-Ray Microscopy**
Hugh Simons
*Technical University of Denmark, Denmark*
A new method for multi-dimensional x-ray microscopy

# Oral, Tuesday, 24 April PM

## ALPS <Room 303>

**ALPS4-E1-4 14:30** *Invited*

**High Power Laser Development and its application for High Energy Density Science**

Ryosuke Kodama
*Institute of Laser Engineering, Osaka University, Japan*

----- Break 15:00-15:15 -----

**[ALPS6-E2] 15:15-17:15**
**Extreme Light Infrastructure 2**
Chair: Kazuo A. Tanaka
*ELI-NP/IFIN-HH, Romania*

**ALPS6-E2-1 15:15** *Invited*

**High Harmonic Generation and Attosecond Science at RIKEN**

Katsumi Midorikawa
*RIKEN Center for Advanced Photonics, Japan*

Recent progress on high harmonic generation and attosecond science at RIKEN is presented, including novel ultrafast laser technology for generation intense isolated attosecond pulses and MHz repetition rated high harmonics.

## ALPS <Room 511+512>

**ALPS5-I1-5 14:15**

**Mid-infrared Frequency Comb Based on Er-doped Ultrashort Pulse Fiber Laser System and Tm-doped Fiber Amplifier**

Kento Mochizuki[1], T. Masahumi[1], L. Jin[1], M. Yamanaka[1], V. Sonnenschein[1], H. Tomita[1], T. Iguchi[1], A. Sato[2], K. Hashizume[2], K. Nozawa[2], N. Nishizawa[1]
*[1]Nagoya University, Japan, [2]Sekisui Medical Co. Ltd., Japan*

We demostrated offset-free mid-infrared frequency comb at 4.3-4.9 μm with difference frequency generation pumped by Er-doped ultrashort pulse fiber laser.

**ALPS5-I1-6** *Canceled*

**ALPS5-I1-7 14:45**

**Nonlinear Parametric Oscillation Phase-matched via High-order Dispersion in High-Q Silica Toroid Microresonators**

Shun Fujii, Minori Hasegawa, Ryo Suzuki, Takasumi Tanabe
*Department of Electronics and Electrical Engineering, Faculty of Science and Technology, Keio University, Japan*

We demonstrated optical nonlinear parametric oscillation phase-matched via high-order dispersion in dispersion engineered silica toroid microresonators. The balance between second- and forth-order dispersions allows generation of phase-matched four-wave mixing in broadband wavelength regime.

----- Break 15:00-15:30 -----

**[ALPS7-I2] 15:30-17:00**
**Optical Frequency Comb (Applications)**
Chair: Scott Diddams
*National Institute of Standards and Technology, USA*

**ALPS7-I2-1 15:30** *Invited*

**Ultrafast Photonics for Precision Optical Measurement and Instrumentation**

Seung-Woo Kim
*Korea Advanced Institute of Science and Technology (KAIST), Korea*

A practical scheme of constructing a versatile source of narrow-linewidth cw lasers based on the frequency comb of a mode-locked fiber laser is presented along with potential applications for optical metrology and instrumentation.

## HEDS <Room 311+312>

**HEDS7-2 14:20**

**Effect of linearly chirped laser pulses on Laser Wakefield Acceleration**

Naveen Chandra Pathak[1], Alexei Zhidkov[1], Tomonao Hosokai[1,2], Zhang Jin[1], Yasuo Sakai[1], Keiichi Sueda[1], Hirotaka Nakamura[2], Junpei Ogino[1], Takamitsu Otsuka[1], Ryosuke Kodama[1,2,3]
*[1]Photon Pioneers Center, Osaka University, Japan, [2]Graduate School of Engineering,Osaka University, Japan, [3]Institute of Laser Engineering, Osaka University, Japan*

Linearly chirped laser pulses are useful for online control of electron self- injection, accelerated bunch charge and energy gain in laser wakefield acceleration.

**HEDS7-3 14:40**

**Generation and Detection of Terahertz Radiation in Laser-solid Interaction**

Zhan Jin[1], Hongbin Zhuo[2,3], Takuya Fukuda[4], Shouta Tajima[5], Noboru Yugami[4], Tomonao Hosokai[5], Zhengming Sheng[3,6], Ryosuke Kodama[1,5,7]
*[1]Photon Pioneers Center, Osaka University, Japan, Japan, [2]National University of Defense Technology, China, [3]Collaborative Innovation Center of IFSA, Shanghai Jiao Tong University, China, [4]Utsunomiya University, Japan, [5]Graduate School of Engineering, Osaka University, Japan, [6]University of Strathclyde, U.K., [7]Institute of Laser Engineering, Osaka University, Japan*

We report experimental results on efficient generation of radially polarized terahertz radiation behind laser-solid interaction. A single-shot terahertz time-domain spectroscopy method is also developed to obtain the temporal waveform of the terahertz wave.

----- Break 15:00-15:30 -----

**[HEDS8] 15:30-16:50**
**Tue-P2**
Chair: Alexei Zhidkov
*Graduate School of Engineering, Osaka University, Japan*

**HEDS8-1 15:30** *Invited*

**Control of Burst Intensification by Singularity Emitting Radiation (BISER) with density jump**

Alexander Pirozhkov[1], T. Zh. Esirkepov[1], A. Sagisaka[1], K. Ogura[1], N. Nakanii[1], H. Kai[1], T.A. Pikuz[2], S. Namba[3], I. Daito[1], Y. Fukuda[1]
*[1]KPSI, QST, Japan, [2]Osaka University, Japan, [3]Hiroshima University, Japan*

We for the first time demonstrated the Burst Intensification by Singularity Emitting Radiation (BISER) control employing a sharp plasma density jump generated by a shock in supersonic gas flow in experiments with the J-KAREN-P laser.

## IoT-SNAP & LSSE <Room 302>

**NSTP-3 14:30** *Invited*

**Application of microwave-photonics technologies to high-frequency Radio Astronomy**

Hitoshi Kikuchi[1]
*[1]National Astronomical Observatory of Japan, Japan, [2]Univercity of Cambridge, UK, [3]Joint ALMA Office, Chile*

We have developed calibration systems for high-frequency Radio Interferometers, which are applied with microwave-photonics technologies. These systems have built-in remote controllers with web-server function.

----- Break 15:00-15:30 -----

**NSTP-4 15:30** *Invited*

**Visualization of radioactive substances by integrating radiation measurement and 3D optical measurement inside the Fukushima Daiichi Nuclear Power Station**

Yuki Sato, Yuta Tanifuji, Yuta Terasaka, Yuki Morishita, Hiroshi Usami, Masaaki Kaburaki, Kuniaki Kawabata, Tateo Torii
*Japan Atomic Energy Agency, Japan*

We drew a 3D radiation distribution map inside the Fukushima Daiichi Nuclear Power Station building by integrating the radiation image resulting from a gamma camera into the 3D optical models of the experimental environment.

# Oral, Tuesday, 24 April PM

## LDC <Room 301>

**LDC3-4 14:15** *Invited*

**Possibilities and Problems of Super-Multiview 3D Display**

Sung Kyu Kim, Min-Koo Kang, Yong-Jun Kwon, Ki-Hyuk Yoon
*Korea Institute of Science and Technology, Korea*

SMV 3D display aims for the characteristics of the horizontal parallax only electro-holographic 3D display. But achieving high quality 3D image and human friendly display performance are significant issues for ideal SMV 3D display.

**LDC3-5 14:45**

**Aerial Protruding DFD Display with AIRR**

Yoshiki Terashima[1], Ryosuke Kujime[1,2], Shiro Suyama[3], Hirotsugu Yamamoto[1,2]
*[1]The University of Utsunomiya, Japan, [2]JST ACCEL, Japan, [3]The University of Tokushima, Japan*

This paper proposes a novel aerial 3D display, which is based on the protruding DFD display. We form two-layered aerial images with AIRR. We have successfully realized aerial protruding DFD display.

----- Break 15:00-15:15 -----

**LDC3-6 15:15** *Invited*

**Integral 3D Display System Using Multiple Display Devices**

Naoto Okaichi, Hayato Watanabe, Hisayuki Sasaki, Masahiro Kawakita, Tomoyuki Mishina
*NHK Science & Technology Research Laboratories, Japan*

We are conducting research using multiple display devices to improve the performance of integral 3D images. Each of the research results using direct-view displays and projectors as the display devices will be described in detail.

## SLPC <Room 416+417>

**SLPC3-4 14:15**

**Effect of laser power on molten pool track and microstructure in laser metal deposition of 316L stainless steel**

Manjaiah Mallaiah, Jean Yves Hascoet, Matthieu Rauch
*Department of Mechanics, Materials and Civil Engineering, Centrale Nantes, France*

This paper presents the grain structures, solidification tracks and micro-hardness evolution of 316L stainless steel material after melt depositions at different laser powers.

**SLPC3-5 14:30**

**The in situ laser-induced synthesis of nickel-gold microstructures for non-enzymatic sensing of glucose**

Ilya I Tumkin, Evgeniia M Khairullina, Ilia A Aliabev, Vladimir A Kochemirovsky, Maxim S Panov
*Institute Chemistry, Saint Petersburg State University, Russia*

In the current work the conductive bimetallic microstructures based on nickel and gold with high sensor activity towards glucose were synthesized using the in situ laser-induced metal deposition technique (LCLD)

**SLPC3-6 14:45**

**Development of non-molten pool type laser coating**

Yorihiro Yamashita[1], Yoshinori Funada[1], Masahiro Tsukamoto[2], Nobuyuki Abe[2], Yuji Sato[2], Yuu Sakon[3], Kazuki Makinoshima[3]
*[1]Machinery and Metal, Industrial Research Institute of Ishikawa, Japan, [2]Laser Process, Joining and Welding Research Institute, Osaka University, Japan, [3]Development Section, Muratani Machine Inc, Japan*

Developed non-molten pool type laser coating process is possible to form a thin layer without dilution and shape distortion. Testing using Ni-based SFA powder showed that it is possible for a thickness of only 0.1mm.

----- Break 15:00-15:15 -----

**[SLPC4] 15:15-17:00**
**Advanced Laser and Industrial Applications**
Chairs: Beat Neuenschwander
*Bern Uniuversity of Applied Sceinces / Institute for Applied Laser, Photonics and Surface technologies ALPS, Switzerland*
Yoshio Hayasaki
*Ustunomiya University, Japan*

**SLPC4-1 15:15** *Invited*

**Latest diode laser technology and its industrial applications**

Markus A. Ruetering, Christoph Ullmann, Matthias Weinbach
*Laserline GmbH, Germany*

The paper will review the actual industrial applications with diode lasers as well as the new approach with 450 nm blue radiation

## XOPT <Room 313+314>

**XOPT3-3 14:30**

**Hard X-ray in-situ full-field microscopy for material science applications**

Irina Snigireva[1], Kehn Vidar Falch[2], Daniele Casari[2], Marco Di Michiel[1], Carsten Detlefs[1], Ragnvald Mathiesen[2], Anatoly Snigirev[3]
*[1]European Synchrotron Radiation Facility, France, [2]Norwegian University of Science and Technology, Norway, [3]Immanuel Kant Baltic Federal University, Russia*

Hard X-ray transmission microscopy based on refractive X-ray optics is employed as a tool in material science to investigate buried-in microstructures in two or three dimensions with spatial resolution approaching 100 nm.

**XOPT3-4 14:45**

**Lensless imaging with a lens**

Anders Filsoee Pedersen[1], Virginie Chamard[2], Hugh Simons[1], Carsten Detlefs[3], Henning Poulsen[1]
*[1]Technical University of Denmark, Denmark, [2]Aix-Marseille Universite, France, [3]European Synchrotron Radiation Facility, France*

We suggest a way to combine the BCDI technique with an objective to allow imaging of individual grains or domains inside a bulk sample, tested using wavefront propagation simulations based on the fractional Fourier transform.

----- Break 15:00-15:30 -----

**[XOPT4] 15:30-17:00**
**Optics II (high heat-load/high brilliance)**
Chair: Harald Sinn
*European XFEL, Germany*

**XOPT4-1 15:30** *Invited*

**Development of a hard X-ray non-invasive wavefront sensor using a single-grating interferometer combined with a thin diamond single-crystal beam splitter**

Lahsen Assoufid[1], Xianbo Shi[1], Walan Grizolli[1], Tomasz Kolodziej[1], Steven Kearney[1], Yuri Shvydko[1], Vladimir Blank[2], Sergey Terenteyev[2], Deming Shu[1], Antoine Wojdyla[3], Kenneth A. Goldberg[3], Mourad Idir[4], Daniel Cocco[5]
*[1]APS, Argonne National Laboratory, USA, [2]Technological Institute for Superhard and Novel Carbon Materials, Russia, [3]ALS, Lawrence Berkeley National Laboratory, USA, [4]NSLS-II, Brookhaven National Laboratory, USA, [5]SLAC National Accelerator Laboratory, USA*

We report on experimental results with a hard x-ray wavefront sensor that could potentially be used as a non-invasive sensor to generate a feedback signal to control or optimize the shape of wavefront-preserving deformable mirrors.

# Oral, Tuesday, 24 April PM

## ALPS <Room 303>

**ALPS6-E2-2 15:45** *Invited*

**Laser-driven Particle Acceleration and Ultra-short X-Ray Generation using PW-class High Power Lasers**

Tetsuya Kawachi
*Kansai Photon Science Institute (KPSI), Quantum Beam Science Directorate, National Institutes for Quantum and Radiological Science and Technology (QST), Japan*

Recent progress of the study of laser particle acceleration and coherent x-ray generation using ultra-intense lasers in QST-KPSI [1] and future prospect including international collaboration on high power laser science and technology are presented.

**ALPS6-E2-3 16:15** *Invited*

**The ELI-ERIC: status, agreements and basic rules**

Florian Gliksohn
*ELI Delivery Consortium, Belgium*

**ALPS6-E2-4 16:45** *Invited*

**Photon Frontier Network Opening Frontiers by Complete Control of Light and Matter**

Yoshiaki Kato[1], Ryosuke Kodama[2], Norikatsu Mio[3]
*[1]The Graduate School for Creation of New Photonics Industries, Japan, [2]Institute of Laser Engineering, Osaka University, Japan, [3]Institute for Photon Science and Technology, School of Science, University of Tokyo, Japan*

Photon Frontier Network, 10-year program implemented in FY 2008-2017 under MEXT, is composed of the consortia C-PhoST and APSA with participation of ~200 scientists. Several results on coherent control of light and matter are presented.

## ALPS <Room 511+512>

**ALPS7-I2-2 16:00**

**Mid-Infrared Frequency Comb Working at 4500 nm Based on Yb-doped Fiber Laser for CRDS Application**

Lei Jin[1], V. Sonnenschein[1], R. Terabayashi[1], N. Hayashi[1], S. Sato[1], M. Yamanaka[1], H. Tomita[1], T. Iguchi[1], A. Sato[2], K. Nozawa[2], K. Yoshida[2], N. Nishizawa[1]
*[1]Dpet. Electronics, Nagoya University, Japan, [2]Sekisui Medical Co. Ltd., Japan*

An offset free mid-infrared optical frequency comb was generated based on an Yb-doped fiber laser system with tunability of 3900-4700 nm. Cavity ring down spectroscopy measurement was demonstrated with QCL and MIR comb reference.

**ALPS7-I2-3 16:15**

**No-scanning 3D image detection with sum-frequency generation of optical frequency combs**

Yurina Tanaka[1,2], Takashi Kato[1,2], Megumi Uchida[1,2], Akifumi Asahara[1,2], Kaoru Minoshima[1,2]
*[1]The University of Electro-Communications (UEC), Japan, [2]Japan Science and Technology Agency (JST), ERATO MINOSHIMA Intelligent Optical Synthesizer (IOS) Project, Japan*

We demonstrate no-scanning 3D imaging with sum-frequency generation of chirped optical frequency combs with μm-level depth accuracy. By using a spectral filter pair and cameras, 2D color image corresponding to 3D shape image is imaged.

**ALPS7-I2-4 16:30**

**One-shot three-dimensional imaging with a paired filter and an optical pseudo-Hilbert transform using chirped-frequency combs**

Takashi Kato[1,2], Megumi Uchida[1,2], Yurina Tanaka[1,2], Kaoru Minoshima[1,2]
*[1]The University of Electro-Communications (UEC), Japan, [2]JST, ERATO MINOSHIMA Intelligent Optical Synthesizer (IOS), Japan*

One-shot three-dimensional imaging with chirped-frequency comb interferometry was demonstrated using 2D spectral imaging technique with a paired spectral filter. Non-scanning image measurement of a coin 3D surface profile with 120-pixels square area was demonstrated.

**ALPS7-I2-5 16:45**

**Simultaneous measurement of refractive index and thickness profiles of solids based on dual-comb spectroscopy**

Yue Wang[1,2], Akifumi Asahara[1,2], Ken-ichi Kondo[1,2], Kaoru Minoshima[1,2]
*[1]The University of Electro-Communications (UEC), Japan, [2]Japan Science and Technology Agency (JST), ERATO MINOSHIMA Intelligent Optical Synthesizer (IOS) Project, Japan*

Raster-scanning dual-comb spectroscopy for simultaneously evaluating the profiles of refractive index and thickness of solid samples is demonstrated. Profiles of refractive index and step structure made of glass plates were successfully measured with $10^{-4}$ uncertainty.

## HEDS <Room 311+312>

**HEDS8-2 16:00**

**X-ray structures with nanometer-spatial resolution in ultraintense laser-plasma interactions**

Bruno Gonzalez-Izquierdo, Masaki Kando, Alexander Pirozhkov
*Kansai Photon Science Institute, Japan*

A technique to measure the spatial distribution of x-ray sources in ultraintense laser-plasma interactions with a few hundred nanometer resolution is presented. This enables the x-ray source size and brightness estimation.

**HEDS8-3 16:20**

**Collective Stopping of Laser Ion Beam in Plasmas**

Kunioki Mima
*The Graduate School for the creation of New Photonics Industries, Japan*

The collective interaction between intense ion beams and plasmas is studied where a high-current density proton beams produced by short pulse laser interacts with a plasma.

**HEDS8-4 16:40**

**Increase of escaping electrons from laser irradiated foils by producing preformed plasma at the back side**

Shunsuke Inoue, Kensuke Teramoto, Sadaoki Kojima, Masaki Hashida, Shuji Sakabe
*Kyoto University, Japan*

We show that electrons emitted from a foil target irradiated by an intense laser pulse are increased by irradiation of the second femtosecond laser pulse in advance on the other surface of the target.

## IoT-SNAP & LSSE <Room 302>

**NSTP-5 16:00** *Invited*

**Social touch in human-human telecommunication mediated by a robot**

Hidenobu Sumioka
*Advanced Telecommunications Research Institute International, Japan*

We present how virtual physical contact mediated by an artificial entity affects our quality of life through human-human telecommunication, forcusing on elderly care and education.

**[Closing Remarks] 16:30-16:45**

Toshikazu Ebisuzaki
*RIKEN, Japan*

# Oral, Tuesday, 24 April PM

## LDC <Room 301>

**LDC3-7 15:45** *Invited*

**Air Floating Image and Its Applications Using a Dihedral Corner Reflector Array**

Yuki Maeda
*Parity Innovations Co. Ltd., Japan*

A distortion-free full-color real image can be displayed in midair using a dihedral corner reflector array. A basis of the dihedral corner reflector array and some applications, such as a floating touch display, are introduced.

**LDC3-8 16:15** *Invited*

**Challenges Toward Visual Interface Based on Aerial Three-Dimensional Image (Closing Remark)**

Daisuke Miyazaki
*Osaka City University, Japan*

Floating three-dimensional (3-D) image formation without any project screen is advantageous for providing interactive operation to the 3-D data directly using fingers or positioning devices. The several studies on aerial 3-D display technologies are described.

----- Break 16:30-16:45 -----

**[LDC4] 16:45-18:00**
**Projection Technology**
Chairs: Jari O. Honkanen
*MicroVision Inc., USA*
Satoshi Ouchi
*Hitachi Consumer Electronics CO., LTD., Japan*

**LDC4-1 16:45** *Invited*

**Edible Retroreflector for Dynamic Projection Mapping on Foods**

Hiromasa Oku
*Gunma University, Japan*

In this presentation, the concept of an edible retroreflector is introduced. Japan agar was found to be adequate material to form it. The prototype was successfully applied to a marker for dynamic projection mapping.

**LDC4-2 17:15** *Invited*

**1000fps, 8bit and Low Latency Projector "DynaFlash"**

Takeshi Yuasa[1], Yoshihiro Watanabe[2], Masatoshi Ishikawa[2]
*[1]Tokyo Electron Device Ltd., Japan, [2]The University of Tokyo, Japan*

High speed projector "DynaFlash" can realize 1000-fps, 8bit depth and 3ms (min) latency based on the Texas Instruments DLP technology and the high-speed control of high-luminance LED.

**LDC4-3 17:45**

**Spatial-division Multiplexing in Holographic 3D Display using High-speed Binary Phase-mode Spatial Light Modulator**

Shigehiko Washizu[1], Syo Harada[1], Xiangyu Quan[1], Kouichi Nitta[1], Shinya Sato[2], Nobuyuki Hashimoto[2], Osamu Matoba[1]
*[1]Kobe University, Japan, [2]CITIZEN Watch Co. Ltd., Japan*

Experimental demonstration of enlarging viewing zone angle and reconstructed image size of holographic 3D display using a high-speed binary-phase-mode spatial light modulator is presented. In the experiment, three-times enlargement is achieved.

## SLPC <Room 416+417>

**SLPC4-2 15:45**

**Development of high-energy-class laser processing technologies using a laser-diode pumped 100-J pulse-shaped laser system**

Yoshio Mizuta, Takashi Kurita, Takeshi Watari, Yuki Kabeya, Takashi Sekine, Yoshinori Tamaoki, Koichi Iyama, Yasuki Takeuchi, Takaaki Morita, Masateru Kurata, Yuma Hatano, Kazuki Kawai, Yuki Muramatsu, Takuto Iguchi, Yoshinori Kato
*Central Research Laboratory Industrial development Center Power Laser Development Group, HAMAMATSU PHOTONICS K.K., Japan*

We have started to develop a laser-diode pumped cryogenically-cooled Yb:YAG laser system capable of generating 100-J pulse energy combined with a material processing system.

**SLPC4-3 16:00**

**Micromachining advances with hybrid fiber lasers**

Rajesh S Patel[1], James Bovatsek[1], Herman Chui[2]
*[1]Applications Engineering, Spectra-Physics, USA, [2]Product Marketing, Spectra-Physics, USA*

A new class of hybrid fiber lasers created by combining fiber and diode pumped solid state laser technologies can deliver both high machining quality and throughput

**SLPC4-4 16:15**

**Silicon carbide and gallium nitride wafer dicing technique**

Egidijus Vanagas, Dziugas Kimbaras, Aivaras Kazakevicius, Karolis Zilvinas Bazilevicius
*Evana Technologies, UAB, Lithuania*

Effective and rapid laser dicing technique for semiconductor devices formed on SiC and GaN substrates with a one pass process. The technique, where thermal stress is induced by delivering at least two ultra-short pulsed-beams.

**SLPC4-5 16:30**

**Layer accurate controlled laser ablation of CFRP using optical distance measurement**

Daniel Holder, Rudolf Weber, Thomas Graf
*Institut für Strahlwerkzeuge (IFSW), University of Stuttgart, Germany*

Optical distance measurement was used to enable controlled and layer accurate laser ablation of CFRP. The reconstructed surface topography by the distance measurement allowed the determination of the fiber direction with an accuracy less than ±5°.

**SLPC4-6 16:45**

**Heat acumulation controlled surface structuring of stainless steel**

Sebastian Faas[1], Corrado Sciancalepore[2], Rudolf Weber[1], Luca Romoli[3], Thomas Graf[1]
*[1]IFSW, University of Stuttgart, Germany, [2]National Interuniversity Consortium of Materials Science, INSTM-Research Unit of Parma, Italy, [3]Department of Engineering and Architecture, University of Parma, Italy*

Stainless steel 316L was structured using the mJ-ps-laser of the IFSW. Structuring rates of up to 500 mm²/s were achieved. A novel simple analytical model was used to calculate the deposited heat during processing.

## XOPT <Room 313+314>

**XOPT4-2 16:00**

**Metrology of Resistive Element Adjustable Length (REAL) cooling for sub-nanometer figure preservation in high heat load FEL optics**

Corey Hardin, May Ling Ng, Daniel Morton, Lance Lee, Lin Zhang, Daniele Cocco
*SLAC National Accelerator Laboratory, USA*

A technique developed at SLAC called REAL to correct thermal deformation in x-ray mirrors is presented. Metrology testing shows the capability to minimize thermal load errors of the system under simulated FEL power.

**XOPT4-3 16:15**

**Accuracy of Estimating the X-ray FEL Pulse Energy from Electron Beam Energy Loss Measurement**

Yiping Feng, Franz-Josef Decker
*SLAC National Accelerator Laboratory, USA*

Using electron beam energy loss and repetition rate measurements to estimate the instantaneous FEL power for implementing safety devices for high repetition rate X-Ray FEL's such as the LCLS-II.

**XOPT4-4 16:30**

**Diamond Channel-Cut Crystals as High-Heat-Load Beam-Multiplexing High-Resolution X-ray Monochromators**

Yuri Shvyd'Ko[1], Tomasz Kolodziej[1], Sergey Terentyev[2], Vladimir Blank[2]
*[1]APS, Argonne National Laboratory, USA, [2]Technological Institute for Superhard and Novel Carbon Materials, Russia*

We will present details on manufacturing and characterization of the diamond channel-cut crystals.

**XOPT4-5 16:45**

**Reflection self-seeding at SACLA**

Ichiro Inoue[1], Taito Osaka[1], Takahiro Inagaki[1], Shunji Goto[1,2], Toru Hara[1], Yuichi Inubushi[1,2], Ryota Kinjo[1], Haruhiko Ohashi[1,2], Takashi Tanaka[1], Kazuaki Togawa[1], Kensuke Tono[1,2], Hitoshi Tanaka[1], Makina Yabashi[1,2]
*[1]RIKEN SPring-8 Center, Japan, [2]Japan Synchrotron Radiation Research Institute, Japan*

This talk presents progresses on reflection self-seeding using micro-channel cut crystals at SACLA. Technical details and the first commissioning results will be described.

**[XOPT5] 17:00-17:15**
**Source**
Chair: Harald Sinn
*European XFEL, Germany*

**XOPT5-1 17:00**

**X-ray Source Technology for High Throughput in the Home-Laboratory and Tomography Applications**

Emil Espes, Ulf Lundström, Julius Hållstedt, Mikael Otendal, Per Takman, Tomi Tuohimaa
*Excillum AB, Sweden*

X-ray analysis rely heavily on the x-ray source brightness for resolution/exposure-time. Traditional x-ray tubes are limited by when the e-beam power-density melts the anode. The MetalJet overcomes this limitation by using a liquid anode.

----- Break/Move 17:15-19:00 -----

**[XOPT Banquet] 19:00-21:00**
The Japanese restaurant ("海宝", Kaihou)

# Oral, Wednesday, 25 April PM

## ALPS & HEDS & XOPT <Room 303>

**[Joint Session] 13:30-15:00**
**Joint Session ALPS+HEDS+XOPT**
Chair: Ryosuke Kodama
*Osaka University, Japan*
Hitoki Yoneda
*Institute for Laser Science, The University of Electro-Communications (UEC), Japan*
Makina Yabashi
*RIKEN SPring-8 Center, Japan*

**HEDSj-1 13:30** *Invited*

**Manipulating Electrons with Intense Laser Pulses**
Victor Malka[1,2]
*[1]Laboratoire d'Optique Appliquée, France, [2]Weizmann Institute of Science, Israel*
I'll then show how by controlling the quiver motion of relativistic electrons intense and bright X-rays beam are produced in a compact and elegant way. Finally I'll show some examples of applications.

**ALPSj-1 14:00** *Invited*

**Development and Commissioning of a 20 fs, 4 PW Laser**
Junghun Shin[1], Hyung Taek Kim[1,2], Seong Ku Lee[1,2], Jae Hee Sung[1,2], Hwang Woon Lee[1], Jin Woo Yoon[1,2], Cheonha Jeon[1], Chang Hee Nam[1,3]
*[1]Center for Relativistic Laser Science (CoReLS), Institute for Basic Science (IBS), Korea, [2]Advanced Photonics Research Institute, Gwangju Institute of Science and Technology (GIST), Korea, [3]Department of Physics and Photon Science, GIST, Korea*
A 20 fs, 4 PW Ti:Sapphire laser beamline is developed at CoReLS. Details of the new beamline, and commissioning experiments that include focal spot optimization, double plasma mirror, and laser wakefield electron acceleration is presented.

**XOPTj-1 14:30** *Invited*

**European XFEL – New Opportunities for X-ray Science**
Robert Krarup Feidenhans'l
*European XFEL, Germany*
The European X-ray Free Electron Laser is the brightest X-ray free electron in the world due to its superconducting accelerator that allows the delivery of up 27000 intense, ultrashort pulses per second.

## BISC & OMC <Room 418>

**[OMC&BISC1] 13:15-15:00**
**OMC and BISC Joint Session 1**
Chair: Takashige Omatsu
*Chiba University, Japan*

**Opening Remarks 13:15-13:30**
Takashige Omatsu
*Chiba University, Japan*

**OMC&BISC1-1 13:30** *Plenary*

**High Temporal and Spatial Pattern Stimulation to Manipulate Brain Function**
Hiroaki Wake[1], Koichiro Haruwaka[1], Xiangyu Quan[2], Osamu Matoba[2]
*[1]Kobe University of Graduate School of Medicine, Japan, [2]Kobe University, Japan*
In the central nervous system (CNS), glial cells, originally termed "nervenkitt," recently focused because of the understanding of their physiological functions. Here, we focused how glial cell regulates the function of neuronal circuits using in vivo two photon microscope.

**OMC&BISC1-2 14:00** *Plenary*

**Femtosecond Laser Trapping, Assembling, and Ejection Dynamics of Dielectric Nanoparticles in Solution**
Hiroshi Masuhara[1], J. Chen[1], W. Chiang[1,2], A. Usman[3], T. Sugiyama[1,4], J. Hofkens[2]
*[1]National Chiao Tung University, Taiwan, [2]Katholieke Universiteit Leuven, Belgium, [3]Universiti Brunei Darussalam, Brunei Darussalam, [4]Nara Institute of Science and Technology, Japan*
We study femtosecond laser trapping dynamics of Rayleigh particles by examining polystyrene, silica, and surfacemodified silica nanoparticles with different diameter and by changing solvent viscosity.

**OMC&BISC1-3 14:30** *Plenary*

**Monitoring Ruffling Cells by Lattice Light-sheet Microscopy**
Bi-Chang Chen, Wei-Chun Tang, Peilin Chen
*Academia Sinica, Taiwan*
The membrane ruffling can be triggered by rapamycin and/or blue light. After stimulation, the three- dimensional dynamics of membrane ruffling has been recorded by lattice light-sheet microscope (LLSM), which is capable of high spatial and temporal recording over three-dimensions.

## IoT-SNAP & LDC & LEDIA <Room 301>

**[IOT-LDC-LEDIA] 13:30-17:15**
**Joint Session (LEDIA, LDC, and IoT-SNAP)**
Chairs: Atsushi Kanno
*National Institute of Information and Communications Technology, Japan*
Sunao Kurimura
*Natinal Institute of Material Science, Japan*
Ryuji Katayama
*Osaka University, Japan*

**Opening Talk 13:30-13:45**
Hiroshi Murata
*Osaka University, Japan*
Kenichi Kitayama
*The Graduate School for the Creation of New Photonics Industries, Japan*
Ryuji Katayama
*Osaka University, Japan*

**IOT-LDC-LEDIA-1 13:45** *Invited*

**IoT Revolution and Business Opportunities in Emerging Market in ASEAN Region**
Huei Ee Yap
*LP-Research Inc., Japan*
The purpose of the ARcore platform is to provide a customer with a complete system integration to create his own high-performance AR product based on the ARcore.

**IOT-LDC-LEDIA-2 14:15** *Invited*

**Fiber-optic-based Life Cycle Monitoring of Aerospace Composite Structures: Toward Digitalization of Next Generation Aircraft**
Shu Minakuchi, Nobuo Takeda
*University of Tokyo, Japan*
This talk will overview our recent research activity of composite life cycle monitoring by embedded optical fiber sensors. The detailed information obtained from composite structures can be utilized to build the digital replicas and to predict their life-cycle performance.

## LIC & PLD & SLPC <Room 302>

**[Joint Session] 13:30-15:15**
**LIC+PLD+SLPC Joint Session 1**
Chairs: Kunihiko Washio
*Paradime Research, Japan*
Takahisa Jitsuno
*Osaka University, Japan*
Takunori Taira
*Inst. material Science, Japan*

**Opening Remarks 13:30-13:45**
Masahiro Tsukamoto
*Osaka Univ., Japan*
Takahisa Jitsuno
*Osaka Univ., Japan*
Takunori Taira
*Inst. material Science, Japan*

**SLPC5j-1 13:45** *Invited*

**Ab-initio large-scale simulation for initial stage of laser damage in transparent nano-materials**
Kazuhiro Yabana[1], Mitsuharu Uemoto[1], Shunsuke A. Sato[2], Yuta Hirokawa[3], Taisuke Boku[1]
*[1]Center for Computational Sciences, University of Tsukuba, Japan, [2]Max Planck Institute for the Structure and Dynamics of Matter, Germany, [3]Graduate School of Systems and Information Engineering, University of Tsukuba, Japan*
We calculate energy transfer from femtosecond laser pulse to 3D nano-materials solving Maxwell equations for light electromagnetic fields and ab-initio time-dependent Kohn-Sham equation for quantum electron dynamics simultaneously.

**SLPC5j-2 14:15** *Invited*

**High throughput surface texturing of embossing rollers with fs-laser and polygon line scanner in fully synchronized mode**
Beat Jaeggi[1,2], Adrian Stirnimann[1], Guido Hennig[3], Beat Neuenschwander[1]
*[1]Institute for Applied Laser, Photoncis and Surface technolpogies ALPS, Bern University of Applied Sciences, Switzerland, [2]LASEA Switzerland, Switzerland, [3]Daetwyler-Graephics AG, Switzerland*
The combination of a polygon line scanner with a rotating roller, fully synchronized to a new high power fs laser, allows laser micromachining with highest precision and high throughput. We will present actual results from the European APPOLO Project.

# Oral, Wednesday, 25 April PM

## ALPS <Room 511+512>

**[ALPS9-G1] 13:30-15:00**
**Diode Laser and Metamatrials**
Chair: Takuo Tanaka
*Metamaterials laboratory, RIKEN, Japan*

### ALPS9-G1-1 13:30

**High-power continuous-wave operation over100W of a single-chip InGaN Laser Diode**

Atsunori Mochida[1], Masao Kawaguchi[1], Shinichiro Nozaki[1], Hiroyuki Hagino[1], Koshi Nakamura[1], Shinichi Takigawa[1], Kouji Oomori[2], Takayuki Yoshida[2], TakumaKatayama[1], Tsuyoshi Tanaka[1]
*[1]Sensing Solution Development Center, Engineering Division, Automotive & Industrial Systems Company, Panasonic Corporation, Japan, [2]Technology Development Department, Corporate Technology Division, Panasonic Smart Factory Solutions Co., Ltd., Japan*

High-power operation over 100W is presented in InGaN laser diodes (LDs). Linear junction-temperature-dependence approximation of wall-plug-efficiency clarifies the relation between thermal saturation and LDs parameters, which enables device design for 100W operation.

### ALPS9-G1-2 13:45

**High power Si light emission device using dressed photons**

Tadashi Kawazoe[1], Motoichi Ohtsu[2]
*[1]Institute of Advanced Laser Technology, Tokyo Denki University, Japan, [2]The University of Tokyo, Japan*

We fabricated Silicon-electro-luminescence devices e.g., a Si-LED and a Si laser. Their optical output powers of them were more than 1 W (Si-LED) and 10 W (Si-LD).

### ALPS9-G1-3 14:00 *Invited*

**Seeing is Believing!? A super plasmonic probe and a Harry Potter's invisible cloak**

Tsung-Yu Huang[1], Ruei-Han Jiang[1,2,3], Chi Chen[1], Ding-Zheng Lin[3], Jian-Hui Lin[1], Tung Lee[1], He-Chun Chou[3], Jen-You Chu[2], Ta-Jen Yen[1,2]
*[1]Department of Materials Science and Engineering, National Tsing Hua University, Taiwan, [2]Department of Materials and Chemical Research Laboratory, Industrial technology and research institute, Taiwan, [3]Research Center for Applied Sciences, Academia Sinica Taiwan*

### ALPS9-G1-4 14:30

**Controlling the phase transition of vanadium oxide using plasmonic metamaterials**

James Frame[1], Nicolas Green[1], Wakana Kubo[2,3], Xu Fang[1]
*[1]Department of Electronics and Computer Science, University of Southampton, UK, [2]Department of Electrical and Electronic Engineering, Tokyo University of Agriculture and Technology, Japan, [3]Metamaterials Laboratory, RIKEN, Japan*

Thermo-plasmonic engineering at the nanoscale can control macroscopic material properties. We demonstrate utilising plasmonic metamaterials to tune the effective phase transition temperature and electrical conductivity of vanadium oxide thin films.

## ICNN <Room 414+415>

**[WELCOME ADDRESS] 13:30-13:45**
Yasuhiko Arakawa
*The University of Tokyo, Japan*

**[ICNN1] 13:45-15:00**
**Nano Devices**
Chair: J.J. Finley
*Technical University of Munich, Germany*

### ICNN1-1 13:45 *Invited*

**Application of Photonic Trumpets to Hybrid Optomechanics and Quantum Sensing**

Jean-Michel Gerard
*CEA/ INAC Grenoble, France*

Free standing GaAs wires are both photonic wires and mechanical resonators. I will review appealing novel opportunities generated by the giant optomechanical coupling between exciton states and vibrations for QDs embedded in a photonic trumpet.

### ICNN1-2 14:15

**Transfer-printed Quantum-dot Single Photon Sources for Efficient Waveguide Coupling**

Ryota Katsumi[1], Yasutomo Ota[2], Masahiro Kakuda[2], Satoshi Iwamoto[1,2], Yasuhiko Arakawa[1,2]
*[1]IIS, Japan, [2]NanoQuine, Japan*

We designed single photon source structure supporting near-unity waveguide coupling, which is robust against position misalignments accompanied by transfer-printing-based integration approach. Experimentally, we observed single photon generation from a transfer-printed quantum-dot single photon sources.

### ICNN1-3 14:30

**Engineering the Photoresponse of InAs Nanowires**

Jack Alexander-Webber
*Department of Engineering, University of Cambridge, UK*

We exploit the sensitivity of InAs nanowires to surface states, through controlled growth conditions and surface passivation treatments, to develop optoelectronic devices with a highly tunable photoresponse.

## LSC <Room 213>

**[Opening Address] 13:30-13:45**
Nobuhiko Sarukura
*Osaka University, Japan*

**[LSC1] 13:45-15:15**
**Free Electron Laser 1**
Chair: Nobuhiko Sarukura
*Osaka University, Japan*

### LSC1-1 13:45 *Invited*

**Current Status of the SPB/SFX Instrument at the European Xfel**

Tokushi Sato[1,2], R. Letrun[1], R. Bean[1], K. Giewekemeyer[1], M. Messerschmidt[1,3], G. Mills[1], H. Kirkwood[1], Y. Kim[1], A. Round[1], M. Sikorski[1], S. Stern[1,2], P. Vagovic[1,2], B. Weinhausen[1], L. L. Morillo[1], S. Takem. C. M.1,[1], A. Legrand[1], B. Manning[1], N. Reimers[1], P. Thute[1], T.Dietze[1], A. Stawniczy[1], Z. Ansari[1], H. N. Chapman[2], A. P. Mancuso[1]
*[1]European XFEL GmbH, Germany, [2]Center for Free-Electron Laser Science (CFEL), DESY, Germany, [3]BioXFEL Science and Technology Center, USA*

Intense, ultrashort, and high repetition rate X-ray pulses in the European XFEL allows one to conduct an optical/X-ray pump-probe experiments. We will report the current status of the SPB/SFX instrument.

### LSC1-2 14:15 *Invited*

**Ultrafast Studies of Photoreaction Dynamics in Artificial Photosynthesis Systems by Laser Pump X-Ray Probe Experiments**

Shunsuke Nozawa[1,2], K. Ichiyanagi[1], R. Fukaya[1], T. Sato[3,4], S. Adachi[1,2]
*[1]Institute of Materials Structure Science, High Energy Accelerator Research Organization, Japan, [2]Department of Materials Structure Science, School of High Energy Accelerator Science, The Graduate University for Advanced Studies, Japan, [3]European XFEL GmbH, Germany, [4]Center for Free-Electron Laser Science, Deutsches Elektronen-Synchrotron, Germany*

To obtain the entire pictures of the photoreaction related to the artificial photosynthesis systems, laser pump x-ray probe XAFS experiments were performed using the XFEL beam and the synchrotron x-ray beam.

## LSSE <Room 316>

**[LSSE3] 13:30-16:30**
**Social Infrastructure**
Chair: Yoshinori Shimada
*Institute for Laser Technology, Japan*

### LSSE3-1 13:30 *Invited*

**Demonstration of High-speed Defect Inspection Technique for Simulated Tunnnel using Laser Hammering Methode**

Masaharu Nishikino[1], Noboru Hasegawa[1], Toshiyuki Kitamura[1], Hajime Okada[1], Shuji Kondo[1], Katsuhiro Mikami[1], Shinri Kurahashi[2], Yoshinori Shimada[2], Tetsuya Kawachi[1]
*[1]National Institutes for Quantum and Radiological Science and Technology, Japan, [2]Institute for Laser Technology, Japan*

The mock-up defect in a large concrete specimen and the defect on a simulated tunnel were measured using the prototype high-speed laser inspection system on the mobile vehicle.

### LSSE3-2 14:00 *Invited*

**Imaging diagnostics of plate-like structures by remote measurement of elastic waves with lasers**

Takahiro Hayashi, Atsuya Maeda, Shogo Nakao
*Kyoto University, Japan*

This paper discusses imaging technique for plate-like structures using flexural vibration generated and detected by lasers. As this technique uses diffuse field, images of defects and adhesive bonds were obtained even in complex structures.

### LSSE3-3 14:30 *Invited*

**Laser Peening Study with Large Scale High Power Laser**

Keisuke Shigemori[1], Yoichiro Hironaka[1], Eisuke Miura[2], Ryunosuke Kuroda[2], Kohei Miyanishi[1], Takeshi Matsuoka[3], Norimasa Ozaki[3], Ryosuke Kodama[3], Takeshi Kurita[4], Norio Kurita[4]
*[1]ILE, Osaka University, Japan, [2]AIST, Japan, [3]Osaka University, Japan, [4]Hamamatsu Photonics, K. K., Japan*

We present recent results on laser peening study on large scale laser facility GEKKO-XII laser system at ILE, Osaka University.

# Oral, Wednesday, 25 April PM

## ALPS <Room 303>

----- Break 15:00-15:30 -----

**[ALPS10-D1] 15:30-17:15**
**Semiconductor Lasers and Ultrafast Fiber Lasers**
Chair: Shun-ich Matsushita
*Laboratories for Fusion Core Technologies, Furukawa Electric Co. Ltd., Japan*

**ALPS10-D1-1 15:30** *Invited*

**Effects of back-irradiance on the reliability of GaAs high power diode pump lasers**
Paul Orville Leisher[1], Susant K. Patra[1], Matthew C. Boisselle[1], Sezer Sezgin[1], Robert J. Deri[1], Chen Li[2], Aman K. Jha[2], Kevin P. Pipe[2], Jason D. Helmrich[3], Devin E. Crawford[3], Prabhu Thiagarajan[3]
*[1]Lawrence Livermore National Laboratory, USA, [2]University of Michigan, USA, [3]Lasertel Incorporated, USA*
The effects of back-irradiance on the reliability of 800-nm diode lasers is investigated. The root-cause of failure is shown to be thermal. Device reliability can be predicted using an Arrhenius model for thermal acceleration.

**ALPS10-D1-2 16:00**

**Demonstration of an asymmetric beam in an on-chip 2D-pattern-projecting lasers**
Takahiro Sugiyama, Kazuyoshi Hirose, Yu Takiguchi, Yoshiro Nomoto, So Uenoyama, Yoshitaka Kurosaka
*Central Research Laboratory, Hamamatsu Photonics K.K., Japan*
We successfully demonstrated an asymmetric beam pattern in integrable phase-modulating surface-emitting lasers that showed static, arbitrary, two-dimensional beam pattern from on-chip size whereas symmetric beam pattern in the conventional way.

**ALPS10-D1-3 16:15**

**More than 350kW Peak Power Pulse Generation of sub-100ps pulse width by using a Very Large Mode Area Er-Doped Fiber Amplifier.**
Ryo Kawahara[1], Hiroshi Hashimoto[1], Jeffrey W. Nicholson[2], Jun Nishina[1], Eisuke Otani[1], Shun-ichi Matsushita[1]
*[1]Laboratories for Fusion Core Technologies, Furukawa Electric Co. Ltd., Japan, [2]OFS laboratories, USA*
We demonstrated more than 350kW peak power pulsed generation of 82.7ps pulse width at 100 kHz by using a very large mode ar a Er-doped fiber amplifier (VLMA-EDFA).

## HEDS <Room 311+312>

----- Break 15:00-15:30 -----

**[HEDS9] 15:30-17:00**
**Wed-P2**
Chair: Alexei Zhidkov
*Osaka University, Japan*

**HEDS9-1 15:30**

**SourceLAB : laser plasma supplier for physics and applications**
François Sylla
*Source Lab., France*
TBD

**HEDS9-2 15:50** *Invited*

**TBD**
Rodrigo Lopez-Martens
*Laboratoire d'Optique Appliquée, France*
TBD

**HEDS9-3 16:20**

**Tracking Strain Field Evolution in Graphite Shaken by Femtosecond Laser Pulses**
Wenxi Liang
*Wuhan National Laboratory for Optoelectronics, Huazhong University of Science and Technology, China*
TBD

## XOPT <Room 313+314>

----- Break 15:00-15:30 -----

**[XOPT6] 15:30-16:30**
**Imaging II**
Chair: Hidekazu Mimura
*The University of Tokyo, Japan*

**XOPT6-1 15:30** *Invited*

**Ptychographic X-ray computed tomography - An outlook for diffraction-limited sources**
Manuel Guizar-Sicairos, Esther H. R. Tsai, Michal Odstrcil
*Swiss Light Source, Switzerland*
Ptychographic nanotomography offers 3D imaging with resolution below 20-nm without imaging lenses. Here we present some of the strategies we follow in order to profit from the increased in brightness from multi-bend achromat synchrotron sources.

**XOPT6-2 16:00** *Invited*

**X-ray nano-imaging and nano-analysis using multilayer coated Kirkpatrick-Baez optics**
Peter Cloetens[1], Julio Cesar da Silva[1], Alexandra Pacureanu[1], Yang Yang[1], Sylvain Bohic[1,2], Murielle Salome[1], Lionel Andre[1], Raymond Barrett[1], Christian Morawe[1], Peter van der Linden[1], Francois Villar[1]
*[1]European Synchrotron Radiation Facility, France, [2]University of Grenoble Alpes, France*
We describe an instrument for the quantitative three dimensional characterization of specimens at the nanoscale. Multilayer coated Kirkpatrick-Baez mirrors provide an intense nanofocus for correlative microscopy exploiting X-ray fluorescence, holographic and ptychographic tomography.

NOTE

# Oral, Wednesday, 25 April PM



## BISC & OMC <Room 418>

----- Break 15:00-15:30 -----

**[OMC&BISC2] 15:30-16:45**
**OMC and BISC Joint Session 2**
Chair: Osamu Matoba
*Kobe University, Japan*

**OMC&BISC2-1 15:30** ***Invited***

**Computational Imaging and Reconstruction in Digital Holographic Microscopy**

Edmund Y.M. Lam
*University of Hong Kong, Hong Kong*

Digital holographic microscopy captures the 3D information of biological specimens as holograms, which can then be reconstructed into sectional images computationally. In this talk, we will discuss recent advances in such algorithms and applications.

**OMC&BISC2-2 15:45**

**Observation of Immunostained Microtubules Using Three-Dimensional Superresolution Microscope with Two-Color Annular Wave Plate**

Yoshinori Iketaki[1], B. Nandor[2], D. Okada[3], H. Kumagai[4]
*[1]Olympus Corp, Japan, [2]Budapest University of Technology and Economics, Hungary, [3]Kitasato University, School of Medicine, Japan, [4]Kitasato University, School of Allied Health Sciences Physics, Japan*

Three-dimensional super-resolution microscopy based on fluorescence depletion (3D-SRM) was applied to the observation of immunostained microtubules having complicated structures stacking each other.

**OMC&BISC2-3 16:00**

**Optical Trapping of Quantum-Dot Conjugated AMPA-type Receptors Depened on Initial Assembling States**

Tatsunori Kishimoto[1,2], Y. Maezawa[1], S. N. Kudoh[2], T. Taguchi[3], C. Hosokawa[1,2,4]
*[1]National Institute of Advanced Industrial Science and Technology (AIST), Japan, [2]Kwansei Gakuin University, Japan, [3]National Institute of Information and Communications Technology (NICT), Japan, [4]Advanced Photonics and Biosensing Open Innovation Laboratory, AIST-Osaka University, Japan*

AMPA-type glutamate receptor (AMPAR) is one of the major neurotransmitter receptors at excitatory synapses.

## IoT-SNAP & LDC & LEDIA <Room 301>

----- Break 14:45-15:15 -----

**IOT-LDC-LEDIA-3 15:15** ***Invited***

**Laser Diode Based Underwater Optical Wireless Communication**

Takao Sawa[1], Koji Tojo[2], Naoki Nishimura[2], Shin Ito[3]
*[1]JAMSTEC, Japan, [2]Shimadzu Corp., Japan, [3]SAS Co., Ltd., Japan*

We developed an underwater optical wireless communication modem using high power laser diode. 20 Mbps communication speed at 120 m distance, and 32 kbps at 190 m distance were established through underwater tests.

**IOT-LDC-LEDIA-4 15:45** ***Invited***

**Recent Progress of Retinal Imaging Laser Technology**

Mitsuru Sugawara, Makoto Suzuki, Manabu Ishimoto, Kinya Hasegawa
*QD Laser, Japan*

This paper describes recent progress of retinal imaging laser technology
from its principle, focus-free imaging, resolution, laser safety,
medical welfare applications to accessibility development for the smart
glass in the IoT era.

## LIC & PLD & SLPC <Room 302>

**PLDj-1 14:45** ***Invited***

**Mechanisims of laser damage in optical components for PW-class laser systems**

Stavros G Demos, Alexei A Kozlov, Kyle Kafka, James B Oliver, Semyon Papernov, Brittany Hoffman, Terrance J Kessler, Sheryl M Gracewski, John C Lambropoulos
*University of Rochester, USA*

We investigate the mechanisms of laser-induced damage and ensuing material modifications on multilayer dielectric mirrors and gratings. Thermomechanical modeling combined with analysis of damage morphologies provides insight into the energy deposition and relaxation pathways.

----- Break 15:15-15:45 -----

**[Joint Session] 15:45-17:20**
**LIC+PLD+SLPC Joint Session 2**
Chair: Takahisa Jitsuno
*Osaka University, Japan*

**PLDj-2 15:45** ***Invited***

**UV-induced aging leading to laser damage in the bulk of fused silica**

Frank R Wagner, Alexandre Beaudier, Jean-Yves Natoli
*Aix Marseille Univ, CNRS, Centrale Marseille, Institut Fresnel, France*

Results on material modifications observed by photoluminescence in the bulk of fused silica during UV S-on-1 tests show modifications in the color center concentrations before the occurrence of damage and help predicting fatigue damage.

# Oral, Wednesday, 25 April PM

## ALPS <Room 511+512>

**ALPS9-G1-5 14:45**

**Photothermal Electric Effect Triggered by Local Heat under Localized Surface Plasmons**

Masaki Kondo, Wakana Kubo
*Tokyo University of Agriculture and Technology (TUAT), Japan*

Photothermal electric effect via plasmonic local heating was observed on the PEDOT:PSS thin film embedding silver nanorod arrays.

----- Break 15:00-15:30 -----

**[ALPS11-G2] 15:30-17:00**
**Nano Structure and Applications**
Chair: Takasumi Tanabe
*Department of Electronics and Electrical Engineering, Faculty of Science and Technology, Keio University, Japan*

**ALPS11-G2-1 15:30**

**UV-laser irradiation of ZnO seed layer for the growth of well-aligned ZnO nanorods**

Qiyan Zhang, Mitsuhiro Honda, Shinji Takayanagi, Yo Ichikawa
*Graduate school of Engineering, Nagoya Institute of Technology, Japan*

We found that UV laser irradiation onto the ZnO seed layer induces crystal orientation of the surface, leads to the growth of densely aligned ZnO nanorods on such laser irradiated layer.

**ALPS11-G2-2 15:45**

**Magneto - optical Kerr effect enhancement by localized plasmon resonance in Au / Co / Au nanostructure**

Yusuke Kikuchi[1,2], Takuo Tanaka[1,2]
*[1]Metamaterials laboratory, RIKEN, Japan, [2]School of Materials and Chemical Technology, Tokyo Institute of Technology, Japan*

We measured the magneto - optical Kerr effect in Au / Co / Au nanometer sized plasmonic structure. Our results indicate that localized plasmon resonance enhances the Kerr rotation on Au / Co / Au.

**ALPS11-G2-3 16:00**

**Metal fine periodic structures on polyimide film fabricated by femtosecond laser writing**

Seiya Toriyama[1], Vygantas Mizeikis[2], Atsushi Ono[2]
*[1]Graduate school of Science and Technology, Shizuoka University, Japan, [2]Research institute of electronics, Shizuoka University, Japan*

We present a new fabrication technique of metal nano-structure on directly polyimide film by employing two-photon induced reduction with femtosecond laser.

## ICNN <Room 414+415>

**ICNN1-4 14:45**

**GeSn/Ge Dual-Nanowire Grown by Molecular Beam Epitaxy for Light Source on Si**

Yuxin Song
*Shanghai Institute of Microsys, China*

GeSn/Ge dual nanowire is demonstrated by MBE. The strain field analyzed by Raman and FEM shows that the compressive strain in GeSn is effectively relaxed, beneficial for direct bandgap conversion, potential for Si-based light source.

----- Break 15:00-15:30 -----

**[ICNN2] 15:30-17:00**
**Quantum Dots and Nanowires**
Chair: J. P. Reithmaier
*University of Kassel, Germany*

**ICNN2-1 15:30** *Invited*

**Semiconductor Quantum Dots and 2D Materials for Nanophotonics**

C. Schneider[1], C. P. Dietrich[1], S. Klembt[1], L. Dusanowski[1], M. Dusanowski[1], S. Höfling[1,2]
*[1]University of Würzburg, Würzburg, Germany, [2]University of St Andrews, St Andrews, UK*

see abstract book

**ICNN2-2 16:00**

**Evaluation of Inter-Sublevel Transition of InAs/GaAs Quantum Dot Structures on On-Axis Si (100) Substrate by Photocurrent Measurement**

Hirofumi Yoshikawa[1,2,3], Jinkwan Kwoen[1], Takahiro Doe[1,3], Makoto Izumi[3], Satoshi Iwamoto[1,2], Yasuhiko Arakawa[1,2]
*[1]Institute for Nano Quantum Information Electronics, University of Tokyo, Japan, [2]Institute of Industrial Science, University of Tokyo, Japan, [3]Corporate Research and Development BU, SHARP Corporation, Japan*

We report the evaluation of inter-sublevel transition of InAs/GaAs quantum dot structures directly grown on on-axis Si (100) substrate by photocurrent measurement.

## LSC <Room 213>

**LSC1-3 14:45** *Invited*

**Resonant Magneto-Optical Kerr Effect with Soft X-Ray Synchrotron Radiation and Free Electron Laser**

Yuya Kubota
*Japan Synchrotron Radiation Research Institute (JASRI), Japan*

Resonant magneto-optical Kerr effects with EUV and soft x-rays could become powerful methods to study magnetism. I will report our recent studies using polarization-modulated soft x-rays at SPring-8, and ultrafast EUV-FEL at FERMI and SACLA.

----- Break 15:15-15:30 -----

**[LSC2] 15:30-16:30**
**Free Electron Laser 2**
Chair: Shinya Koshihara
*School of Science, Tokyo Institute of Technology, Japan*

**LSC2-1 15:30** *Invited*

**Tracing the Laser Induced Ultrafast Destruction of Giant Xe Clusters by Time Resolved X-Ray Diffraction Measurements**

Kiyonobu Nagaya
*Department of Physics, Graduate School of Science, Kyoto University, Japan*

We have carried out time-resolved x-ray diffraction measurements of clusters at SACLA. We confirmed ultrafast laser induced destruction of xenon nano-crystals in femtosecond time scale.

**LSC2-2 16:00** *Invited*

**Ultrafast Lattice Dynamics of Transition-metal Dichalcogenides**

Kyoko Ishizaka[1,2]
*[1]Quantum-Phase Electronics Center (QPEC) & Department of Applied Physics, University of Tokyo, Japan, [2]RIKEN Center for Emergent Matter Science (CEMS), Japan*

The ultrafast lattice dynamics of transition-metal dichalcogenides have been investigated by utilizing the ultrafast electron diffraction (UED) and XFEL (SACLA). The development of UED with recent results will be mainly presented.

## LSSE <Room 316>

----- Break 15:00-15:30 -----

**LSSE3-4 15:30** *Invited*

**High speed and high resolution laser measurement for infrastructure**

Takeharu Murakami, Norihito Saito, Yuichi Komachi, Takashi Michikawa, Michio Sakashita, Shigeru Kogure, Kiwamu Kase, Satoshi Wada, Katsumi Midorikawa
*RIKEN, Japan*

We developed a high resolution LIDAR to detect cracks with 200 μm width on a concrete placed 5 m away. We also try to develop the high resolution measurement on running vehicles.

**LSSE3-5 16:00** *Invited*

**Non-destructive inspection with compact neutron source**

Yoshie Otake
*RIKEN, Japan*

Nondestructive inspection methods to detect void and water in concrete using backscattered neutron and to estimate salt concentration in concrete with prompt-gamma neutron analysis has been developed based on accelerator-driven compact neutron system, RANS.

**LSSE5-1 16:30** *Invited*

**Thermochemical Hydrogen Production Using a Concentrating Solar System**

Tatsuya Kodama
*Niigata University, Japan*

The concentrated solar high-temperature heat has the potential to produce hydrogen via multi-step water splitting cycles. The lecture introduces our novel beam-down solar concentrating system for our new particle fluidized water splitting reactor.

## Oral, Wednesday, 25 April PM

### ALPS <Room 303>

**ALPS10-D1-4 16:30**

**Robust Yb:fiber laser architecture for high repetition rate femtosecond pulse generation**

Guanyu Liu, Aimin Wang, Zhigang Zhang
*State Key Laboratory of Advanced Optical Communication System and Networks, School of Electronics Engineering and Computer Science, Peking University, China*

We demonstrate a 700MHz repetition rate, 181fs self-starting Yb:fiber laser incorporated with a phase biased nonlinear amplifying loop mirror. Although the fiber is non-polarization maintaining, the mode locking is environmentally stable.

**ALPS10-D1-5 16:45**

**Spectral-Temporal Dynamics of Soliton Explosion in Passively Mode-Locked Yb Fiber Laser**

Masayuki Suzuki, Hiroto Kuroda
*Faculty of Medicine, Aichi Medical University, Japan*

We report on a spectral-temporal dynamics of soliton explosion at a different position of cavity in a passively mode-locked Yb fiber laser with a nonlinear polarization of evolution by using a time-stretched dispersive Fourier transformation.

### HEDS <Room 311+312>

**HEDS9-4 16:40**

**TBD**

Franck Falcoz
*Amplitude Technology, France*

TBD

### XOPT <Room 313+314>

**[XOPT7] 16:30-17:15**
**Optics III (reflective)**
Chair: Hidekazu Mimura
*The University of Tokyo, Japan*

**XOPT7-1 16:30**

**Compact and large-magnification full-field X-ray microscope using concave-convex imaging mirrors**

Jumpei Yamada[1], Satoshi Matsuyama[1], Yasuhisa Sano[1], Yoshiki Kohmura[2], Makina Yabashi[2], Tetsuya Ishikawa[2], Kazuto Yamauchi[1]
*[1]Osaka University, Japan, [2]RIKEN SPring-8 Center, Japan*

A novel X-ray imaging optics consisting of concave and convex mirrors were developed for a compact and large-magnification full-field X-ray microscope. Results of mirror fabrication and imaging test will be reported.

**XOPT7-2 16:45**

**Design of 160-mm and 300-mm Long Elliptically Bent Hard X-ray Mirrors with Precision Compact Laminar Flexure Bending Mechanism**

Deming Shu[1], Aiguo Li[2], Steven P. Kearney[1], Chengwen Mao[2], Jayson Anton[1,3], Ross Harder[1], X. Shi[1], Tim Mooney[1], Lahsen Assoufid[1]
*[1]APS, Argonne National Laboratory, USA, [2]SSRF, Shanghai Institute of Applied Physics, China, [3]University of Illinois at Chicago, USA*

Mechanical design as well as finite element analyses results of the precision compact mirror benders for 160-mm-long and 300-mm-long hard x-ray mirrors with trapezoid and rectangular shapes are presented in this paper.

**XOPT7-3 17:00**

**The commission of Montel Optics at Taiwan Photon Source**

Gung-Chian Yin, Bo-Yi Chen, Chien-Yu Lee, Xiao-Yun Li, Bi-Hsuan Lin, Shao-Chin Tseng, Shih-Hung Chang, Mau-Tsu Tang
*National Synchrotron Radiation Research Center, Taiwan*

With whole new design approaches, the focus spot of Montel optics is recently improved to 50 nm. The Montel optics is designed as V-shaped and the state-of-the-art polishing method (EEM) is applied to the mirror.

----- Break/Move 17:15-18:00 -----

Conference Reception
Wednesday, 25 April 18:00-20:00
InterContinental Ballroom, 3rd floor InterContinental Yokohama Grand
Sponsored by Japan Laser Corporation, SPIE

NOTE

## Oral, Wednesday, 25 April PM

### BISC & OMC <Room 418>

**OMC&BISC2-4 16:15**

**Enhanced Collection Efficiency of Vesicles in A Suspension by Optical Pressure Using Gold Nanoparticles**

Takashi Kaneta, M. Kuboi, N. Takeyasu
*Okayama University, Japan*

We describe a collection of micro-vesicles on a glass substrate using the optical pressure of a laser beam. The laser beam was focused on the glass substrate which sandwiches a suspension containing micrometer-sized vesicles prepared by a phospholipid.

**OMC&BISC2-5 16:30**

**Rotational Dynamics of Bacteria in An Optical Tweezer**

Sharath Ananthamurthy
*University of Hyderabad, India*

The swimming of bacterium in fluid occurs in low-Reynold's regime. The trapping of a bacterium using laser light gives us information about the hydrodynamic coefficients which are very important in understanding the efficiency of swimming of bacterium.

### IoT-SNAP & LDC & LEDIA <Room 301>

**IOT-LDC-LEDIA-5 16:15** ***Invited***

**III-nitride Semiconductor Light Emitting Transistors**

Kazuhide Kumakura, Junichi Nishinaka, Hideki Yamamoto
*NTT Basic Research Laboratories, NTT Corporation, Japan*

Light-emitting transistors, which are based on heterojunction bipolar transistors, can output both electric and optical signals with high-frequency modulation. We discuss their potential for optical communication and optoelectronic device applications.

**IOT-LDC-LEDIA-6 16:45** ***Invited***

**High Photosensitivity HFET-type Nitride Based Photosensors**

Motoaki Iwaya[1], Tetsuya Takeuchi[1], Satoshi Kamiyama[1], Isamu Akasaki[1,2]
*[1]Meijo University, Japan, [2]Nagoya University, Japan*

In this presentation, we introduce a GaN-based heterostructure field effect transistor type photosensor featuring high photosensitivity and rejection ratio. These photosensors have many applications such as flame sensor, visible light communication etc.

### LIC & PLD & SLPC <Room 302>

**LICj-1 16:15** ***Invited***

**Ultrafast laser direct writing of periodic nanostructure in bulk semiconductor crystals**

Yasuhiko Shimotsuma
*Department of Material Chemistry, Graduate School of Engineering, Kyoto University, Japan*

Self-assembled periodic nanostructures in bulk semiconductor crystals are photoinduced by ultrafast laser pulses. The formation mechanism of these nanostructures in bulk semiconductor crystal could be influenced by the transition type and the bandgap energy. Particularly, the electronic stress induced by the deformation potential of electronic states is considered to be one of important key for nanostructure formation.

**LICj-2 16:45** ***Invited***

**One-shot 3D giant-pulse micro-laser processing by LCOS direct control**

Yasuki Sakurai[1,2], Yuji Hotta[1], Ryohei Otowa[1], Masashi Nishitateno[1], Lihe Zheng[2], Hiroshi Yamamoto[2], Takunori Taira[2]
*[1]Santec corporation, Japan, [2]Institute of molecular science, Japan*

We propose the one-shot 3D material processing with spatially modulated giant-pulse micro-laser output by LCOS direct control. The fine structured organic semiconductor film has been fabricated by MW-class 532nm beam exposer.

**Closing of Joint Session**
**17:15-17:20**

Conference Reception
Wednesday, 25 April 18:00-20:00
InterContinental Ballroom, 3rd floor InterContinental Yokohama Grand
Sponsored by Japan Laser Corporation, SPIE

## Oral, Wednesday, 25 April PM

### ALPS <Room 511+512>

**ALPS11-G2-4 16:15**

**THz Antireflective Structures Fabricated by Femtosecond Laser Processing**

Xi Yu, Mahiro Takeuchi, Shingo Ono, Jongsuck Bae
*Nagoya Institute of Technology, Japan*

Antireflective Structures on Si substrates are fabricated by femtosecond laser processing. The structure is constituted by periodic grooves at micro order. Their antireflective characteristics are evaluated by THz-TDS (terahertz time-domain spectroscopy).

**ALPS11-G2-5 16:30**

**Significant suppression of cross talk and enhancement of angular response in color image sensors using a wave-guided color filter array**

Kuo-Feng Lin, Chin-Chuan Hsieh
*VisEra Technologies Company, Taiwan*

The sensitivity and signal-to-noise ratio are significantly improved in use of a wave-guided color filter array design as compared with the entombed color filter array with a micro lens array.

### ICNN <Room 414+415>

**ICNN2-3 16:15**

**Far Infrared Intersubband Photodetectors Based on Quantum Disc in Nanowire Arrays with Photoresponse to Normal Incidence Radiation**

Mohammad Karimi[1,2]
[1]*Solid State Physics and NanoLund, Lund University, Sweden,* [2]*Halmstad University, Sweden*

Abstract attached

**ICNN2-4 16:30**

**One-Dimensional Electronic States in Closely Stacked InAs/GaAs Quantum Dots with Different Growth Temperatures**

Toshiyuki Kaizu, Kazuki Hirao, Takashi Kita
*Kobe University, Japan*

We achieved the emission wavelength tuning of the closely stacked InAs/GaAs quantum dots by varying the growth temperature and demonstrated their one-dimensional miniband formation from the polarization anisotropy and PL decay lifetime obeying T0.5 dependence.

**ICNN2-5 16:45**

**Strain Analysis of InPBi Quantum Dots**

Liyao Zhang
*University of Shanghai for Science and Technology, China*

InPBi thin film crystal was first realized in 2013. The photoluminescence of InPBi is strong and broad at room temperature. The strain effects on the optical properties of InPBi QDs are discussed through FEM simulation.

### LSC <Room 213>

**[LSC3] 16:30-17:30**
**Charge Lattice Spin 1**
Chair: Shunsuke Nozawa
*Institute of Materials Structure Science, High Energy Accelerator Research Organization, Japan*

**LSC3-1 16:30** ***Invited***

**Time-Resolved X-Ray Diffraction Study of Perovskite Cobalt Oxides for Detecting Transient Spin-Orbital-Lattice Interaction**

Ryo Fukaya[1], Y. Yamasaki[2], H. Nakao[1], S. Nozawa[1], J. Adachi[1], K. Ichiyanagi[1], K. Fukumoto[1], S. Adachi[1]
[1]*Institute of Materials Structure Science, High Energy Accelerator Research Organization, Japan,* [2]*National Institute for Materials Science, Japan*

Time-resolved X-ray diffraction is a useful method for direct observation of photoinduced phase transition process. We repot photoinduced dynamics of transient spin-orbital-lattice interaction in perovskite cobalt oxides by time-resolved hard-X-ray and resonant soft-X-ray diffraction.

**LSC3-2 17:00** ***Invited***

**Photo-control of Charge-Structure-Spin Coupled Order in Strongly Correlated Quantum Matters: Role of Ultrafast Structural Dynamics**

Shinya Koshihara[1], Y. Okimoto[1], T.Ishikawa[1], M.Hada[2], Y.Hayashi[2], K.Onda[3]
[1]*School of Science, Tokyo Institute of Technology, Japan,* [2]*Graduate School of Natural Science and Technology, Okayama University, Japan,* [3]*Faculty of Science, Kyushu University, Japan*

We demonstrate that hidden state plays a key role in the ultrafast photo-responses of organic and inorganic systems with strong electron-lattice cooperative interactions.

Conference Reception
Wednesday, 25 April 18:00-20:00
InterContinental Ballroom, 3rd floor InterContinental Yokohama Grand
Sponsored by Japan Laser Corporation, SPIE

# Oral, Thursday, 26 April AM

## ALPS <Room 303>

**[ALPS12-C1] 9:00-10:45**
**Ultra-High Intensity Lasers and Technology**
Chair: Toshiyuki Kawashima
*Hamamatsu Photonics K.K., Japan*

**ALPS12-C1-1 9:00** *Invited*

**PW-class multi Hz laser generating ultra-high contrast pulses and interaction with aligned nanostructures**

Jorge J. Rocca[1], Yong Wang[1], Shoujun Wang[1], Alex Rockwood[1], Bradley M. Luther[1], Reed Hollinger[1], Alden Curtis[1], Chase Calvi[1,2], M.G. Capeluto[2], V.N. Shlyaptsev[1], A. Pukhov[3], V. Kaymak[3], C. S. Menoni[1]
*[1]Electrical and Computer Engineering Department, Department of Physics ,Colorado State University, USA, [2]FCEyN,University of Buenos Aires, Argentina, [3]Heinrich-Heine – Universität Düsseldorf, Germany*

We have demonstrated 0.85PW, 30fs laser pulses at 3.3Hz repetition rate from a Ti:Sapphire laser and we have focused ultra-high contrast second harmonic pulses to an intensity of $6.5x10^{21}W/cm^2$ to study relativistic interactions with nanostructures.

**ALPS12-C1-2 9:30**

**New Architectures for PW-Scale High Peak Power Lasers Scalable to Near-MW Average Powers**

Craig William Siders, A.J. Bayramian, K.D. Chesnut, A.C. Erlandson, E. Feigenbaum, T.C. Galvin, W.A. Molander, H.T. Nguyen, M.L. Rehak, P.A. Rosso, E.F. Sistrunk, K.I. Schaffers, T.M. Spinka, C. L. Haefner
*Advanced Photon Technologies, Lawrence Livermore National Laboratory, NIF & Photon Science Directorate, USA*

Laser architectures based upon multi-pulse extraction and continuous-wave laser diode pumping are scalable to near-MW peak power while maintaining application-enabling PW-class peak power.

**ALPS12-C1-3 9:45**

**Generation of the Ultraintense Laser Pulse by Focusing the 4 PW Laser**

Jin Woo Yoon[1,2], Seong Ku Lee[1,2], Jae Hee Sung[1,2], Hwang Woon Lee[1], Il Woo Choi[1,2], Cheonha Jeon[1], Junghun Shin[1], Chang Hee Nam[1,3]
*[1]Center for Relativistic Laser Science, Institute for Basic Science (IBS), Korea, [2]*Advanced Photonics Research Institute, GIST, Korea, *[3]*Dept. Of Physics and Photon Science, GIST, Korea

The highest peak intensity of $0.73\times10^{23}$ W/$cm^2$ was achieved by focusing the 4 PW laser pulse using an f/1.6 OAP.

## ALPS <Room 511+512>

**[ALPS13-D2] 9:00-10:45**
**Visible and Mid-Infrared Lasers**
Chair: Masaki Tokurakawa
*Institute for Laser Science, The University of Electro-Communications (UEC), Japan*

**ALPS13-D2-1 9:00** *Invited*

**Development of direct visible pulse fiber laser**

Shota Kajikawa[1], Minoru Yoshida[1], Osamu Ishii[2], Masaaki Yamazaki[2], Yasushi Fujimoto[3]
*[1]Faculty of Science and Engineering, Kindai University, Japan, [2]Sumita Optical Glass, Inc., Japan, [3]Department of Electrical and Electronic Engineering, Chiba Institute of Technology, Japan*

A Pr-doped double-clad structured waterproof fluoride glass fibre (Pr:DC-WPFGF) was successfully drawn. Visible pulse oscillation in a Pr:DC-WPFGF with a graphene and SESAM as saturable absorbers (SAs) were reported.

**ALPS13-D2-2 9:30**

**Characterization of Transition-Metal-Doped Saturable Absorbers for Passive Q-switching of Visible Lasers**

Hiroki Tanaka[1,2], Elena Castellano-Hernández[2], Christian Kränkel[2,3], Fumihiko Kannari[1]
*[1]Department of Electronics and Electrical Engineering, Keio University, Japan, [2]Center for Laser Materials, Leibniz Institute for Crystal Growth, Germany, [3]Institute of Laser-Physics, Universität Hamburg, Germany*

A detailed characterization of $Co^{2+}$-doped oxide crystals as visible saturable absorbers is presented. Absorption recovery times, and ground- and excited-state absorption cross sections of a variety of samples are accurately determined.

**ALPS13-D2-3 9:45**

**Ultrafast Thulium-Doped Fiber Amplifier for Multiphoton Microscopy**

Yutaka Nomura[1,2], Takao Fuji[1]
*[1]Institute for Molecular Scienc, Japan, [2]JST-PRESTO, Japan*

A broadband amplifier system covering 1.7 to 2.0 μm is developed using thulium-doped fibers. Spectral broadening within the amplifier fiber enabled generation of 50 fs pulses at an average power of 4.2 W.

## BISC <Room 419>

**[Opening Remarks] 9:30-9:45**
Toyohiko Yatagai
*Utsunomiya University, Japan*

**[BISC1] 9:45-12:00**
**Advanced Optical Miroscopy 1**
Chair: Nanguang Chen
*National Univ. of Singapore, Singapore*

**BISC1-1 9:45** *Invited*

**Coherent brightfield (COBRI) micros copy for ultrahig h-speed single-particle tracking on lipid bilayer membranes**

Yi-Hung Liao, Chia-Lung Hsie
*Academia Sinica, Taiwan*

Detecting linear scattering light from biological entity is useful for label-free bioimaging. Coherent brightfield (COBRI) microscopy provides the sensitivity to see individual native biological nanoparticles in live cells with nanometer spatial localization precision and microsecond temporal resolution.

## HEDS <Room 311+312>

**[HEDS10] 9:00-10:30**
**Thu-A1**
Chair: Alexander Pirozhkov
*KPSI, QST, Japan*

**HEDS10-1 9:00** *Plenary*

**Capillary discharges for optical guiding and for optics of charged particle beams**

Sergei V. Bulanov[1,2,3]
*[1]Institute of Physics of ASCR, ELI-Beamlines, Czech Republic, [2]Kansai Photon Research Institute, National Institutes for Quantum and Radiological Science and Technology, Japan, [3]Prokhorov General Physics Institute, Russian Academy of Sciences, Russia*

We discuss the plasma and magnetic field properties in capillary discharges intended for optical guiding and for optics of charged particle beams.

**HEDS10-2 9:30**

**Characteristics of femtosecond-laser-assisted discharges for laser wake-field acceleration**

Alexei G. Zhidkov
*Graduate School of Engineering, Osaka University, Japan*

Femtosecond laser pulse induced discharges can be stable and well reproducible to serve as optical elements in laser driven accelerators. Results of full kinetic PIC and MHD simulations are presented.

# Oral, Thursday, 26 April AM

## ICNN <Room 414+415>

**[ICNN3] 9:00-10:30**
**Quantum Optics & Plasmonics**
Chair: C. Chang-Hasnain
*University of California, Berkeley, USA*

### ICNN3-1 9:00 *Invited*

**Degenerate Optical Parametric Oscillators for Solving Ising Model**
Hiroki Takesue
*NTT Basic Research Laboratories, NTT Corporation, Japan*

I describe our effort to generate thousands of time-multiplexed degenerate optical parametric oscillators for a coherent Ising machine, using kilometers-long fiber cavities and the telecommunications-band phase sensitive amplifiers.

### ICNN3-2 9:30

**Spin-Glass Problem Solved with Coupled Plasmon Particle System**
Toshiharu Saiki, Yusuke Hirukawa
*Keio University, Japan*

We proposed an idea to implement an algorithm for Ising spin glass problem to coupled plasmon particles interacting with a phase-change material to modify the dipole-dipole interaction autonomously so as to reach the solution efficiently.

### ICNN3-3 9:45

**Enhanced Optical Absorption of Graphene Monolayer with Attenuated Total-Reflection Configuration in the Visible Range**
Gaige Zheng[1], Linhua Xu[1], Jicheng Wang[2], Min Lai[1]
*[1]Nanjing University of Information Science & Technology, China, [2]Jiangnan University, China*

We propose novel possible operation principle for graphene-based absorber through the resonant coupling of the external electromagnetic radiation in an attenuated total-reflection structure.

## IoT-SNAP <Room 413>

**[IoT2] 9:00-10:30**
**IoT-SNAP Plenary session**
Chairs: Norihiro Hagita
*ATR Intelligent Robotics and Communicatuon Laboratories, Japan*
Ronald Freund
*Fraunhofer Heinrich Hertz Institute, Germany*

### IoT2-1 9:00 *Keynote*

**Smart Photonic Sensor Solutions for Smart Factories**
Wolfgang Schade
*Fraunhofer HHI, Germany*

The future concept for smart factories is directly correlated to the development of smart sensor concepts. Here photonic sensors can lead to considerably higher flexibility, user-friendliness and efficiency in automation, robotics, optimizing individual machine processes or human machine interaction.

### IoT2-2 9:45 *Keynote*

**Architecture for Real-time and Real-world Intelligence beyond Human: Real Fusion among Sensing, Network, and AI Technologies**
Masatoshi Ishikawa
*University of Tokyo, Japan*

Increase of number of sensors and processors requires new type of sensing and processing architecture with hierarchical parallel distributed structure for realizing dynamic integration and fusion of heterogeneous and polymodal information from sensor nodes or IoT nodes in a network.

## LDC <Room 301>

**[LDC5] 9:00-10:30**
**Visible Lasers Connecting Automotive and Human -1-**
Chairs: Josef Schug
*Lumileds Germany GmbH, Germany*
Shigeto Iwamoto
*Honda Motor Co., Ltd., Japan*

### LDC5-1 9:00 *Invited*

**The Future of Automotive Lighting with Laser Technology**
Philipp Ansorg, Wolfgang Huhn
*AUDI AG, Germany*

Laser light sources for car headlamps entered series production and will be improved in performance and safety. New systems combine laser light with a MOEMS mirror scanner, DMD or LCoS to realise new light functionality.

### LDC5-2 9:30 *Invited*

**Laser Scanning Headlamp**
Takuya Kitazono, Yasushi Kita, Shinya Hoshino, Taiki Mori, Shuichi Harata, Takao Saito, Yasushi Yatsuda
*Stanley Electric co., ltd., Japan*

The high-resolution Adaptive Driving Beam by the laser scanning headlamp is effective for the reduction of the night traffic fatal accidents. We demonstrated improvement of the visibility and to guide the driver's eyes.

## LEDIA <Room 411+412>

**[LEDIA1] 9:00-10:30**
**LEDIA1**
Chairs: Jeehee Cho
*Chonbuk National University, Korea*
Hoi Wai Choi
*The University of Hong Kong, Hong Kong*

### LEDIA1-1 9:00 *Invited*

**Development of Advanced Hybrid GaN-based Tunnel Junction LEDs**
James S. Speck
*University of California, Santa Barbara, USA*

In this presentation, we present UCSB work on the develop of hybrid MBE/MOCVD tunnel junction LEDs. The tunnel junctions are grown directly on MOCVD LED layers which are terminated with a heavily doped layer. We review cleaning procedures prior to the NH3 (ammonia) MBE.

### LEDIA1-2 9:30

**Characterization of AlGaN-Based Tunnel Junction Ultraviolet Light Emitting Diodes**
Yusuke Goto, Hisanori kojima, Kazuyoshi Iida, Myunghee KIM, Norikatsu Koide, Tetsuya Takeuchi, Motoaki Iwaya, Satoshi Kamiyama, Isamu Akasaki
*Meijo University, Japan*

We demonstrated AlGaN-based tunnel junction (TJ) ultraviolet light emitting diodes (UV-LEDs) fabricated on high-quality n-Al0.62Ga0.38N templates using MOVPE. A TJ UV LEDs emitting at 310 nm under 40mA driving current was obtained.

### LEDIA1-3 9:45

**Electroluminescence Enhancement for Near-Ultraviolet Light Emitting Diodes with Graphene/AZO-Based Current Spreading Layers**
Li Lin[1], Yiyu Ou[1], Xiaolong Zhu[2], Berit Herstrøem[3], Flemming Jensen[3], Haiyan Ou[1]
*[1]Department of Photonics Engineering, Technical University of Denmark, Denmark, [2]Department of Micro- and Nanotechnology, Technical University of Denmark, Denmark, [3]DTU Danchip, Technical University of Denmark, Denmark*

Near-ultraviolet light emitting diodes with different aluminum-doped zinc oxide-based current spreading layers were fabricated and electroluminescence (EL) was compared. A 170% EL enhancement was achieved by using a graphene-based interlayer.

# Oral, Thursday, 26 April AM

## LIC <Room 302>

**[Opening Remark] 9:00-9:30**
Takunori Taira
*IMS, Japan*

**[LIC1] 9:30-10:45**
**Advanced ignition systems and applications (1)**
Chair: Geoffrey Dearden
*University of Liverpool, UK*

**LIC1-1 9:30** ***Invited***

**Laser ignition of quiescent and flowing methane/air-mixtures under elevated pressures using a passively Q-switched laser**
Mark Bärwinkel, Dieter Brüggemann
*University of Bayreuth, Germany*
A passively Q-switched laser ignition system is applied to ignite quiescent and flowing methane/air-mixtures under elevated pressures. Special emphasis lies on lean mixtures. The effective focal length of the focusing line is varied to change the focal point properties.

## LSC <Room 213>

**[LSC4] 9:00-10:00**
**Charge Lattice Spin 2**
Chair: Shin-ichi Kimura
*Graduate School of Frontier Biosciences, and Department Physics, Graduate School of Science, Osaka University, Japan*

**LSC4-1 9:00** ***Invited***

**Time-Resolved X-Ray Study of Ultrafast Charge/Spin Dynamics**
Hiroki Wadati
*Institute for Solid State Physics, University of Tokyo, Japan*
We chose time-resolved x-ray measurements to study ultrafast charge/spin dynamics in transition-metal compounds. We performed a time-resolved x-ray study in a pump-probe setup by using our experimental setup at BL07LSU in SPring-8.

**LSC4-2 9:30** ***Invited***

**Ultrafast Lattice and Spin Dynamics in Topological Chalcogenide Materials**
Muneaki Hase
*Division of Applied Physics, Faculty of Pure and Applied Sciences, University of Tsukuba, Japan*
We present ultrafast lattice and spin dynamics in topological chalcogenide materials, such as phase-change materials and topological insulators, based on coherent phonon spectroscopy as well as inverse Faraday and optical Kerr effects.

## LSSE <Room 316>

## OMC <Room 418>

**[OMC1] 9:00-10:45**
**OMC I**
Chair: Keiji Sasaki
*Hokkaido Univ., Japan*

**OMC1-1 9:00** ***Invited***

**Optical Fiber Nano-Tweezers, A Complementary Approach for Micro- and Nanoparticle Trapping**
Jochen Fick
*Institut NÉEL*

**OMC1-2 9:30** ***Invited***

**Seeing is believing: single molecule microscopy, a powerful tool from nanoparticle investigations to microbiome analysis.**
Johan Hofkens
*KU Leuven, Belgium*
TBD

# Oral, Thursday, 26 April AM

## PLD <Room 212>

**[PLD3] 9:00-10:15**
**High Power Laser Damage I**
Chair: Takahisa Jitsuno
*Osaka University, Japan*

### PLD3-1 9:00 *Plenary*

**Toward "defect-free" optics: a pioneering comprehensive metrology method**

Jianda Shao[1], J. Chen[2], S. Liu[1], M. Zhu[1], L. Ma[2], W. Li[2], M. Huang[2]
*[1]Shanghai Institute of Optics and Fine Mechanics, China, [2]ZC Optoelectronic Technologies Ltd., China*

The laser based inertial confinement fusion (ICF) research devices, typically represented by the National Ignition Facility (NIF) are striving to seek a new energy source for human-being. However, until now ICF systems worldwide still face several obstacles.

### PLD3-2 9:30

**Study of absorption and defects properties for large aperture high-power laser optics at multiple wavelengths**

Jian Chen[1,2], Z. Wu[1,2], L. Ma[1,2], X. Wang[1,2], H. Zhou[1,2], W. Xu[1,2]
*[1]Anhui Province Key Laboratory of Non-Destructive Evaluation, China, [2]ZC Optoelectronic Technologies Ltd, China*

Many precise laser systems set strict requirements on the optics, such as low absorption, high laser damage threshold, and low defect density.

### PLD3-3 9:45

**Comparation of 355-nm nanosecond and 1064-nm picosecond laser-induced damage in high-reflective coatings**

Yuan'an Zhao, C. Li, Y. Zhao, Y. Cui, X. Peng, C. Shan, M. Zhu, J. Wang, J. Shao
*Shanghai Institute of Optics and Fine Mechanics, China*

Laser-induced damage in optical components has always been a key challenge in the development of high-power laser systems. In picosecond regime, the laser-matter interactions are quite complex and the damage mechanism is not yet understood.

## SLPC <Room 416+417>

**[SLPC7] 9:00-10:00**
**Micro Nano Processing**
Chairs: Andreas Ostendorf
*Ruhr-University Bochum, Germany*
Masaki Hashida
*Kyoto University, Japan*

### SLPC7-1 9:00

**Laser fluence and time-interval dependences of ablation suppression for titanium by double-pulse femtosecond laser irradiation**

Yuki Furukawa[1,2], Sadaoki Kojima[1], Kensuke Teramoto[1,2], Shunsuke Inoue[1,2], Masaki Hashida[1,2], Shuji Sakabe[1,2]
*[1]Advanced Research Center for beam Science, Institute for Chemical Research, Kyoto University, Japan, [2]Graduate School of Science, Kyoto University, Japan*

Double-pulse femtosecond laser pulses are irradiated on a titanium plate for various combinations of fluence. The depths of laser-produced craters are measured. The ablation suppression is observed by choosing appropriate fluence and time interval combination.

### SLPC7-2 9:15

**Deep drilling of metals with ultra-short laser pulses**

Daniel Johannes Förster, Daniel Holder, Thomas Arnold, Rudolf Weber, Thomas Graf
*Institut für Strahlwerkzeuge IFSW, University of Stuttgart, Germany*

A simplified model of the percussion drilling process to predict the achievable drilling depth was derived and systematically investigated. Based on this, a hole with a drilling depth of 10 mm could be achieved.

### SLPC7-3 9:30

**Formation of microstructures on Ni film surface by nanosecond laser irradiation**

Kazuki Koda[1], Wataru Kobayashi[2], Hiro Imai[2], Masahiro Tsukamoto[3]
*[1]Department of Mechanical Engineering, Osaka University, Japan, [2]DENSO CORPORATION, Japan, [3]Joining and Welding Research Institute, Osaka University, Japan*

The formation of microstructures on a Ni film surface by nanosecond laser irradiation was investigated. The microstructures were formed by the interaction between the laser-induced plume and the film surface.

### SLPC7-4 9:45

**Two-dimensional amorphous transitional metal oxides from laser ablation in liquids for photocatalytic hydrogen production**

Z.Y. Lin, W.J. Li, G.W. Yang
*School of Materials Science & Engineering, Sun Yat-sen University, China*

Two-dimensional amorphous transitional metal oxides from laser ablation in liquids for photocatalytic hydrogen production

## XOPT <Room 313+314>

**[XOPT8] 9:00-10:30**
**Imaging III**
Chair: Taito Osaka
*RIKEN SPring-8 Center, Japan*

### XOPT8-1 9:00 *Invited*

**Recent Advance and Future Potential in X-ray Imaging with Gratings**

Wataru Yashiro
*Tohoku University, Japan*

X-ray grating interferometries have attracted much attention because they allow for several advantages over the conventional techniques. I will introduce the recent advance and future potentials in the interferometries for material and life sciences.

### XOPT8-2 9:30

**The interaction of infrared laser radiation with polypropylene studied by pink-beam 4D X-ray Phase CT**

Karol Vegso[1], Yanlin Wu[2], Hidekazu Takano[2], Masato Hoshino[1], Atsushi Momose[2]
*[1]Japan Synchrotron Radiation Research Institute, Japan, [2]Tohoku University, Japan*

The 4D X-ray phase CT utilizing X-ray Talbot Interferometer was used to study interaction of infrared laser beam with polypropylene. The temporal resolution achieved in 4D CT was 4 s.

### XOPT8-3 9:45

**High-fluence x-ray focusing system for high-resolution coherent diffraction imaging at SACLA**

Hirokatsu Yumoto[1,2], Takahisa Koyama[1,2], Takashi Kimura[3], Akihiro Suzuki[3], Takashi Kameshima[1,2], Yasumasa Joti[1,2], Kensuke Tono[1,2], Naoya Tani[3], Tatsuro Tachibana[3], Yusuke Konishi[3], Yoshitaka Bessho[4], Yoshinori Nishino[3], Makina Yabashi[1,2], Haruhiko Ohashi[1,2]
*[1]Japan Synchrotron Radiation Research Institute, Japan, [2]RIKEN SPring-8 Center, Japan, [3]Hokkaido University, Japan, [4]Academia Sinica, Taiwan*

We developed a CDI system with high-fluence x-ray focusing optics to enhance diffraction signals from nanosized particles. The manufactured mirror optics realized a high-fluence focus with a beam size of 100 nm at 4 keV.

# Oral, Thursday, 26 April AM



## ALPS <Room 303>

**ALPS12-C1-4 10:00**

**Meter-size 575x1015mm Gold-coated Gratings for 10PW-class lasers**

Arnaud Cotel
*HORIBA Scientific, France*

We present the latest results of Meter-size gratings production for 10PW-class laser pulse compression. More than 10 Gold-coated 1480gr/mm gratings in size 575x1015mm have already been manufactured and characterized.

**ALPS12-C1-5 10:15**

**High quality and high damage threshold optics with ozone mixed gas grating**

Yurina Michine, Hitoki Yoneda
*Institute for Laser Science, University of Electro-Communications, Japan*

High diffraction efficient and spatial mode cleaner's transient grating is created with ozone mixed gas pumped by UV lasers. This also has high damage threshold. It opens new high fluence laser optics in air.

**ALPS12-C1-6 10:30**

**Multiple-Plate Pulse Compression for Generation of Few-Cycle, CEP-Stable, Intense Mid-Infrared Pulses**

Peiyu Xia, Faming Lu, Nobuhisa Ishii, Teruto Kanai, Jiro Itatani
*Institute for Solid State Physics, The University of Tokyo, Japan*

Pulse compression of femtosecond mid-infrared pulses is demonstrated using YAG and Si plates. With this multiple-plate compression scheme, we produce sub-two-cycle, CEP-stable, intense pulses (21.0 fs, 45 μJ) with octave-spanning spectrum around 3.5 μm.

----- Break 10:45-11:00 -----

**[ALPS14-C2] 11:00-12:30**
**High Energy Lasers and Technology**
Chair: Hiromitsu Kiriyama
*Kansai Photon Science Institute (KPSI), National Institutes for Quantum and Radiological Science and Technology (QST), Japan*

**ALPS14-C2-1 11:00** ***Invited***

**Current status of 10 PW laser and 100 PW laser project**

Yuxin Leng, Xiaoyan Liang, Ruxin Li, Zhizhan Xu
*State Key Laboratory of High Field Physics, Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences, China*

We'll report the new progress of implementing a 10PW laser facility, including the generation of a 5.4PW/24fs laser pulses from a Ti:Sapphire crystal based CPA laser system and the design of a 100PW laser system.

## ALPS <Room 511+512>

**ALPS13-D2-4 10:00**

**Femtosecond-Laser-Written Ho:KGd$(WO_4)_2$ Waveguide Lasers at 2.06 μm**

Esrom Kifle[1], Pavel Loiko[2], Xavier Mateos[1], Javier Rodríguez Vázquez de Aldana[3], Airan Ródenas[1,4], Magdalena Aguiló[1], Francesc Díaz[1], Viktor Zakharov[2], Andrey Veniaminov[2], Uwe Griebner[5], Valentin Petrov[5]
*[1]Física i Cristal·lografia de Materials i Nanomaterials (FiCMA-FiCNA)-EMaS, Dept. Química Física i Inòrganica, Universitat Rovira i Virgili (URV), Spain, [2]ITMO University, Russia, [3]Aplicaciones del Láser y Fotónica, University of Salamanca, Spain, [4]Istituto di Fotonica e Nanotecnologie, Consiglio Nazionale delle Ricerche (IFN-CNR), Italy, [5]Max Born Institute for Nonlinear Optics and Short Pulse Spectroscopy, Germany*

A circular cladding (60 μm) channel waveguide is femtosecond-laser-written in monoclinic 5 at.% Ho:KGd$(WO_4)_2$. Under in-band pumping at 1950 nm, the Ho waveguide laser generated 212 mW at 2055 nm with a slope efficiency of 67 %.

**ALPS13-D2-5 10:15**

**Point-by-Point inscription of fiber Bragg grating by a Femtosecond laser for 2.8 μm fiber laser**

Kenji Goya[1], Hiyori Uehara[1], Satoshi Hattori[2], Daisuke Konishi[2], Masanao Murakami[2], Shigeki Tokita[1]
*[1]Institute of Laser Engineering, Osaka University, Japan, [2]Mitsuboshi Diamond Industrial Co., Ltd., Japan*

We demonstrate stable and efficient 2.8 μm fiber laser owing to point-by-point femtosecond laser inscription of fiber Bragg grating in an erbium-doped ZBLAN fiber.

**ALPS13-D2-6 10:30**

**Efficient CW and Q-switched operation of Er:$Lu_2O_3$ ceramic laser at 2.8 μm**

Hiyori Uehara[1], Shigeki Tokita[1], Junji Kawanaka[1], Daisuke Konishi[3], Masanao Murakami[3], Seiji Shimizu[3], Ryo Yasuhara[2]
*[1]Institute of Laser Engineering, Osaka University, Japan, [2]National Institute for Fusion Science, Japan, [3]Mitsuboshi Diamond Industrial Co., Ltd., Japan*

Room temperature CW operation with output power of 2.6 W and passively Q-switched operation with pulse energy of 9.4 μJ have been demonstrated by an Er:$Lu_2O_3$ ceramic at 2.85 μm wavelength.

----- Break 10:45-11:00 -----

**[ALPS15-F1] 11:00-12:15**
**Terahertz Photonics 1**
Chair: Takashi Notake
*Teraphotonics Team, RIKEN, Japan*

**ALPS15-F1-1 11:00** ***Invited***

**Liquid Crystal Based Devices for THz Applications**

Lei Wang[1], Makoto Nakajima[2], Yanqing Lu[3]
*[1]College of Electronic and Optical Engineering & College of Microelectronics, Nanjing University of Posts and Telecommunications, China, [2]Institute of Laser Engineering, Osaka University, Japan, [3]College of Engineering and Applied Sciences, Nanjing University, China*

We first developed a large birefringence liquid crystal material in terahertz range. Then broadband tunable terahertz waveplate driven with porous graphene and graphene-assisted high efficiency tunable terahertz metamaterial absorber using this material were demonstrated.

## BISC <Room 419>

**BISC1-2 10:15** ***Invited***

**Visualizing a beating zebrafish heart with improved line-scan microscopy**

Nanguang Chen
*National Univ of Singapore, Singapore*

We have developed a high-speed line-scan optical microscope that is capable of acquiring high-resolution, high-contrast fluorescence images at more than 100 fps. This advanced imaging technique has been applied to multi-dimensional imaging of zebrafish heart.

----- Break 10:45-11:00 -----

**BISC1-3 11:00** ***Invited***

**Fast, long-term super-resolution imaging with Hessian structured illumination microscopy**

Xiaoshuai Huang[1], Junchao Fan[2], Liuju Li[1], Haosen Liu[2], Runlong Wu[3], Yi Wu[4], Lisi Wei[1], Heng Mao[5], Amit Lal[6], Peng Xi[6], Liqiang Tang[7], Yunfeng Zhang[3], Yanmei Liu[1], Shan Tan[2], Liangyi Chen[1]
*[1]Institute of Molecular Medicine, Peking University, China, [2]Huazhong University of Science and Technology, China, [3]School of Electronics Engineering and Computer Science, Peking University, China, [4]School of Software and Microelectronics, Peking University, China, [5]School of Mathematical Sciences, Peking University, China, [6]Department of Biomedical Engineering, Peking University, China, [7]ColdSpring Science Corporation, China*

To increase the temporal resolution and maximal imaging time of super-resolution (SR) microscopy, we have developed a deconvolution algorithm for structured illumination microscopy based on Hessian matrixes (Hessian-SIM).

## HEDS <Room 311+312>

**HEDS10-3 10:00** ***Invited***

**TBD**

Mitsuhiro Yoshida
*KEK, Japan*

TBD

**[HEDSp11] 10:30-12:00**
**Poster Session**
**<Exhibition Hall A>**
Chair: Hirotaka Nakamura
*Osaka University, Japan*

Poster session program p.116

# Oral, Thursday, 26 April AM

## ICNN <Room 414+415>

**ICNN3-4 10:00**

**Surface Plasmon Polariton Generation in Carbon Nanotube**

Sergey Moiseev, Aleksei Kadochkin, Yuliya Dadoenkova, Igor Zolotovskii
*Ulyanovsk State University, Russia*

We have shown the possibility of far infrared surface plasmon polariton generation in a single-walled CNT. In such generator the amplification is created by drift currents, and the feedback is realized due to periodically profiled

**ICNN3-5 10:15**

**Coherent Absorption At Interfaces for Film Thickness Measurement to Plasmonic Selective Excitation**

Fei He[1], Kevin Macdonald[2], Xu Fang[1]
*[1]Department of Electronics and Computer Science, University of Southampton, UK, [2]Optoelectronics Research Centre and Centre for Photonic Metamaterials, University of Southampton, UK*

We demonstrate using two coherent light beams to measure the thickness of absorptive thin films and selectively excite plasmonic resonances at the surface of transparent bulk substrates.

----- Break 10:30-11:00 -----

**[ICNN4] 11:00-12:00**
**Nanolasers and Photonic Devices**
Chair: M. Takenaka
*The University of Tokyo, Japan*

**ICNN4-1 11:00** *Invited*

**TBA**

Connie Chang-Hasnain
*University of California, Berkeley, USA*

see abstract book

## IoT-SNAP <Room 413>

----- Break 10:30-11:00 -----

**[IoT3] 11:00-12:00**
**Photonics Technologies I**
Chairs: Shigeru Kato
*DENSO Corporation, Japan*
Shieru Nakamura
*NEC Corporation, Japan*

**IoT3-1 11:00** *Invited*

**Fiber optic nerve systems by use of optical correlation domain techniques for structural health monitoring to enhance safety and security of the society**

Kazuo Hotate
*Toyota Technological Institute, Japan*

Distributed fiber optic strain/temperature sensing based on Brillouin scattering are discussed. Correlation domain techniques are mainly considered, which realize unique functions, such as random accessibility.

## LDC <Room 301>

**LDC5-3 10:00** *Invited*

**Application of Laser to Headlamps and Thermal Design**

Takashi Inoue, Yosuke Ohashi, Takashi Ito
*KOITO MANUFACTURING CO.,LTD, Japan*

This paper describes how laser diodes can be used for headlamps and their potential as light sources, focusing on headlamp functionality and thermal design.

----- Break 10:30-10:45 -----

**[LDC5] 10:45-12:15**
**Visible Lasers Connecting Automotive and Human -2-**
Chairs: Philipp Ansorg
*Audi AG, Germany*
Masaru Kuramoto
*Stanley Electric Co., Ltd., Japan*

**LDC5-4 10:45** *Invited*

**Dynamic Laser-based Lighting for Automotive Headlamps**

Josef Schug, Ulrich Hechtfischer, Roman Hohn, Steffen Zozgornik
*Lumileds Germany GmbH, Germany*

Laser-based lighting finds its application in car headlighting, particularly in the high beam. First implementations use a single static source. Dynamic beam pattern can be either realized with discrete segmented sources or in an advanced

**LDC5-5 11:15** *Invited*

**Laser Light Technology for Automotive Applications**

Paul Rudy, Troy Trottier, Eric Goutain, James Raring
*SoraaLaser, USA*

Conventional sources such as HID, halogen lamps and LEDs have limitations in reliability, size and luminance. We present an overview of laser light, a new solid-state technology featuring the highest luminance demonstrated commercially.

## LEDIA <Room 411+412>

**LEDIA1-4 10:00**

**Optical and Device Characteristics of InGaN/GaN Light Emitting Diodes with Multilayer Graphene as Transparent and Current Spreading Electrodes**

Ying-Hsiang Wang[1], Wei-Ming Lee[1], Shih-Wei Feng[1], Hsiang-Chen Wang[2]
*[1]Department of Applied Physics, National University of Kaohsiung, Taiwan, Taiwan, [2]Graduate Institute of Opto-Mechatronics, National Chung Cheng University, Taiwan, Taiwan*

We demonstrated InGaN-based LEDs with graphene transparent conductive electrodes. The shorter response, rise, delay, and recombination times of the InGaN-based LEDs with graphene transparent conductive electrodes provide more efficient carrier injection, transport, relaxation, and recombination.

**LEDIA1-5 10:15**

**Gan Metal–Semiconductor–Metal Ultraviolet Photodetector with a Reduced-Graphene Oxide Schottky Contact**

Bhishma Pandit, Jaehee Cho
*Chonbuk National University, Korea*

GaN and its ternary compound with AlN have drawn much attention for the high speed and high responsivity ultraviolet (UV) photodetectors (PDs) because of their direct and wide energy bandgap, robustness and high radiation hardness.

----- Break 10:30-10:45 -----

**[LEDIAp2] 10:45-11:42**
**Short Presentation**
Chair: Hisashi Murakami
*Tokyo University of Agriculture and Technology, Japan*

Poster session program p.122-

# Oral, Thursday, 26 April AM



## LIC <Room 302>

**LIC1-2 10:00**

**Influence of ignition position of internal combustion engine with laser-induced breakdown ignition**

Genki Momose[1], Takeshi Saito[1], Eiichi Takahashi[2], Hirohide Furutani[2]
*[1]Meisei University, Japan, [2]The National Institute of Advanced Industrial Science and Technology, Japan*

We investigated the influence of ignition position on the combustion state and engine performance in a laser-induced breakdown ignition engine.

**LIC1-3 10:15**

**Experiments on laser cleaning of sooted optical windows**

Kazuki Okada, Yuto Ito, Wookyung Kim, Tomoyuki Johzaki, Shin-ichi Namba, Takuma Endo
*Hiroshima University, Japan*

Transparent glass plates were artificially sooted, and they were repetitively irradiated by 1064-nm laser. An explosive air flow normally away from the glass plate was induced by the laser irradiation of the soot.

**LIC1-4 10:30**

**Benchmark of a time and space resolved numerical energy transfer model for ns laser pulses at 1064 nm in gaseous propellants**

Michael Boerner, Michael Oschwald
*Institute of Space Propulsion, German Aerospace Centre (DLR), Germany*

A numerical energy transfer model for focused nanosecond laser pulses at 1064 nm in gaseous media and discretized in time and space is presented and tested against published experimental data.

----- Break 10:45-11:00 -----

**[LIC2] 11:00-12:00**
**Advanced ignition systems and applications (2)**
Chair: Nobuyuki Kawahara
*Okayama Univ., Japan*

**LIC2-1 11:00** ***Invited***

**Recent development of a sub-nanometer flattening using a non-uniform optical field**

Takashi Yatsui
*School of Engineering, University of Tokyo, Japan*

We have developed sub-nanometer scale flattening process of the near-field etching based on a non-uniformity of the electric field. Here We present recent development of the near-field etching on various materials and structures.

## LSC <Room 213>

**[LSC5] 10:00-12:15**
**Photoemission Spectroscopy 1**
Chair: Kazutaka Nakamura
*Laboratory for Materials and Structures, Institute of Innovative Research, Tokyo Institute of Technology, Japan*

**LSC5-1 10:00** ***Invited***

**Current Situation and Future Prospects of Ultra-High-Resolution Laser-Photoemission Spectroscopy on Materials Science**

Shik Shin
*Institute for Solid State Physics, University of Tokyo, Japan*

Current situation and future prospects of ultra-high-resolution laser-photoemission spectroscopy on materials science

----- Break 10:30-10:45 -----

**LSC5-2 10:45** ***Invited***

**Exotic Surface States on Kondo Insulators**

Shin-ichi Kimura
*Graduate School of Frontier Biosciences, and Department Physics, Graduate School of Science, Osaka University, Japan*

Topological Kondo insulator (TKI) has an exotic surface metallic state. We introduce our recent results of the surface state on two TKI materials, YbB12(001) and SmB6(111) using synchrotron angle-resolved photoelectron spectroscopy.

**LSC5-3 11:15** ***Invited***

**Electronic States of Bi(110) Ultrathin Films Studied by Photoemission Spectroscopy with Laser And Synchrotron Radiation**

Kazutoshi Takahashi, M. Imamura, I. Yamamoto, J. Azuma
*Synchrotron Light Application Center, Saga University, Japan*

Electronic structure of ultrathin Bi(110) films grown on epitaxial graphene has been studied by ARPES and AR2PPES using synchrotron radiation and laser. Time-resolved 2PPES of 1BL Bi(110) showed faster decay than that of 2BL film.

## LSSE <Room 316>

**[LSSEp4] 10:30-12:00**
**Others**
**Poster Session**
**<Exhibition Hall A>**

Poster session program p.117

## OMC <Room 418>

**OMC1-3 10:00**

**Optical Trapping of Gold and Semiconductor Nanoparticles at Oil-Water Interfaces with A Focused Near-Infrared Laser Beam**

Tatsuya Shoji[1], S. Naka[1], S. Koyama[2], T. Kameyama[2], T. Torimoto[2], Y. Tsuboi[1]
*[1]Osaka City Univ, Japan, [2]Nagoya Univ., Japan*

A tightly focused laser beam exerts optical force on nanoparticles dispersed in an aqueous solution, leading to an optical trapping of them at the focal point.

**OMC1-4 10:15**

**Nanoparticle Manipulation Using A Tapered Fiber**

Hideki Fujiwara, K. Yamauchi, K. Sasaki
*Hokkaido Univ, Japan*

Optical trapping has utilized for manipulating micrometer-sized objects such as biological tissues.

**OMC1-5 10:30**

**Simultaneous Optical Trapping and Imaging in Axial Plane**

Ming Lei, Y. Liang
*Xi'an Institute of Optics and Precision Mechanics, China*

Optical tweezers has demonstrated great success in widespread applications, such as life science, atom cooling and fundamental physics.

----- Break 10:45-11:00 -----

**[OMC2] 11:00-12:15**
**OMC II**
Chair: Juan José Sáenz
*Univ. Autónoma de Madrid, Spain*

**OMC2-1 11:00** ***Invited***

**The Dynamics of Trapped, Rotating Microparticles in Vacuum**

Kishan Dholakia
*University of St. Andrews, UK*

TBD

# Oral, Thursday, 26 April AM

| PLD <Room 212> | SLPC <Room 416+417> | XOPT <Room 313+314> | |
|---|---|---|---|

**PLD3-4 10:00**

**351nm mirrors with modified outer stack and post-treatment methods to increase the laser damage resistance**

Feng Pan, F. Pan, Z. Liu, Q. Wu
*Chengdu Fine Optical Engineering Research Ctr., China*

The 351nm mirrors with different outer stacks were prepared by electron beam evaporation. The damage morphology and damage mechanism of different mirrors were analyzed.

----- Break 10:15-10:45 -----

**[PLD4] 10:45-12:00**
**High Power Laser Damage II**
Chair: Shinji Motokoshi
*Inst. for Laser Technology, Japan*

**PLD4-1 10:45** ***Invited***

**Investigation on the multilayer coating with co-evaporated interface**

Meiping Zhu, N. Xu, Y. Chai, J. Sun, K. Yi, J. Wang, Y. Zhao, J. Shao
*Shanghai Institute of Optics and Fine Mechanics, China*

Multilayer coatings fabricated by e-beam evaporation are widely used in high power laser system. Much work has been done to investigate the laser induced damage mechanism.

**PLD4-2 11:15**

**Effect of micro-crack and reaction product on laser damage performance of optical glass during chemical etching**

Huapan Xiao, Z. Chen, H. Wang, J. Wang, N. Yu
*Xi'an Jiaotong Univ, China*

Chemical etching is usually utilized to improve the laser damage performance of optical glass by mitigating micro- cracks, while it inevitably produces some reaction products (RPs).

----- Break 10:00-10:30 -----

**[SLPCp8] 10:30-12:00**
**Poster Session**
**<Exhibition Hall A>**
Chairs: Yuji Sato
*JWRI, Osaka University, Japan*
Shin-Ichiro Masuno
*JWRI, Osaka University, Japan*

Poster session program p.117-

**XOPT8-4 10:00** ***Invited***

**Radiation-Damage-Free Imaging of Solid Electrolytes for Lithium-Ion Batteries by Single-Shot Coherent Diffraction Imaging**

Takashi Kimura
*Hokkaido University, Japan*

X-ray free-electron lasers can overcome the limitation of radiation-damage by capturing a femtosecond snapshot of sample structure. I will talk about coherent X-ray diffraction imaging of a high radiation sensitive solid electrolyte at SACLA.

**[XOPTp9 Poster Session]**
**10:30-12:00**
**<Exhibition Hall A>**

Poster session program p.119-

# Oral, Thursday, 26 April AM



## ALPS <Room 303>

**ALPS14-C2-2 11:30**

### Development of Cryogenically Cooled Helium Gas Circulation System for Cooling Active Medium of 100 J Class Laser Amplifier

Yasuki Takeuchi[1], Yoshio Mizuta[1], Takashi Sekine, Takashi Kurita[1], Masateru Kurata[1], Yuma Hatano[1], Takaaki Morita[1], Yuki Kabeya[1], Kazuki Kawai[1], Yuki Muramatsu[1], Takuto Iguchi[1], Yoshinori Tamaoki[1], Koichi Iyama[1], Yujin Zheng[1], Shigeki Tokita[2], Junji Kawanaka[2], Yoshinori Kato[1]
*[1]Industrial Development Center, Central Research Laboratory, Hamamatsu Photonics K.K., Japan, [2]*Institute of Laser Engineering, Osaka University, Japan

1-kW class cryostat cooled He-gas flowing system to demonstrate cooling method of laser medium has been developed. A cooling capacity was estimated over 1.4 kW with mass flow rate of 100 g/s at 150 K.

**ALPS14-C2-3 11:45**

### Development of a 10-J, 10-Hz Cryogenically-Cooled Yb:YAG Ceramics Active-MirrorLaser Amplifier System

Takaaki Morita[1], Takashi Sekine[1], Yasuki Takeuchi[1], Yuuma Hatano[1], Takashi Kurita[1], Yoshinori Tamaoki[1], Koichi Iyama[1], Yuki Kabeya[1], Masateru Kurata[1], Takuto Iguchi[1], Yoshio Mizuta[1], Kazuki Kawai[1], Yuki Muramatsu[1], Yoshinori Kato[1], Shigeki Tokita[2], Junji Kawanaka[2]
*[1]Industrial Development Center, Central Research Laboratory, Hamamatsu Photonics K.K., Japan, [2]*Institute of Laser Engineering, Osaka University, Japan

A cryogenically cooled Yb:YAG ceramics active-mirror laser amplifier for 10-J at 10-Hz output laser system has been developed. A laser diode module with 25-kW peak power was tested as a pump source for this amplifier.

**ALPS14-C2-4 12:00**

### High energy cryogenically cooled Yb:YAG/Cr:YAG microchip laser

Xiaoyang Guo[1,2], Shigeki Tokita[1], Junji Kawanaka[1]
*[1]Institute of Laser Engineering, Osaka University, Japan, [2]*Department of Electronic Science and Engineering, Kyoto University, Japan

We have developed a diode pumped cryogenically cooled Yb:YAG/Cr:YAG passively Q-switched microchip laser. A maximum energy of 12.1 mJ with 3.7 MW peak power was obtained

**ALPS14-C2-5 12:15**

### Heat Capacitive Active Mirror and Top-Cap Effect

Ken-ichi Ueda[1,2,3,4]
*[1]Institute for Laser Science, UEC-Tokyo, Japan, [2]Inst. Laser Engineering, Osaka Univ., Japan, [3]Hamamatsu Photonics, Japan, [4]JST PRESTO, Japan*

A novel concept "Heat Capacitive Active Mirror HCAM" has been developed for the plane wave generation without thermal-lens. HCAM design allows to keep the maximum temperature and thermal-lens-effect in the same level to the thin disk laser without top-cap.

----- Lunch 12:30-13:00 -----

**[ALPSp] 13:00-14:30**
**Poster Session**
**<Exhibition Hall A>**

Poster session program p.123-

## ALPS <Room 511+512>

**ALPS15-F1-2 11:30**

### Liquid phase growth of Ge doped GaSe and $GaSe_{1-x}Te_x$ bulk crystals at low temperature for highly efficient THz wave source

Yohei Sato, Chao Tang, Tadao Tanabe, Yutaka Oyama
*Department of materials science, Tohoku University, Japan*

In order to efficiently generate THz wave, GaSe crystal is grown by low temperature liquid phase growth. Ge doped GaSe and $GaSe_{1-x}Te_x$ crystals are grown for improvement of transparency and mechanical strength, respectively.

**ALPS15-F1-3 11:45**

### Laser-matter interaction in picosecond pulsed second-harmonic generation by periodically poled $LiTaO_3$: Experiment and theory

Oleg A. Louchev, Satoshi Wada
*Center for Advanced Photonics, RIKEN, Japan*

We present results of combined experimental-theoretical study of laser-matter interaction in picosecond pulsed second-harmonic generation by periodically-poled $LiTaO_3$ crystal. Modified two-temperature excitation-relaxation model allows exact simulation of laser excitation and after-pulse relaxation continuing ≈50 ps.

**ALPS15-F1-4 12:00**

### Efficient Terahertz Emission from the Co/Pt Ferromagnetic Heterostructure Based on Inverse Spin Hall Effect

Hongsong Qiu, Kosaku Kato, Kazumasa Hirota, Nobuhiko Sarakura, Masashi Yoshimura, Makoto Nakajima
*Institute of Laser Engineering, Osaka University, Japan*

We demonstrated new efficient terahertz emitter of Co/Pt heterostructure due to inverse spin Hall effect. The radiation mechanism was investigated in detail and new model which includes the effect of spin diffusion length was proposed.

## BISC <Room 419>

**BISC1-4 11:30**

### Multi-focal holographic slit confocal fluorescence microscopy

Hung-Chun Wang[1], Yuan Luo[2], Chou-Min Chia[2]
*[1]National Tsing Hua University, Taiwan, [2]National Taiwan University, Taiwan*

The non-axial line-scanning multifocal confocal microscopy incorporates multiplex volume holographic grating (MVHG) in illumination and combination of multifocal image system to image multiplane at the same time. The system resolve volume tissue fast and well, offering a solution of replacing biopsy.

**BISC1-5 11:45**

### Lateral spatial resolution improvement in laser scanning fluorescence microscopy using a subdiffraction limit optical spo

Takahiro Nishimura[1], Yusuke Ogura[1], Yosuke Tamada[2], Jun Tanida[1]
*[1]Osaka Univ, Japan, [2]NIBB, Japan*

This paper confirmed that use of a computer generated hologram that makes the size of the generated spots smaller than the single diffraction limited can improve the lateral spatial resolution of the laser scanning fluorescence microscopy.

----- Lunch 12:00-13:15 -----

**[BISC2] 13:15-15:00**
**Optical Coherence Tomography**
Chair: Yuan Luo
*National Taiwan University, Taiwan*

**BISC2-1 13:15** ***Invited***

### Endoscopic optical coherence tomography and angiography for gastroenterology applications

Hsiang-Chieh Lee[1,2], Kaicheng Liang[2], Osman O. Ahsen[2], Zhao Wang[2], Marisa Figueiredo[3], Benjamin Potsaid[2,4], Vijaysekhar Jayaraman[5], Qin Huang[3], Hiroshi Mashimo[3,6], James G. Fujimoto[2]
*[1]National Taiwan Univ, Taiwan, [2]Massachusetts Institute of Technology, USA, [3]VA Boston Healthcare System, USA, [4]Thorlabs Inc., USA, [5]Praevium Research Inc., USA, [6]Harvard Medical School, USA*

Endoscopic optical coherence tomography (OCT) angiography enables volumetric coregistered architectural and microvasculature imaging of the human gastrointestinal tract in vivo. In this talk, we will discuss technical advances and clinical gastroenterology applications with the endoscopic OCT angiography technique.

## HEDS <Room 311+312>

**[HEDSp11]**

Poster session program p.116

----- Lunch 12:00-14:00 -----

# Oral, Thursday, 26 April AM

## ICNN <Room 414+415>

**ICNN4-2 11:30**

**Quantum-Dot Nanolaser Integrated on a Silicon Waveguide Buried in Silicon Dioxide by Transfer Printing**

Alto Osada[1], Yasutomo Ota[1], Ryota Katsumi[2], Katsuyuki Watanabe[1], Satoshi Iwamoto[1,2], Yasuhiko Arakawa[1,2]

*[1]Institute for Nano Quantum Information Electronics, The University of Tokyo, Japan, [2]Institute of Industrial Science, The University of Tokyo, Japan*

We report the hybrid integration of a quantum dot nanolaser on silicon photonic circuits using transfer printing. The pick-and-place assembly method facilitates the integration of a nanolaser on a single CMOS-processed silicon waveguide.

**ICNN4-3 11:45**

**Observation of Anomalous Er Emission in a Er,O-codoped GaAs-based Two Dimensional Photonic Crystal Nanocavity**

Natsuki Fujioka, Masayuki Ogawa, Taiki Kishina, Ryoma Higashi, Masahiko Kondow, Jun Tatebayashi, Yasufumi Fujiwara

*Graduate School of Engineering, Osaka University, Japan*

We report on the fabrication of a GaAs:Er,O-based two-dimensional PhC nanocavity and the observation of characteristic behavior of Er emission from the nanocavity.

----- Lunch Break 12:00-13:00 -----

**[ICNN5p] 13:00-14:30**
**Poster Session**
**<Exhibition Hall A>**

Poster session program p.121-

## IoT-SNAP <Room 413>

**IoT3-2 11:30**

**Evaluation of multi-mode fibers for 28GHz RF transmission**

Takamitsu Aiba[1], Satoshi Tanaka[1], Toshinori Suzuki[1], Atsushi Kanno[2], Naokatsu Yamamoto[2], Tetsuya Kawanishi[3], Tomohiro Wakabayashi[1]

*[1]YAZAKI CORPORATION, Japan, [2]National Institute of Information and Communications Technology, Japan, [3]Waseda University, Japan*

We evaluate impacts of multi-mode fiber characteristics such as fiber length and bending condition for 28 GHz RF transmission.

**IoT3-3 11:45**

**Photonic Microwave Time Delays Using Nonlinear Dynamics of Semiconductor Lasers for Antenna Remoting Applications**

Sheng-Kwang Hwang, Kun-Lin Hsieh, Chin-Lung Yang

*National Cheng Kug University, Taiwan*

Microwave time delay using semiconductor laser dynamics is investigated. A tunable range of 90 ps over a bandwidth of 4 GHz at 40 GHz is realized by adjusting the power or frequency of optical inputs.

----- Lunch 12:00-13:30 -----

**[IoT4] 13:30-17:00**
**Core Technologies**
Chairs: Takahiro Ishii
*Fujikura Ltd., Japan*
Akira Yamada
*DOCOMO R&D Center, Japan*

**IoT4-1 13:30** *Invited*

**A Platform PRINTEPS to Develop Practical Intelligent Robot Applications**

Takahira Yamaguchi

*Keio University, Japan*

We are developing PRactical INTEligent aPplicationS (PRINTEPS), which is a user-centric platform to develop integrated intelligent applications only by combining four types of modules such as knowledge-based reasoning, speech dialog, image sensing and motion management..

## LDC <Room 301>

**LDC5-6 11:45** *Invited*

**GaN-based Laser Diodes for Automotive Applications**

Takashi Miyoshi, Shingo Masui, Shin-ichi Nagahama

*Nichia Corporation, Japan*

GaN-based single mode blue and green laser diodes (LDs) were fabricated on c-plane GaN substrates. The wall plug efficiency were 26.5% in 453nm and 12.3% in 515nm, respectively.

----- Lunch 12:15-13:30 -----

**[LDC6] 13:30-15:00**
**Speckle/Color**
Chairs: Young-Joo Kim
*Yonsei University, Korea*
Shigeo Kubota
*Oxide Corp., Japan*

**LDC6-1 13:30** *Invited*

**The Development of Speckle Reduction Technologies in Our Group for Laser Projection Displays: a Short Summary**

Zhaomin Tong

*Shanxi University, China*

In this paper, speckle reduction methods developed in our group are reviewed. The methods include polarization diversity, binary phase diffuser, MEMS scanning mirror, and non-sequential technique.

## LEDIA <Room 411+412>

----- Lunch Break 11:42-13:00 -----

**[LEDIAp2] 13:00-14:30**
**Poster Session**
**<Exhibition Hall A>**

Poster session program p.122-

# Oral, Thursday, 26 April AM



## LIC <Room 302>

**LIC2-2 11:30**

**Investigation on increase of ignition probability by using laser induced ignition with burst pulse in aerospace engine**

Yoshiki Matsuura[1], Masahiro Sasaki[1], Jun Izawa[2], Mitsunori Itou[2], Takahisa Nagao[2]
*[1]IHI Aerospace Co., LTD., Japan, [2]IHI Co., LTD., Japan*

IHI Aerospace has studied on the laser ignition device for Oxygen/Methane thruster with sub-nanosecond pulse laser which can produce 10 kHz order burst pulses. In this study, the ignition probability is going to be evaluating with multi-burst pulse mode.

**LIC2-3 11:45**

**The aging properties of dichroic films used in laser ignition systems**

Duo Tang, Yong Li, Wenzhi Qin, Xiangbo Ji, Yuan Gao, Zhihao Wang, Liang Wang
*Institute of Chemical Materials, CAEP, China*

Two dichroic films were prepared to investigate their aging properties. Results indicate that the environmental viability of dichroic films can be significantly improved by carefully tailoring their micro-structure.

----- Lunch 12:00-13:30 -----

**[LIC3] 13:30-15:00**
**Advanced ignition systems and applications (3)**
Chair: Takuma Endo
*Hiroshima Univ., Japan*

**LIC3-1 13:30** ***Invited***

**Laser spark plug developments for engine ignition**

Geoffrey Dearden[1], Nicolaie Pavel[2], Mark Bärwinkel[3], Peter Heinz[3], Dieter Brüggemann[3], Gabriela Croitoru[2], Oana Valeria Grigore[3]
*[1]University of Liverpool, School of Engineering, UK, [2]National Institute for Laser, Plasma and Radiation Physics, Laboratory of Solid-State Quantum Electronics, Romania, [3]University of Bayreuth, Department of Engineering Thermodynamics & Transport Processes, Germany*

Progress in laser ignition research, targeting laser source or laser spark plugs with dimensions and properties suitable for engine operation is outlined. Paths taken to build laser spark plugs and test engine results are described.

## LSC <Room 213>

**LSC5-4 11:45** ***Invited***

**Ultrafast Nonlinear Ionization of Atoms in Intense EUV/NIR Laser Fields**

Mizuho Fushitani
*Department of Chemistry, Graduate School of Science, Nagoya University, Japan*

Shot-by-shot photoelectron spectroscopy with EUV-FEL and/or NIR laser pulses has been employed to simple rare gas atoms to investigate ultrafast nonlinear phenomena including multiple ionization and coherent excitations in multiphoton processes.

----- Lunch 12:15-13:15 -----

**[LSCp6] 13:15-13:45**
**LSC Poster Session**
**<Exhibition Hall A>**

Poster session program p.123

## LSSE <Room 316>

**[LSSEp4]**

Poster session program p.117

----- Lunch 12:00-13:30 -----

**[LSSE5] 13:30-15:00**
**Energy Production and Transmission**
Chair: Akihiko Nishimura
*Japan Atomic Energy Agency, Japan*

**LSSE5-2 13:30** ***Invited***

**R&D status of heat utilization technologies for high-temperature gas-cooled reactor and solar energy**

Odtsetseg Myagmarjav[1], J. Iwatsuki[1], N. Tanaka[1], H. Noguchi[1], Y. Kamiji[1], I. Ioka[2], M. Nomura[3], T. Yamada
*[1]Japan Atomic Energy Agency, Japan, [2]Nuclear Science and Engineering Center, Japan, [3]Department of Applied Chemistry, Japan*

This paper summarizes current R&D of key devices of thermochemical water-splitting iodine-sulfur process for hydrogen production, and of process evaluation.

## OMC <Room 418>

**OMC2-2 11:30**

**Hydrodynamic Micro-Manipulation Using Optically Actuated Flow Control**

Une Butaite[1], D. Phillips[2], J. Taylor[1], G. Gibson[1]
*[1]University of Glasgow, UK, [2]University of Exeter, UK*

The advancement of techniques to control matter at small scales, optical trapping, for example, has driven the growth of nanotechnology. However, optical tweezers are limited by what types of materials and what size of objects they can affect.

**OMC2-3 11:45**

**Remote Plasmonic Optical Trapping on Silver Nanowire Induced by Nonlinear Wave-Mixing Effects**

Shuichi Toyouchi
*Katholieke Universiteit Leuven, Belgium*

We have experimentally demonstrated remote plasmonic optical trapping on a chemically-synthesized silver nanowire (AgNW) induced by nonlinear optical effects, i.e. sum-frequency generation (SFG) and four wave-mixing (FWM).

**OMC2-4 12:00**

**Manipulation of Nanoparticles with Tailored Optical Focal Field**

Guanghao Rui, B. Gu, Y. Cui
*Southeast University, China*

We develop a novel strategy to form a stable 3D manipulating of dielectric and metallic nanoparticles even under the most challenging situations through careful and purposeful engineering a vectorial optical field as the illumination.

----- Lunch 12:15-13:30 -----

**[OMC3] 13:30-15:00**
**OMC III**
Chair: Min-Kyo Seo
*KAIST, Korea*

**OMC3-1 13:30** ***Invited***

**Movement of Matter by Light-fueled Molecular Machines: Theory and Experiments**

Zouheir Sekkat
*MAScIR, Morocco*

In this talk, I will discuss the concept of the photoisomerization force and its role in the phtotinduced motion of matter supported by molecular machines.

# Oral, Thursday, 26 April AM

## PLD <Room 212>

**PLD4-3 11:30**

**Strategies for improving the laser-induced damage thresholds of dichroic coatings developed for high-transmission at 527nm and high reflection at 1054nm**

Ella S. Field, D. Kletecka
*Sandia National Labs., USA*

We report on progress for increasing the laser-induced damage threshold of dichroic beam combiner coatings for high transmission at 527 nm and high reflection at 1054 nm (22.50 angle of incidence, S-polarization).

**PLD4-4 11:45**

**Investigation on water vapor transport of e-beam coatings by employing a PIAD capping layer**

Tingting Zeng[1,2], M. Zhu[1], Y. Chai,[1], C. Yin[1,2], N. Xu[1,2], J. Shao[1]
*[1]Shanghai Institute of Optics and Fine Mechanics, China, [2]Univ. of Chinese Academy of Sciences, China*

The large aperture multilayer coatings by electronic beam deposition are widely used in high power laser systems, e.g. National Ignition Facility, ShenGuang series big laser Facilities, and so on, because of high laser-resistance, surface uniformity, as well as good optical performance.

----- Lunch 12:00-13:00 -----

**[PLD5] 13:00-15:00**
**Defects and DUV**
Chair: Meipin Zhu
*Shanghai Inst. of Optics and Fine Mechanics, China*

**PLD5-1 13:00** ***Invited***

**UV laser-induced degradation of nonlinear optical borate crystals**

Masashi Yoshimura[1,2], R. Murai[1], Y. Takahashi[1], Y. Mori[1,2]
*[1]Osaka University, Japan, [2]SOSHO CHOKO Inc., Japan*

There is an increasing demand for deep ultraviolet (UV) sources in industrial fields such as high-resolution inspection and advanced material processing. CsLiB6O10 (CLBO) is one of nonlinear optical crystal suitable for generating DUV output with wavelength below 300 nm [1].

**PLD5-2 13:30**

**Study of laser-induced damage and defect by multiple pulses irradiation for silica glasses**

Shinji Motokoshi[1,3], Y. Takemura[2], H. Ogawa[2], M. Yoshida[2], K. Fujioka[3], T. Jitsuno[3], M. Yoshimura[3]
*[1]Institute for Laser Technology, Japan, [2]Kindai university, Japan, [3]Osaka Univ., Japan*

The Laser-induced damage threshold (LIDT) of optics decreases with increase irradiation laser pulse number and pulse frequency.

## SLPC <Room 416+417>

**[SLPCp8]**

Poster session program p.117-

----- Lunch 12:00-13:30 -----

**[SLPC9] 13:30-15:00**
**Cutting and Welding**
Chairs: Yasuhiro Okamoto
*Okayama University, Japan*
Takahiro Nakamura
*Tohoku University, Japan*

**SLPC9-1 13:30** ***Invited***

**Sensors in laser materials processing: Are they finally ready to take the lead?**

Ruediger Moser[1], Matthias Strebel[1], Tobias Beck[2], Stephan André[2], Martin Schoenleber[2], Markus Kogel-Hollacher[1]
*[1]R&D, Precitec GmbH & Co. KG, Gaggenau, Germany, [2]R&D, Precitec Optronik GmbH, Neu-Isenburg, Germany*

This contribution to the SLPC conference will report on industrial solutions for laser processing implemented in a production line which support the Industry 4.0 aspects of flexible manufacturing, condition monitoring and smart maintenance to reduce machine downtime and facilitate self optimisation.

## XOPT <Room 313+314>

**[XOPTp9 Poster Session]**

Poster session program p.119-

----- Lunch 12:00-13:30 -----

**[XOPT10] 13:30-15:00**
**Optics IV (ML/diffractive)**
Chair: Wataru Yashiro
*Tohoku University, Japan*

**XOPT10-1 13:30** ***Invited***

**Multilayer Laue Lens Fabrication and Measurement Results**

Raymond P. Conley[1,2], Nathalie Bouet[2], Albert T. Macrander[1], Jörg Maser[1], Deming Shu[1], Yong S. Chu[2], Juan Zhou[2], Evgeny Nazaretski[2], Hanfei Yan[2], Xiaojing Huang[2]
*[1]APS, Argonne National Laboratory, USA, [2]NSLS-II, Brookhaven National Laboratory, USA*

Multilayer Laue lens have been produced with a new material system of $WSi_2$/Al-Si and reach 102 µm in deposition thickness, the largest MLL reported. Also, efficiency measurements of a series of wedged MLLs are presented.

# Oral, Thursday, 26 April PM

## ALPS <Room 303>

**[ALPSp]**

Poster session program p.123-

## BISC <Room 419>

**BISC2-2 13:45**

**Evaluation of photodamage with polarization-sensitive optical coherence tomography**

Trung Nguyen Hoang, Cheng Yu Lee, Meng-Tsan Tsai
*Chang Gung University, Taiwan*

Polarization sensitive optical coherence tomography (PS-OCT) is an extension of conventional optical coherence tomography (OCT) which enable the function to investigate birefringence characteristic of materials of biological tissue.

**BISC2-3 14:00**

**A 2.8-mm beam diameter system for retinal imaging with OCT and adaptive optics**

Maddipatla Reddikumar, Joel Cervantes, Yukitoshi Otani, Barry Cense
*Utsunomiya Univ, Taiwan*

A less-complex 2.8-mm beam diameter spectral domain optical coherence tomography system with an adaptive optics module presented. In this system a Shack-Hartmann wavefront sensor used for aberration sensing and the Deformable mirror used for aberration correction.

**BISC2-4 14:15**

**Study on photothermolysis with multi-functional, high-resolution optical coherence tomography**

Tai-Ang Wang[1], Ming-Che Chan[1], Meng-Tsan Tsai[2]
*[1]National Chiao Tung University, Taiwan, [2]Chang Gung University, Taiwan*

A high-resolution OCT is developed for observation of photothemolysis effect. Using a compact supercontinuum generation laser to achieve high resolution, our HROCT is centered at 750nm, with 300nm bandwidth, and axial resolution < 1 micron.

**BISC2-5 14:30**

**Motion artifacts in endoscopic catheter-based images: simulation and motion correction method**

Elham Abouei[1], Anthony M. D. Lee[2], Geoffrey Hohert[2], Michelle C. Cua[2], Pierre Lane[2]
*[1]Univ of British Columbia, Canada, [2]BC cancer research center, Canada*

A model of motion artifacts for 3D/2D rotational pullback catheter data and a motion correction method called azimuthal en face image registration is presented. Qualitative and quantitative evaluations of the method are analysed for OCT-AFI images.

**BISC2-6 14:45**

**Assessment of micro-optical coherence tomography (μOCT) as an imaging tool for pancreatic disease diagnosis**

Chi Hu[1], Linbo Liu[2]
*[1]Northwestern Polytechnical University, China, [2]Nanyang Technological University, Singapore*

The feasibility of μOCT as an imaging tool for pancreatic disease diagnosis is evaluated.Ex vivo experiments with both normal tissues and those with pancreatic edema are conducted to verify the applicability of μOCT

----- Break 15:00-15:30 -----

## HEDS <Room 311+312>

**[HEDS12] 14:00-15:05**
**Special Session**
Chair: Ryosuke Kodama
*Osaka University, Japan*

**HEDS12-1 14:00** ***Dedication Remarks***

**TBD**

Ryosuke Kodama[1,2]
*[1]Graduate School of Engineering, Osaka University, Japan, [2]Institute of Laser Engineering, Osaka University, Japan*

TBD

**HEDS12-2 14:05** ***Special***

**TBD**

Pikuz Tatiana
*Graduate School of Engineering, Osaka University, Japan*

TBD

**HEDS12-3 14:35** ***Special***

**TBD**

Tetsuya Kawachi
*Kansai Photon Science Institute, QST, Japan*

TBD

----- Break 15:05-15:30 -----

# Oral, Thursday, 26 April PM

## ICNN <Room 414+415>

**[ICNN5p]**

Poster session program p.121-

**[ICNN6] 14:30-15:45**
**Silicon Photonics**
Chair: R. Taylor
*University of Oxford, UK*

**ICNN6-1 14:30** *Invited*

**Efficient Phase Modulation based on Si Hybrid MOS Capacitor for Universal Photonic Integrated Circuits**
Mitsuru Takenaka, Shinichi Takagi
*The University of Tokyo, Japan*
Owing to the large electron-induced refractive index change in InGaAsP, we have successfully demonstrated efficient, low-loss, and low-power optical phase modulation by using the Si hybrid MOS capacitor, suitable for large-scale universal PICs.

**ICNN6-2 15:00**

**Membrane Buried Heterostrucutre Lasers Integrated on Silicon Nanowire Waveguide**
Takuma Aihara, Tatsurou Hiraki, Koji Takeda, Koichi Hasebe, Takuro Fujii, Tai Tsuchizawa, Takaaki Kakitsuka, Shinji Matsuo
*NTT Device Technology Laboratories, NTT Corporation, Japan*
We present a 2-mm-long lateral current-injection membrane buried heterostructure laser on a 200-nm-thick Si waveguide. The maximum output power emitted from the Si waveguide is 36 mW.

## IoT-SNAP <Room 413>

**IoT4-2 14:00** *Invited*

**Trend of Ethical, Legal, Social and Economic Issues on AI Related Technology for Social Implementation**
Yukiko Horikawa[1,2], Norihiro Hagita[1,2], Takahiro Miyashita[1,2]
*[1]ATR, Japan, [2]Intelligent Robotics and Communication Laboratories, Japan*
Trends of domestic and international Ethical, Legal, Social and Economic issue's discussion will be introduced.

**IoT4-3 14:30**

**Information Centric Communication based on MQTT over Layer 2 Networks**
Yuya Sasaki[1], Tetsuya Yokotani[2]
*[1]Kanazawa Institute of Technology Graduate School, Japan, [2]Kanazawa Institute of Technology, Japan*
We discuss application protocols for IoT over legacy communication networks, and then propose operations of MQTT over IP based on Layer 2 networks.

**IoT4-4 14:45**

**Optimizing Data Collection Route of Mobile Sink in On-Demand Wireless Sensor Networks employing Wake-up Receiver**
Akitoshi Asada, Hiroyuki Yomo
*Kansai University, Japan*
In this paper, we investigate route control of a drone, which is used as a mobile sink, for on-demand sensor networks employing a wake-up receiver.

----- Break 15:00-15:30 -----

## LDC <Room 301>

**LDC6-2 14:00**

**Image Resolution of Raster-scan Laser Mobile Projectors Considering Color Speckle Effects**
Junichi Kinoshita[1], Akira Takamori[1], Kazuhisa Yamamoto[1], Kazuo Kuroda[2], Koji Suzuki[3]
*[1]Osaka University, Japan, [2]Utsunomiya University, Japan, [3]Oxide Corporation, Japan*
Image resolution of raster-scan laser mobile projectors was analyzed considering color speckle using a high-speed speckle measurement device. Color speckle has an effect of widening the chromaticity range of various color shifting behavior.

**LDC6-3 14:15**

**Light Source Coherence and the Impact of Diffusers on the Image Quality of a Holographic Display System**
Yuanbo Deng, Daping Chu
*University of Cambridge, UK*
We show the relationship between the spatial and temporal coherences of the light source and the image sharpness and speckle in a linear holographic display system and the change due to adding a diffuser.

**LDC6-4 14:30**

**Theoretical Analysis of Angular Dependency of Speckle Contrast**
Makio Kurashige, Kazutoshi Ishida
*Dai Nippon Printing Co., Ltd., Japan*
Angular characteristics of speckle contrast under the moving diffuser condition was analyzed based on the speckle reduction theory. The result was well matched with the theoretical assumption in this report.

**LDC6-5 14:45**

**Measurement of Chromaticity and Photometric Quantity of Laser Displays by the Discrete Centroid Wavelength Method**
Keisuke Hieda, Tomoyuki Maruyama, Tomohiro Takesako, Fumio Narusawa
*HIOKI E.E. CORPORATION, Japan*
The discrete centroid wavelength method can simultaneously measure the centroid wavelength and radiometric quantity of three-color lasers. The accuracy of this new method was experimentally verified by comparing with an optical spectrum analyzer and Si-photodiode.

----- Break 15:00-15:30 -----

## LEDIA <Room 411+412>

**[LEDIAp2]**

Poster session program p.122-

**[LEDIA3] 14:30-15:45**
**Novel Application & Materials**
Chairs: Ryuji Katayama
*Osaka University, Japan*
Je Won Kim
*Namseoul University, Korea*

**LEDIA3-1 14:30** *Invited*

**LED Technology for Dental Applications**
Paul Michael Petersen
*Technical University of Denmark, Denmark*
LEDs have a large potential in many dental and oral applications. Areas such as photo polymerization, fluorescence imaging, photodynamic therapy, and photoactivated disinfection are important future candidates for LED based diagnostics and treatment in dentistry.

**LEDIA3-2 15:00**

**Organosilicon-Functionalized Carbon Dots Based White LED**
Yunfeng Wang[1], Zhengmao Yin[3], Chuanjian Zhou[2], Zheng Xie[1], Shuyun Zhou[1]
*[1]The HongKong Polytechnic University, China, [2]The HongKong Polytechnic University, China, [3]College of Materials Science and Engineering, Qingdao University of Science and Techlogy, China*
Organisilicon functionalized carbon dots can be used as optical conversion materials in the application of dichromatic and trichromatic White LED which can meet high requirement for lighting and display.

# Oral, Thursday, 26 April PM

## LIC <Room 302>

### LIC3-2 14:00

**The influence of film structure on AL/PTFE multilayer laser ignition**

Xiujuan Sun, Qiubo Fu
*Institute of Chemical Materials, CAEP, China*

Al/PTFE multilayer films with different structures were prepared and single pulsed laser loading tests were conducted, results showed that the multilayered structure influences the reaction, and pulsed width have a dominate influence on the effects

### LIC3-3 14:15

**Laser ignitions for non-solvent ionic liquid propellant based on Ammonium dinitramide**

Noboru Itouyama[1], Hiroto Habu[2]
*[1]The University of Tokyo, Japan, [2]Japan Aerospace Exploration Agency (JAXA), Japan*

This study was focused on the breakdown laser ignition for high performance and low toxicity ionic liquid propellant based on high energetic materials, and proposed the conceivable thruster system with this propellant.

### LIC3-4 14:30

**Direct initiation of detonation using laser ablation**

Kazuhiro Ishii, Sakiko Ishihara, Hidefumi Kataoka
*Yokohama National Univesity, Japan*

The critical energy of direct initiation of detonation induced by laser ablation, which is estimated from the energy conversion efficiency, is in good agreement with the previous experimental data.

### LIC3-5 14:45

**On the performances of a 4-cylinder automobile engine with classical spark plug and laser ignition systems**

Adrian Birtas[1], Nicolae Boicea[1], Florin Draghici[2], Radu Chiriac[3], Gabriela Croitoru[4], Mihai Dinca[4,5], Nicolaie Pavel[4]
*[1]Renault Technologie Roumanie, Romania, [2]University Politehnica of Bucharest, Faculty of Electronics, Telecommunications and Information Technology, Romania, [3]University Politehnica of Bucharest, Faculty of Mechanical Engineering, Romania, [4]National Institute for Laser, Plasma and Radiation Physics, Laboratory of Solid-State Quantum Electronics, Romania, [5]University of Bucharest, Faculty of Physics, Romania*

A 4-cylinder automobile engine was ignited by classical spark plugs as well as by laser sparks. Engine efficiency parameters were registered at 2000-rpm speed and 2-bar BMEP for stoichiometric and lean mixtures up to lambda~1.25.

----- Break 15:00-15:30 -----

## LSC <Room 213>

**[LSC7] 13:45-15:45**
**Ultrafast Speed 1**
Chair: Shin-ichi Adachi
*Photon Factory, Institute of Materials Structure Science (IMSS), KEK, Japan*

### LSC13-2 13:45 *Invited*

**Materials Informatics based on Reliable Materials Database**

Yoshiyuki Kawazoe[1,2]
*[1]The New Industry Creation Hatchery Center, Tohoku University, Japan, [2]Physics and Nanotechnology, SRM Institute of Science and Technology, India*

Materials Informatics (MI) is expected to open a new horizon of materials research. We propose a reliable band-gap engineering method using all-electron full-potential approach TOMBO with deep-learning technology.

### LSC7-1 14:15 *Invited*

**Simultaneous Photon Emission from X-ray to THz Wave from Aqueous Solutions Irradiated by Focused Femtosecond Laser Pulses**

Koji Hatanaka
*Research Center for Applied Sciences, Academia Sinica, Taiwan*

Simultaneous emission/detection of X-ray and THz wave from aqueous solutions irradiated by focused femtosecond laser pulses in air will be introduced.

### LSC7-2 14:45 *Invited*

**New Trend of Ultrafast EUV Spectroscopy Towards Petaherz-Scale Solid State Technology**

Katsuya Oguri, H. Mashiko, K. Kato, H. Gotoh
*NTT Basic Research Laboratories, NTT Corporation, Japan*

We introduce our recent research activities in the development of ultrafast EUV spectroscopy techniques based on attosecond high-order harmonic sources and its application to various solid electron systems from wide-gap semiconductors to 2D materials.

## LSSE <Room 316>

### LSSE5-3 14:00 *Invited*

**Corrosion resistance of aluminum coated stainless steel in carbonate molten salts**

Kohji Nagashima
*Kyoto University, Japan*

For increasing the maximum operating temperature of CSP plants, the corrosion test of Al coated SUS310S was performed using carbonate molten salts at 650 degrees Celsius.

### LSSE5-4 14:30 *Invited*

**Solar-thermal energy conversion using solar selective absorbers based on semiconducting beta-FeSi2**

Okuhara Yoshiki[1], Tomohiro Kuroyama[1], Daisaku Yokoe[1], Takeharu Kato[1], Masasuke Takata[1], Takuhito Tsutsui[2], Kazuto Noritake[2]
*[1]Japan Fine Ceramics Center, Japan, [2]Toyota Industries Corporation, Japan*

A solar selective absorbing coating, combining the interband absorption of beta-FeSi2 with the thermally stable low-emissivity of a Ag layer, was proposed for efficient photo-thermal energy conversion at high temperatures.

----- Break 15:00-15:30 -----

## OMC <Room 418>

### OMC3-2 14:00

**Optical Vortex Induced Chiral Mass-Transport of Azo-Polymer Through Two Photon Absorption**

Keigo Masuda[1], S. Nakano[1], Y. Kinezuka[1], M. Ichijo[1], R. Shinozaki[1], K. Miyamoto[1,2], T. Omatsu[1,2]
*[1]Graduate School of Advanced Integration Science, Chiba University, Japan, [2]Molecular Chirality Research Center, Chiba University, Japan*

Azo-polymer exhibits mass-transport owing to cis-trans photo-isomerization upon irradiation of visible light, resulting in the establishment of a surface relief.

### OMC3-3 14:15

**Thermophoresis-assisted Optical trapping of Pyrene-labeled Hydrophilic Polymer Chains**

Kenta Ushiro[1], T. Shoji[1], T. Asoh[1], F. Kato[2], K. Murakoshi[2], Y. Tsuboi[1]
*[1]Osaka City University, Japan, [2]Hokkaido University, Japan*

We found that plasmonic optical trapping of soft nanomaterials were driven not only by an enhanced optical force but also by thermophoretic force.

### OMC3-4 14:30

**Sub-Millimeter Helical Fiber Created by Bessel Vortex Beam Illumination**

Junhyung Lee[1], Y. Arita[2,3], R. Matsuo[1], S. Toyoshima[1], K. Miyamoto[1,2], K. Dholakia[1,3], T. Omatsu[1,2]
*[1]Graduate School of Science and Engineering, Chiba University, Japan, [2]Molecular Chirality Research Center, Chiba University, Japan, [3]SUPA, School of Physics & Astronomy, University of St Andrews, UK*

We fabricated the self-writing of sub-millimeter helical fibers in an ultraviolet photo-cure resin by irradiation of optical vortex beam irradiation in single photon regime.

----- Break 14:45-15:15 -----

# Oral, Thursday, 26 April PM

## PLD <Room 212>

**PLD5-3 13:45**

**Laser damage measurement of commercially available UV fused silica at 193nm**

Xingliang Song, P. Sha, J. Rui, G. Liu, B. Liu, J. Zhao, Y. Zhou, J. Yang, G. Xiong, Y. Wang
*Academy of Opto-Electronics, CAS, China*

Fused silica is considered as a more flexible material in the UV spectrum. To get the actual performance of fused silica made optical window, it is necessary to study its LIDT.

**PLD5-4 14:00**

**Transmissivity testing of calcium fluoride windows under high pulse repetition rate laser radiation at 193nm**

Xingliang Song[1,2], Y. Fan[1], P. Sha,[1], H. Zong[1,2], H. Li[1], J. Zhao[1], Y. Zhou[1], J. Yang[1], G. Xiong[1], Y. Wang[1]
*[1]Academy of Opto-Electronics, CAS, China, [2]Univ. of Chinese Academy of Sciences, China*

Calcium fluoride(CaF2) is the most recognized optical material for laser optics under 200nm. CaF2 laser windows are categorized into different grades according to material purity level.

**PLD5-5 14:15**

**Influence of bulk defects on bulk damage performance of fused silica optics at 355-nm pulse laser**

Jin Huang
*China Academy of Engineering Physics, China*

We demonstrate the effects of typical bulk defects of fused silica on bulk damage threshold under nanosecond UV pulse laser. A new test method is built to evaluate laser induced bulk damage performance more reasonably.

**PLD5-6 14:30**

**Interstitial O2 and Si-H stretching bond defects absorption produced in fused silica during laser-induced damage**

Chunyan Yan, B. Liu, X. Ju
*Univ. of Science and Technology Beijing, China*

Fused silica irradiated with 6.8-ns 355-nm laser pulses is studied by micro-Raman scattering spectroscopy.

**PLD5-7 14:45**

**Absorption enhancement by laser-induced defects in fused silica**

Takahisa Jitsuno[1], S. Motokoshi[2], M. Yoshimura[1]
*[1]Osaka Univ, Japan, [2]Institute for Laser Technology, Japan*

Absorption enhancement phenomena by laser-induced defects have been investigated experimentally in fused silica with 157 nm F2 laser pulse.

----- Break 15:00-15:30 -----

## SLPC <Room 416+417>

**SLPC9-2 14:00**

**High-quality high-speed welding of aluminum with 16 kW average laser power**

Christian Hagenlocher, Florian Fetzer, Rudolf Weber, Thomas Graf
*Institut fuer Strahlwerkzeuge, University of Stuttgart, Germany*

High laser powers enable welding of aluminum alloys with very high feed rates. X-ray videos show a constant capillary without any fluctuations. The resulting weld is free of pores and shows a constant penetration depth.

**SLPC9-3 14:15**

**High power fiber laser welding of aerospace alloys with filler wire**

Mohammed Naeem
*Engineering/ Application, Prima Power Laserdyne, USA*

Work has been carried at Prima Power Laserdyne to develop laser and processing parameters to produce welds with nickel and titanium aerospace alloys to produce good quality welds that meet the stringent requirements of the aerospace industry.

**SLPC9-4 14:30**

**Latest laser welding technology - Potentials for difficult to weld steel grades**

Matthias Beranek
*TRUMPF Laser- und Systemtechnik GmbH, Germany*

With 'Modulated Laserwelding' TRUMPF is introducing a novel solid state laser technology to solve the problems and challenges in laserwelding of high strength steel grades opening up a whole new set of possibilities for parts designs and usecases.

**SLPC9-5 14:45**

**High aspect ratio laser cutting of CFRP using nanosecond UV laser pulses**

Masahiro Moriyama[1,7], Akira Mizutani[2], Shuntaro Tani[4], Ryosuke Nakamura[2], Atsushi Kosuge[4], Isao Ito[4], Zhigang Zhao[4], Takashi Hira[1], Yohei Kobayashi[4,6], Hiroharu Tamaru[1,6], Norikatsu Mio[3,6], Makoto Kuwata-Gonokami[5], Junji Yumoto[1, 6]
*[1]Institute for Photon Science and Technology, The University of Tokyo, Japan, [2]Department of Applied Physics, The University of Tokyo, Japan, [3]Photon Science Center, The University of Tokyo, Japan, [4]Institute for Solid State Physics, The University of Tokyo, Japan, [5]Department of Physics, The University of Tokyo, Japan, [6]Research Institute for Photon Science and Laser Technology, The University of Tokyo, Japan, [7]Toray Industries, Inc., Japan*

Laser processing of CFRPs for aircraft using nanosecond UV laser pulses was studied. As a result of this study, high aspect ratio laser cutting of more than 80 on CFRPs was achieved.

----- Break 15:00-15:30 -----

## XOPT <Room 313+314>

**XOPT10-2 14:00**

**A tender X-ray PGM for tuning the photon energy interval 0.6 – 6 keV with a single plane grating**

Werner Jark
*Elettra - Sincrotrone Trieste, Italy*

A tender X-ray PGM for tuning 600 - 6000 eV

**XOPT10-3 14:15**

**Soft X-Ray and EUV diffraction gratings design for space and synchrotron applications**

Arnaud COTEL
*HORIBA Scientific, France*

The holographic recording technique coupled with the ion-etching process allow to achieve very high groove density up to ~6000gr/mm optimized in EUV and Soft X-Ray. We will describe the method for grating optimization.

**XOPT10-4 14:30**

**Fabrication of novel gratings to improve spatial resolution in X-ray phase imaging**

Talgat Mamyrbayev[1], Katsumasa Ikematsu[1,2], Pascal Meyer[1], Marcus Zuber[3], Angelica Cecilia[3], Atsushi Momose[2], Juergen Mohr[1]
*[1]Institute of Microstructure Technology, Karlsruhe Institute of Technology, Germany, [2]Tohoku University, Japan, [3]Institute for Photon Science and Synchrotron Radiation, Karlsruhe Institute of Technology, Germany*

The spatial resolution of X-ray grating interferometry setups is limited by the gratings period. We have designed and fabricated new parabolic shaped gratings to overcome these limits. Contrast visibility is 80%.

**XOPT10-5 14:45**

**Multilayer Optics and Scatterless Apertures for High-Brilliance X-ray Sources**

Joerg Wiesmann, Frank Hertlein, Jürgen Graf, Carsten Michaelsen
*Incoatec GmbH, Germany*

We discuss multilayer mirrors and scatterless apertures as beam conditioning components in state-of-the-art X-ray analytical equipment for home-labs and synchrotrons. Furthermore, we present applications of these components in combination with high brilliance laboratory microfocus sources.

----- Break 15:00-15:30 -----

# Oral, Thursday, 26 April PM

BISC <Room 419> | HEDS <Room 311+312>



**[BISC3] 15:30-18:00**
**Optical Imaging of Multimodal and Biomedical Information**
Chair: Tatsuki Tahara
*Kansai Univ., Japan*

**[HEDS13] 15:30-17:00**
**Thu-P2**
Chair: Rodrigo Lopez-Martens
*Laboratoire d'Optique Appliquée, France*

**BISC3-1 15:30** *Invited*

**Spatial resolution enhancement in laser scanning microscopy using vector beams**

Yuichi Kozawa[1,2], Shunichi Sato[1]
*[1]Tohoku Univ, Japan, [2]JST, PRESTO, Japan*

Cylindrical vector beams have unique features such as the formation of a small focal spot under tight focusing condition. We utilize such characteristic to enhance the spatial resolution in laser scanning microscopy.

**HEDS13-1 15:30** *Invited*

**Recent progress of platform development for experiments using XFEL combined with high-intensity laser at SACLA**

Toshinori Yabuuchi
*RIKEN SPring-8 Center, Japan*

An experimental platform using a hard x-ray FEL combined with a high-intensity laser is ready for early users' experiments starting in 2018 at the SACLA facility. The commissioning status and future perspectives will be presented.

**BISC3-2 16:00** *Invited*

**Computational imaging utilizing volume hologram**

Tomoya Nakamura, Masahiro Yamaguchi
*Tokyo Institute of Technology, Japan*

Volume hologram is a powerful tool for enabling computational imaging. This report mainly introduces the light-field imaging system utilizing volume hologram, and the talk corresponding to this report also addresses other applications of volume hologram

**HEDS13-2 16:00** *Invited*

**TBD**

Mamiko Nishiuchi
*Kansai Photon Science Institute, QST, Japan*

TBD

**BISC3-3 16:30** *Invited*

**Multimodal digital holographic microscopy for simultaneous phase and fluorescence imaging**

Xiangyu Quan[1], Osamu Matoba[1], Yasuhiro Awatsuji[2]
*[1]Kobe Univ., Japan, [2]Kyoto Inst. of Tech., Japan*

This paper introduces a new type of multimodal digital holographic microscopy for biological applications. Off-axis digital holography is applied both in 3D phase imaging and 3D fluorescence imaging. In addition, image recovery by iterative method to obtain focused fluorescence images are introduced.

**HEDS13-3 16:30**

**Generation of ultrahigh field by micro-bubble Coulomb implosion**

Masakatsu Murakami, Alex Arefiev[2], Myles-Allen Zosa[1]
*[1]Institute of Laser Engineering, Osaka University, Japan, [2]UC san diego, USA*

We propose a novel concept, Coulomb implosion, to generate an ultrahigh field to accelerate protons to relativistic energies. Coulomb-imploded bubbles behave as nano-pulsars with repeated implosions and explosions to emit protons.

# Oral, Thursday, 26 April PM

## ICNN <Room 414+415>

**ICNN6-3 15:15**

**Linear-Spectral Mach-Zehnder Interferometer with Fano-Resonant Graded-Stub Filters Based on Pillar Photonic Crystal Waveguides**

Masatoshi Tokushima
*Photonics Electronics Technology Research Association (PETRA), Japan*

We proposed a linear-spectral Mach-Zehnder interferometer with graded-stub filters based on pillar photonic crystal waveguides that can output the transmitted light from ports other than the input one.

**ICNN6-4 15:30**

**Nonlinear Al-Si-Al Plasmonic Waveguide and Its Application to A Photodetector**

Hidetaka Nishi, Tai Tsuchizawa, Maasaki Ono, Masaya Notomi, Hiroshi Fukuda, Shinji Matsuo
*NTT, Japan*

We report on observation of two-photon absorption within an Al-Si-Al plasmonic waveguide. By utilizing internal photoemission at the Al-Si boundary and nonlinear carrier generation, we applied it to a photodetector for over 45-Gbit/s data reception.

----- Break 15:45-16:00 -----

**[ICNN7] 16:00-17:30**
**Quantum Dots and Lasers**
Chair: M. Holmes
*The University of Tokyo, Japan*

**ICNN7-1 16:00** *Invited*

**Integration of III-V Nanowire Lasers on Silicon: Physics and Materials Aspects**

Jonathan James Finley
*Technical University of Munich, Germany*

see abstract book

**ICNN7-2 16:30** *Invited*

**Temperature Insensitive Quantum Dot Lasers and Optical Amplifiers**

Johann Peter Reithmaier[1], Gadi Eisenstein[2]
*[1]University of Kassel, Germany, [2]Technion-Israel, Institute of Technology, Haifa, Israel*

A review is given on the application of improved QD gain material with low temperature sensitivity for high-speed lasers and semiconductor optical amplifiers (SOAs) working in the 1.5 um wavelength range.

## IoT-SNAP <Room 413>

**IoT4-5 15:30** *Invited*

**IoT-enabled Smart Vision with AI**

Khanh VoDuc
*NVIDIA, USA*

This talk will introduce NVIDIA AI solutions enabling the brilliant future of IOT-enabled Smart Vision devices, from smart cameras to drones to robots to smart cities.

**IoT4-6 16:00**

**Traffic Emulation using a Traffic Generator on IoT Systems - Case of Surveillance Camera Traffic -**

Tetsuya Yokotani[1], Yoshiki Kuwabara[1], Kohsuke Tsuchiya[1], Koji Omote[1], Hiroaki Mukai[1], Toshiaki Tomizawa[2]
*[1]Kanazawa Institute of Technology, Japan, [2]Mitsubishi Electric Corporation, Japan*

This paper describes a way to emulate the network traffic of surveillance camera systems by developing a traffic generator for detecting security threats.

**IoT4-7 16:15**

**IoT gateway as a sensor for IoT network anomaly detection**

Koji Sato, Toshiaki Tomisawa, Hiroaki Hirai, Katsuhiro Shimizu
*Mitsubishi Electric Corporation, Japan*

This paper reports results of performance evaluation of per-flow traffic statistics monitoring function implemented on low-cost gateway equipment to realize machine learning based network anomaly detection for insecure IoT devices.

**IoT4-8 16:30**

**High-accurate visual inspection for semiconductor lasers using Convolutional Neural Network trained with original small dataset and additional synthesized images**

Hiroyuki Kusaka[1], Masahiro Kashiwagi[1], Yuya Sato[1], Masahiro Iwasaki[1], Shinichi Nakatori[1], Kiminori Kurosawa[1], Taku Taguchi[1], Masanori Muto[2], Yumi Yamada[2], Kenji Nishide[1]
*[1]FujikuraLtd., Japan, [2]Optoenergy, Inc., Japan*

A high-accurate visual inspection using CNN has been demonstrated. The accuracy of the category with a few images has been improved by adding synthesized images.

## LDC <Room 301>

**[LDC7] 15:30-17:45**
**Lasers and Light Sources**
Chairs: Ichiro Fujieda
*Ritsumeikan University, Japan*
Tetsuya Yagi
*Mitsubishi Electric Corp., Japan*

**LDC7-1 15:30** *Invited*

**Watt-class Green and Blue Laser Diodes**

Masahiro Murayama[1], Yusuke Nakayama[1], Yukio Hoshina[1], Hideki Watanabe[1], Noriyuki Fuutagawa[1], Hidekazu Kawanishi[1], Toshiya Uemura[2], Hironobu Narui[1]
*[1]Sony Corporation, Japan, [2]Toyoda Gosei Co., Ltd., Japan*

Watt-class green and blue laser diodes were successfully fabricated on semipolar {20-21} plane and c-plane GaN substrates, respectively. These lasers are promising light sources that meet the ITU-R Recommendation BT.2020 for future laser display applications.

**LDC7-2 16:00** *Invited*

**Development of RGB Light Source for Head-Up Display at Automobile**

Nan Ei Yu
*Gwangju Institute of Science and Technology, Korea*

Fiber-based RGB laser light source module is presented. A set of laser diodes are coupled with optical fiber and merged into single output with optical fiber combiner device.

**LDC7-3 16:30** *Invited*

**Progress in Self-Frequency Doubling Crystal Green Modes and Its Potential Application for Laser Display**

JiYang Wang, Haohai Yu, Huaijin Zhang
*Shandong University, China*

SFD crystals and lasers have gained renewed attention and Nd:RECa4O(BO3)3 (RE = Yor Gd) crystals, with SFD lasers becoming commercial products. The promising application of SFD green laser in laser displays was discussed.

## LEDIA <Room 411+412>

**LEDIA3-3 15:15**

**Solution Processed All Inorganic Quantum Dots Light Emitting Diodes with UV Ozone Treatment**

Hsin-Chieh Yu[1,2], Yiyang Shen[2], Hoang-Tuan Vu[2], Chih-Chiang Yang[2], Chun-Yuan Huang[3]
*[1]Institute of Lighting and Energy Photonics, College of Photonics, National Chiao Tung University, Taiwan, [2]Advanced Optoelectronic Technology Center, National Cheng Kung University, Taiwan, [3]Department of Applied Science, National Taitung University, Taiwan*

All inorganic quantum dots light emitting diodes (QLEDs) with emission wavelength of 536nm were demonstrated. The maximum current efficiency and luminance with UV ozone treatment for 3 minutes were 1.66 cd/A and 14623 cd/m2, respectively.

**LEDIA3-4 15:30**

**Photonic Conversion Mediums Based on Polymer Embedded Carbon Dots for Applications in Light Emitting/Solar Energy Harvesting Devices**

Corneliu S. Stan, Petronela Horlescu, Catalina A. Peptu
*Gheorghe Asachi Technical University, Romania*

The particular emissive properties of our Carbon Dots with PLQY>80% embedded in polymer matrices are suitable for applications as photonic conversion layers in light emitting devices or increasing the conversion efficiency of solar cells.

----- Break 15:45-16:15 -----

**[LEDIA4] 16:15-17:45**
**Advanced Devices II**
Chairs: James S. Speck
*UCSB, USA*
Gen-ichi Hatakoshi
*Waseda University, Japan*

**LEDIA4-1 16:15** *Invited*

**GaN Monolithic Integration for Lighting and Display**

Hoi Wai Choi
*The University of Hong Kong, Hong Kong*

The monolithic integration of optoelectronic and electronic devices on the GaN platform for lighting and display is discussed. Optoelectronic devices include red, green and blue LEDs achieved by strain manipulation, while SB-MOSFETs and BJTs are candidates as electronic devices.

# Oral, Thursday, 26 April PM

## LIC <Room 302>

**[LIC4] 15:30-17:00**
**Advanced applications of laser (1)**
Chair: Nicolaie Pavel
*National Institute for Laser, Plasma and Radiation Physics - INFLPR, Rumania*

**LIC4-1 15:30** *Invited*

**Short pulsed laser ablation of fluorides and thin film deposition for ultraviolet optoelectronics**

Shingo Ono[1], Fumihiro Itoigawa[1], Akira Yoshikawa[2]
*[1]Nagoya Institute of Technology, Japan, [2]Tohoku University, Japan*

Laser ablation using nanosecond or femtosecond laser pulses was applied for the fluoride thin films growth. We demonstrated the vacuum ultraviolet field emission lamps and photodetectors by employing such fluoride thin films.

**LIC4-2 16:00** *Invited*

**Effects of Laser Induced shock waves on droplets**

J. Yi, A. Renaud, L. Zimmer
*CNRS, CentraleSupélec, Université Paris-Saclay, France*

The interaction between laser induced shock-waves and droplets are investigated using Planar Imaging techniques for the shock-wave investigation and a 4D-Interferometrie Particle Imaging technique to measure position, size and velocities of droplets in the vicinity of the laser induced plasmas.

## LSC <Room 213>

**LSC7-3 15:15** *Invited*

**Ultrafast Many-Body Electron Dynamics in a Strongly-Correlated Ultracold Rydberg Gas**

Nobuyuki Takei[1,2], C. Sommer[1,2,3], C. Genes[3], G. Pupillo[4], A. Tanaka[1], M. Mizoguchi[1,2], Y. Zhang[1], S. Takeda[1,2], T. Kishimoto[1,5], H. Goto[1], K. Koyasu[1,2], H. Chiba[1,6], M. Weidemüller[7,8], K. Ohmori[1,2]
*[1]Institute for Molecular Science, National Institutes of Natural Sciences, Japan, [2]The Graduate University for Advanced Studies (SOKENDAI), Japan, [3]Max Planck Institute for the Science of Light, Germany, [4]University of Strasbourg, France, [5]The University of Electro-Communications, Japan, [6]Iwate University, Japan, [7]Universität Heidelberg, Germany, [8]University of Science and Technology of China, China*

We demonstrate a novel combination of high-density ultracold Rydberg atoms and ultrafast photonics with attosecond precision. Strong many-body correlations have been manifested in ultrafast electron dynamics observed on the attosecond time scale.

----- Break 15:45-16:00 -----

**[LSC8] 16:00-17:00**
**Ultrafast Speed 2**
Chair: Masahiro Katoh
*Institute for Molecular Science, National Institutes of Natural Sciences, Japan*

**LSC8-1 16:00** *Invited*

**Coherent Control of Optical Phonons Using Femtosecond Pulses**

Kazutaka Nakamura
*Laboratory for Materials and Structures, Institute of Innovative Research, Tokyo Institute of Technology, Japan*

We have demonstrated coherent control of optical phonons and electron-phonon coupled states in using a pair of relative phase-locked femtosecond optical pulses. The microscopic theory for the coherent control of optical phonons was developed.

## LSSE <Room 316>

**[LSSE6] 15:30-17:10**
**Remote Sensing and Laser Induced Breakdown Spectroscopy**
Chair: Takashi Fujii
*Central Research Institute of Electric Power Industry, Japan*

**LSSE6-1 15:30** *Invited*

**Lidar project for thermospheric sodium observations at EISCAT radar site in Norway**

Takuya D. Kawahara[1], Satonori Nozawa[2], Norihito Saito[3], Takuo T. Tsuda[4], Testuya Kawabata[2], Toru Takahashi[5], Satoshi Wada[3]
*[1]Shinshu Universityn, Japan, [2]ISEE, Nagoya University, Japan, [3]Photonics Control Technology Team, RIKEN Center for Advanced Photonics, Japan, [4]The University of Electro-Communications, Japan, [5]National Institute of Polar Research, Japan*

New thermospheric and daytime Na lidar observations at EISCAT radar site in Tromso (69.6N, 19.2E), Norway are planned.

**LSSE6-2 16:00** *Invited*

**Development of in-situ LIBS and laser Raman spectroscopic analyzers for deep-sea exploration**

Tomoko Takahashi[1], Soichi Yoshino[1], Yutaro Takaya[2], Tatsuo Nozaki[3], Toshihiko Ohki[1,4], Koichi Ohki[4], Tetsuo Sakka[5], Blair Thornton[1,6]
*[1]The University of Tokyo, Japan, [2]Waseda University, Japan, [3]Japan Agency for Marine-Earth Science and Technology, Japan, [4]OK Lab. Co. Ltd., Japan, [5]Kyoto University, Japan, [6]University of Southampton, UK*

LIBS and laser Raman spectroscopy have a large potential to in-situ chemical analysis for exploration of deep-sea mineral resources. In this study, development of deep-sea LIBS and laser Raman spectrometers is reported.

## OMC <Room 418>

**[OMC4] 15:15-16:15**
**OMC IV**
Chair: Pavel Zemánek
*Institute of Scientific Instruments of the ASCR, v.v.i., Czech Republic*

**OMC4-1 15:15**

**Property of Magnetic Trapping of Superconducting Sub-micron Particles**

Jun Naoi[1], Y. Takahashi[1], M. Takamune[1], Y. Nakamura[1], M. Kumakura[2], M. Ashida[3], F. Matsushima[1], Y. Moriwaki[1]
*[1]University of Toyama, Japan, [2]University of Fukui, Japan, [3]Osaka University, Japan*

Laser ablation in superfluid helium is one of the effective experimental technique for producing nano and micro particles. This technique potentially produces particles with single crystalline spherical structure.

**OMC4-2 15:30**

**Laser Induced Metal Particle Migration in Glass**

Hirofumi Hidai, A. Sawafuji, S. Matsusaka, A. Chiba, N. Morita
*Chiba Univ, Japan*

We have reported that laser-induced metal particle migration in glass. Laser illumination heated a metal particle in glass. The surrounding glass of the metal particle was also heated and softened; hence, the metal particle migrated in the glass.

**OMC4-3 15:45**

**Au nanoparticles fabricated by optical vortex ablation**

Nakamura Yuri[1], Katsuhiko Miyamoto[2], Tsukasa Torimoto[3], Yasuyuki Tsuboi[4], Takashige Omatsu[2]
*[1]Chiba univ, Japan, [2]Chiba Univ. Molecular Chirality Research Center, Japan, [3]Nagoya University, Japan, [4]Osaka City University, Japan*

We present the new structured string-shaped Au nano-structures, formed by employing the optical vortex ablation processing on an Au thin film. Such structured materials are expected to pave the way for advanced chemical reactions.

**OMC4-4 16:00**

**Fabrication of Cadmium Selenide Quantum Dots with Laser Ablation in Superfluid Helium**

Yosuke Minowa, T. Suzuki, K. Setoura, S. Ito, H. Miyasaka, M. Ashida
*Osaka Univ, Japan*

We fabricated semiconductor cadmium selenide (CdSe) quantum dots via the pulsed laser ablation in the superfluid helium. The fabricated quantum dots showed blue-shifted fluorescence due to the strong quantum confinement effect.

----- Break 16:15-16:30 -----

# Oral, Thursday, 26 April PM

PLD <Room 212> | SLPC <Room 416+417> | XOPT <Room 313+314>

**[PLD6] 15:30-17:15**
**Laser Materials**
Chair: Takahisa Jitsuno
*Osaka Univ., Japan*

**PLD6-1 15:30** *Invited*

**Highly-efficient Ho:KY(WO4)2 thin-disk lasers at 2.06 µm**

Valentin P. Petrov[1], X. Mateos[1,2,3], P. Loiko[4], S. Lamrini[2], K. Scholle[2], P. Fuhrberg[2], S. Suomalainen[5], A. Härkönen[5], M. Guina[5], S. Vatnik[6], I. Vedin[6], M. Aguiló[3], F. Díaz[3], Y. Wang[1], U. Griebner[1]
*[1]Max-Born-Institut für Nichtlineare Optik und Kurzzeitspektroskopie, Germany, [2]Univ. Rovira i Virgili, Spain, [3]LISA Laser Products OHG, Germany, [4]ITMO Univ., Russia, [5]Tampere Univ. of Technology, Finland, [6]Institute of Laser Physics, Russia*

We report on the first Holmium (Ho3+) monoclinic double tungstate thin-disk laser. It is based on a 250 µm-thick 3 at. % Ho:KY(WO4)2 active layer grown on a (010)-oriented KY(WO4)2 substrate.

**PLD6-2 16:00** *Invited*

**Functional crystal films fabricated by pulsed laser deposition**

Jacob I. Mackenzie, S. V. Kurilchik, J. A. Grant-Jacob, J. J. Prentice, R. W. Eason
*Univ of Southampton, UK*

Crystalline films grown by epitaxial deposition techniques are typically limited by growth rates to being relatively thin (~<1 micron).

**[SLPC10] 15:30-16:45**
**Blue Laser Development and Processing**
Chairs: James Bovatsek
*Spectra-physics, USA*
Masahiro Tsukamoto
*JWRI, Osaka University, Japan*

**SLPC10-1 15:30** *Invited*

**High power blue lasers development for copper material processing**

Jean-Michel Pelaprat, Matthew Finuf, Robert Fritz, Mark Zediker
*NUBURU Inc, USA*

We will report the recent development of high power blue laser, their performance and their advantages for material processing. We will further report recent application results of metal processing and in particular the bead on plate test results with a 150 Watt and a 500Watts Continuous Wave blue laser, for welding copper foils up to 1mm thick and dissimilar metals lap welding up to 250 µm.

**SLPC10-2 16:00** *Invited*

**High brightness blue direct diode laser for advanced materials processing**

K. Tojo[1], N. Wakabayashi[1], M. Yamada[1], S. Uno[1], N. Ishigaki[1], T Hiroki[1], J. Saikawa[1], S. Masuno[2], K. Asano[3], K. Asuka[4], N. Abe[2], M. Tsukamoto[2]
*[1]Device Dept., Shimadzu Corporation, Japan, [2]Joining and Welding Research Institute, Osaka University, Japan, [3]Yamazaki Mazak Corporation, Japan, [4]Nichia Corporation, Japan*

High-power, high-brightness fiber-coupled Blue Direct Diode Laser using new beam multiplexing technique to achieve 450-nm power intensity of 1.2MW/cm2 on the fiber facet for practical use of several kind of material processing will be presented.

**[XOPT11] 15:30-15:45**
**Methods**
Chair: Diling Zhu
*SLAC National Accelerator Laboratory, USA*

**XOPT11-1 15:30**

**Machine and Deep Learning Exploration for Spectral X-ray Computed Tomography Materials Classification Applications**

Edward Steven Jimenez[1], April Suknot[2], Kyle Thompson[3], Ryan Goodner[3], Srivathsan Koundinyan[1]
*[1]Sandia National Laboratories - Mission Algorithms R&S, USA, [2]Sandia National Laboratories - R&D Systems Architecture, USA, [3]Sandia National Laboratories - Non-Destructive Diagnositics, USA*

Spectral CT for Industrial Application has great potential to dramatically improve data use and quality. This work presents an exploratory investigation into the feasibility of leveraging the reconstructed waveform along with machine and deep learning

**[XOPT12] 15:45-16:30**
**Optics V (reflective/nonlinear)**
Chair: Diling Zhu
*SLAC National Accelerator Laboratory, USA*

**XOPT12-1 15:45**

**X-ray Ring-Focusing Mirror**

Hidekazu Mimura[1], Yoko Takeo[1], Hiroto Motoyama[1], Yasunori Senba[2], Hikaru Kishimoto[2], Haruhiko Ohashi[2]
*[1]The University of Tokyo, Japan, [2]Japan Synchrotron Radiation Research Institute, Japan*

We propose, fabricate, and evaluate the ring-focusing mirror that can produce the x-ray beam having the ring-shaped intensity distribution. The ring-shaped intensity successfully profiles are observed at the soft x-ray beamline (BL25SU) of SPring-8.

**XOPT12-2 16:00**

**Ghost Imaging with Paired X-ray Photons**

Aviad Schori[1,2], Denis Borodin[1,2], Kenji Tamasaku[2], Sharon Shwartz[1,2]
*[1]Bar-Ilan University, Israel, [2]RIKEN SPring-8 Center, Japan*

We observed ghost imaging by using parametrically down-converted x-ray photon pairs. We reconstructed the image of slits with nominally zero background levels. Our procedure can lead to observations of many quantum phenomena at x-ray wavelengths.

## Oral, Thursday, 26 April PM

BISC <Room 419> | HEDS <Room 311+312>

**[Closing Remarks] 16:50-17:00**
Sergei V. Bulanov[1,2]
*[1]ELi-Beamlines, Czech Republic, [2]Kansai Photon Science Institute, QST, Japan*

**BISC3-4 17:00** ***Invited***

**Fluorescent molecular force probes for rheology and mechanobiology**
Shohei Saito
*Kyoto Univ., Japan*
Fluorescent molecular force probes have been developed for rheology and mechanobiology. To realize fluorescence response to pico-Newton forces, we have explored flexible force probes based on a conformational change of flexible molecules.

**BISC3-5 17:30** ***Invited***

**Illuminating gene expression dynamics by optogenetics**
Akihiro Isomura
*Kyoto Univ., Japan*
Cells receive diverse signaling cues from their environment that trigger cascades of biochemical reactions in a dynamic manner. Live-cell imaging technologies have revealed dynamic patterns of gene activities; however it has been challenging to clarify....

## Oral, Thursday, 26 April PM

### ICNN <Room 414+415>

**ICNN7-3 17:00**

**Room-Temperature Continuous-Wave Operation of InAs/GaAs Quantum Dot Lasers on On-Axis Si (001) Just Substrate**

Jinkwan Kwoen[1], Bongyong Jang[1], Takeo Kageyama[1], Katsuyuki Watanabe[2], Yasuhiko Arakawa[1,2]
*[1]NanoQunie, The University of Tokyo, Japan, [2]IIS, The University of Tokyo, Japan*

We report the room temperature 'continuous-wave' operation of InAs / GaAs quantum dot lasers directly grown on Si (001) just substrate by miniaturizing the laser structure.

**ICNN7-4 17:15**

**Amplified Spontaneous Emission and Lasing from Cesium Lead Halide Perovskite Nanocubes**

Zhengzheng Liu[1], Zhiping Hu[2], Tongchao Shi[1], Zeyu Zhang[1], Xin Xing[1], Xiaosheng Tang[2], Juan Du[1], Yuxin Leng[1]
*[1]Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences, China, [2]Chongqing University, China*

We report tunable amplified spontaneous emission and low-threshold lasing from cesium lead halide perovskite CsPbX3 (X=Br/I/Cl) nanocubes with high quality and enhanced stability by facile low-temperature, solution-processed method.

### IoT-SNAP <Room 413>

**IoT4-9 16:45**

**Broadband infrared reflection through heavily doped and stacked polar-dielectrics**

Mohsen Janipour, Kursat Sendur
*Sabanci University, Turkey*

Polar dielectrics, like GaN and SiC, show excellent mechanical and thermal properties so they are excellent candidates for operating in extreme environments applications.

### LDC <Room 301>

**LDC7-4 17:00**

**Utilizing the Unique Properties of Ceramic Fluorescent Converters for Laser Pumped Phosphor Light-Engines in Digital Projection**

Volker Hagemann[1], Albrecht Seidl[1], Kazuyuki Inoguchi[2]
*[1]SCHOTT AG, Germany, [2]SCHOTT Nippon K.K., Japan*

Laser pumped phosphors are widely used in solid state based light-engines for digital projection. We compare the properties of ceramic converters to other solutions and present results for irradiance levels up to 230W/mm$^2$ and beyond.

**LDC7-5 17:15**

**Highly-Reliable Operation under High Case Temperature in 638-nm BA-LD**

Kyousuke Kuramoto, Shinji Abe, Motoharu Miyashita, Masatsugu Kusunoki, Takehiro Nishida, Tetsuya Yagi
*Mitsubishi Electric Corp., Japan*

638-nm dual-emitter LD with total emitter width of 150-um showed better characteristics compared with the triple-emitter of 180-um under 55 deg.C, pulse. The LD had MTTF around 26K hours, 1.9 times of the triple.

**LDC7-6 17:30**

**Spectral Study of a Side-Emitting Laser-Pumped Phosphor Layer**

Masamichi Ohta, Ichiro Fujieda
*Ritsumeikan University, Japan*

A side-emitting configuration can utilize the photoluminescence photons trapped in a laser-pumped phosphor layer. Shorter-wavelength photons are lost during lateral light propagation due to self-absorption, leading to an angle-dependent spectrum.

### LEDIA <Room 411+412>

**LEDIA4-2 16:45**

**Fabrication of 10x10 array structure of micro-LED display using Si micro-cup substrate**

Ryosuke Nawa, Takeyoshi Onuma, Tomohiro Yamaguchi, Tohru Honda
*Kogakuin Univ., Japan*

Fabrication of Si micro-cup substrate and its application for a 10x10 array structure of micro-LED display are demostrated to reduction of cross-talk.

**LEDIA4-3 17:00**

**GaAsP Tunable Single-Mode Semiconductor Laser using Periodically Slotted Structure with Simplified Fabrication Process**

So Kusumoto, Masahiro Uemukai, Ryuji Katayama
*Osaka University, Japan*

A tunable single-mode laser using a 10-micron-period slotted structure was fabricated by single-step RIE for simultaneous ridge and slotted structure formation. Single-mode lasing with a 1.56 nm tuning range was demonstrated.

**LEDIA4-4 17:15** ***Invited***

**Nano-Mold & Nano Structured LEDs**

Je Won Kim
*Namseoul University, Korea*

TBD

# Oral, Thursday, 26 April PM

## LIC <Room 302>

**LIC4-3 16:30**

**Effects of high irradiation dose on a Nd:YAG/Cr:YAG microchip composite for remote laser-induced breakdown spectroscopy (LIBS)**

Koji Tamura[1,2], Hironori Ohba[1,2], Morihisa Saeki[1,2], Tomitsugu Taguchi[1], Hwan Hong Lim[3], Takunori Taira[3], Ikuo Wakaida[2]
*[1]The National Institutes for Quantum and Radiological Science and Technology, Japan, [2]Japan Atomic Energy Agency, Japan, [3]National Institutes of Natural Sciences, Japan*

Effects of high irradiation dose on a Nd:YAG/Cr:YAG microchip composite and the giant-pulse microchip laser operation were investigated. Although emission from the composite was observed, laser operation was possible.

**LIC4-4 16:45**

**First experimental demonstration of low laser-plasma instabilities in gas-filled spherical hohlraums at laser injection angle designed for ignition target**

Yao-Hua Chen[1], Zhichao Li[2], Xufei Xie[2], Ke Lan[1,3,4], Chunyang Zheng[1,3,4], Chuanlei Zhai[1], Liang Hao[1], Dong Yang[2], Wen Yi Huo[1], Guoli Ren[1], Xiaoshi Peng[2], Tao Xu[2], Yulong Li[2], Sanwei Li[2], Zhiwen Yang[2], Liang Guo[2], Lifei Hou[2], Yonggang Liu[2], Huiyue Wei[2], Xiangming Liu[2], Weiyi Cha[2], Xiaohua Jiang[2], Yu Mei[2], Yukun Li[2], Keli Deng[2], Zheng Yuan[2], Xiayu Zhan[2], Haijun Zhang[2], Baibin Jiang[2], Wei Zhang[2], Xuewei Deng[2], Jie Liu[1,3,4], Kai Du[2], Yongkun Ding[2], Xiaofeng Wei[2], Wanguo Zheng[2], Xiaodong Chen[2], E. M. Campbell[5], Xian-Tu He[1,3,4]
*[1]Institute of Applied Physics and Computational Mathematics, China, [2]Chinese Academy of Engineering Physics, China, [3]Peking University, China, [4]Shanghai Jiao Tong University, China, [5]University of Rochester, USA*

The first experiments demonstrating low levels of LPI in spherical hohlraums with a laser injection angle of 55° are reported.

## LSC <Room 213>

**LSC8-2 16:30** *Invited*

**Visualizing Chemical Reactions in Solution with Femtosecond X-Ray Scattering**

Shin-ichi Adachi
*Photon Factory, Institute of Materials Structure Science (IMSS), KEK, Japan*

This work showcases tracking of detailed structural changes of a molecule in solution with sub-ps temporal and sub-angstrom spatial resolutions.

**[LSC9] 17:00-18:00**
**Light Source 1**
Chair: Katsuya Oguri
*NTT Basic Research Laboratories, NTT Corporation, Japan*

**LSC9-1 17:00** *Invited*

**Optical Vortex Beam from Helical Undulator**

Masahiro Katoh[1,2]
*[1]Institute for Molecular Science, National Institutes of Natural Sciences, Japan, [2]Sokendai (The Graduate University for Advanced Studies), Japan*

Recent experimental studies on optical vortex beam from helical undulators will be described as well as its underlying physics.

**LSC9-2 17:30** *Oral*

**Overview of Diffraction Gratings Technologies for High-Intense Laser, Synchrotron and FEL**

Arnaud Cotel
*HORIBA Scientific, France*

One of the key component in the high-intense lasers, synchrotron and FE is the diffraction grating used tailor the spectral properties of these light sources. We will present these gratings technologies and performances.

## LSSE <Room 316>

**LSSE6-3 16:30** *Oral*

**Spectroscopy of Sputtered Metal by Glow Discharge**

Daisuke Ishikawa, Shuichi Hasegawa
*The University of Tokyo, Japan*

As one remote sensing method, we have shown the applicability of glow discharge laser absorption emission spectroscopy of gas, liquid residue, and solid metals.

**LSSE6-4 16:50** *Oral*

**Mid-Infrared (IR) Tunable Optical Parametric Oscillator (OPO)-Based Differential Absorption Lidar (DIAL) for Methane Concentration Measurements**

Taieb Gasmi Cherifi
*Division of Science & Engineering. Saint Louis University-Madrid Campus, Spain*

We present an all solid state differential absorption lidar (DIAL) based on the mid-infrared (3 to 4.5μm) tunable Optical Parametric Oscillator (OPO) for detection of methane. We also present experimental results on atmospheric methane measurements.

## OMC <Room 418>

**[OMC5] 16:30-18:00**
**OMC V**
Chair: Takashige Omatsu
*Chiba Univ., Japan*

**OMC5-1 16:30**

**Bottle Beam Generation from A Frequency-Doubled Nd:YVO4 Laser with A Tightly End-Pumping Geometry**

J. Tung[1], Y. Ma[1], Y. Chen[2], K. Miyamoto[1], T. Omatsu[1]
*[1]Chiba University, Japan, [2]National Chiao Tung University, Taiwan*

Bottle beams with a zero-intensity zone surrounded by three-dimensional bright regions are of considerable interest in atom traps, optical shielding and imaging techniques.

**OMC5-2 16:45**

**Evaluation of Laguerre-Gaussian Beam Generated with Integrable Phase-Modulating Surface-Emitting Lasers**

Yu Takiguchi, K. Hirose, T. Sugiyama, S. Uenoyama, Y. Nomoto, Y. Kurosaka
*Hamamatsu Photonics KK, Japan*

We demonstrated direct surface-emitting of Laguerre–Gaussian beams with wavefront modulated lasers. This integrable phase-modulating surface-emitting lasers has potential to emit arbitrarily configured beam patterns without requiring any optical elements or scanning devices.

**OMC5-3 17:00**

**Analytical Representation for Structured Light Generated by Astigmatic Transformation of Hermite-Gaussian Beams**

Y. Hsieh, P. Tuan, J. Tung, K. Su, H. Liang, Y. Chen
*NCTU, Taiwan*

Theoretical wave functions are analytically derived to formulate the propagation evolution of the Hermite-Gaussian (HG) beams transformed by single lens astigmatic mode converter with arbitrary angle.

**OMC5-4 17:15**

**Parameter Optimization for Observation of High-Dimensional Effect in Orbital Angular Momentum Entanglement**

Yoko Miyamoto
*Univ of Electro-Communications, Japan*

Anharmonic behavior of coincidence count rate obtained with the hologram shifting method can be used to probe high-dimensional effect of orbital angular momentum (OAM) entangled photon pairs.

**OMC5-5 17:30**

**Generation of High-Energy Geometric Structured Beams by Off-Axis Pumped Nd:YAG/Cr4+:YAG Lasers with Degenerate Resonators**

Pi-Hui Tuan[1], Y. Hsieh[1], H. Liang[2], K. Su[1], Y. Chen[1]
*[1]National Chiao Tung University, Taiwan, [2]National Taiwan Ocean University, Taiwan*

Off-axis pumped Nd:YAG/Cr4+:YAG lasers under degenerate cavity conditions are explored to achieve high-pulseenergy geometric modes for beam transformation.

**OMC5-6 17:45**

**Shrinking Optical Vortex to the Nanoscale**

Jingbo Sun[1], Keigo Masud[1,2], Tianboyu Xu[1], Katsuhiko Miyamoto[2,3], Takashige Omatsu[2,3], Natalia M. Litchinitser[1]
*[1]The State University of New York, USA, [2]Graduate School of Advanced Integration Science, Chiba University, Japan, [3]Molecular Chirality Research Center, Chiba University, Japan*

TBD

## Oral, Thursday, 26 April PM

### PLD <Room 212>

**PLD6-3 16:30**

**Third-order-nonlinear effects in ceramics**

Efim A. Khazanov, V. Ginzburg, A. Kochetkov
*Institute of Applied Physics of the Russian Academy of Sciences, Russia*

The orientation of crystallographic axes in each ceramics grain is random. The nature of ceramics manifests itself in the presence of the effects dependent on crystal orientation.

**PLD6-4 16:45**

**Visible waveguide lasers based on femtosecond laser inscribed cladding waveguides in Pr:YLF crystal**

Hongliang Liu[1], M. Hong[2], F. Chen[3]
*[1]Nankai Univ., China, [2]National Univ. of Singapore, Singapore, [3]Shandong Univ, China*

Channel waveguide in Pr:YLF crystal is fabricated by emtosecond laser (fs-laser) micromachining system. The micro Raman (μ-Raman) spectra and scanning confocal fluorescence imaging investigations of the depressed cladding structure indicated that slight changes (with respect to widths of the emission lines and spectral positions) have been generated in the laser-modification region.

**PLD6-5 17:00**

**Design and fabrication of multiplexed volume Bragg gratings as angle amplifiers in high-power beam scanning system**

Peng Chen, Y. Jin, H. He, J. Chen, J. Zhao, J. Xu, Y. Zhang, F. Kong
*Shanghai institute of optics and fine mechanics, China*

Volume Bragg Grating (VBG) recorded in photo-thermo-refractive (PTR) glass has advantages of high diffraction efficiency, excellent wavelength selectivity and angle selectivity, high angle magnification and flexible design, and high power tolerance, making it good candidate for angle amplifier in high power beam scanning system.

### SLPC <Room 416+417>

**SLPC10-3 16:30**

**Laser cladding of pure copper with blue and IR laser**

Kohei Asano[1,6], Masahiro Tsukamoto[2], Yuji Sato[2], Ritsuko Higashino[2], Yoshihisa Sechi[3], Takahiro Hara[4], Masanori Sengoku[5], Minoru Yoshida[5]
*[1]Graduate School of Engineering, Osaka University, Japan, [2]Joining and Welding Research Institute, Osaka University, Japan, [3]ProductionTechnology Division, Kagoshima Prefectural Institute of Industrial Technology, Japan, [4]School of Engineering, Osaka University, Japan, [5]Graduate School of Science and Engineering, Kindai University, Japan, [6]Yamazaki Mazak Corp., Japan*

Laser cladding of pure copper was conducted by the laser cladding system with blue laser and that with IR laser on type 304 stainless steel plates. We investigated pure copper layers produced by both systems and indicated primacy of blue laser over IR laser.

**[SLPC 2018 Award Ceremony and Closing Remark] 16:45**
Masahiro Tsukamoto
*JWRI, Osaka University, Japan*

### XOPT <Room 313+314>

**XOPT12-3 16:15**

**Evidence for collective nonlinear interactions in x ray into ultraviolet parametric down conversion**

Denis Borodin[1], Aviad Schori[1], Jean-Pascal Rueff[2], James Ablett[2], Sharon Shwartz[1]
*[1]Bar Ilan University, Israel, [2]Synchrotron SOLEIL, France*

We present the observation of the non-monotonic spectral dependence of parametric down conversion of x rays into ultraviolet. We propose a model that includes nonlinear interactions with plasmons, which explains the existence of the resonances.

**[Closing] 16:30-16:35**
**Closing Remarks**
Kazuto Yamauchi
*Osaka University, Japan*

# Oral, Friday, 27 April AM

## ALPS <Room 511+512>

**[ALPS16-F2] 9:15-10:30**
**Terahertz Photonics 2**
Chair: Oleg A. Louchev
*Center for Advanced Photonics, RIKEN, Japan*

**ALPS16-F2-1 9:15** *Invited*

**Strong dc Precursors of Intense Laser Pulses in Electro-Optic Crystals**

Michael I. Bakunov[1], Alexey V. Maslov[1], Maxim V. Tsarev[1], Evgeny S. Efimenko[2], Sergey A. Sychugin[1]
*[1]University of Nizhny Novgorod, Russia, [2]Institute of Applied Physics, Russian Academy of Sciences, Russia*

We show that simultaneous optical rectification and multiphoton absorption of an ultrashort laser pulse in an electro-optic crystal can generate a strong dc electromagnetic precursor ahead of the laser pulse.

**ALPS16-F2-2 9:45**

**Effects of delayed feedback rates on THz wave generation using laser chaos**

Fumiyoshi Kuwashima[1], Takuya Shirao[1], Kazuyuki Iwao[1], Naoya Sakaue[1], Siori Gouda[1], Takurou Sirasaki[1], Masahiko Tani[2], Kazuyoshi Kurihara[3], Kohji Yamamoto[2], Osamu Morikawa[4], Hideaki Kitahara[2], Makoto Nakajima[5]
*[1]Department of Electrical and Electronic Engineering, Fukui University of Technology, Japan, [2]Research Center for Development of Far-Infrared Region, University of Fukui, Japan, [3]Fac. of Educ., Univ. of Fukui, Japan, [4]Chair of Liberal Arts, Japan Coast Guard Academy, Japan, [5]Institute of Laser engineering, Osaka Univ., Japan*

The generation of a stable THz wave is investigated from a photoconductive antenna excited using a chaotic oscillation in multimode semiconductor laser with optical delayed feedback by an external mirror.

## BISC <Room 419>

**[BISC4] 9:00-10:45**
**Multimodal Imaging and Devices**
Chair: Yoshihisa Aizu
*Muroran Institute of Technology, Japan*

**BISC4-1 9:00**

**Non-scanning in-vivo three-dimensional hybrid structured illumination microscopy h-speed single- particle tracking on lipid bilayer membranes**

Ju-Hsuan Chien
*National Taiwan University, Taiwan*

Demonstrate HiLo structured illumination microscopy by the use of digital micro-mirror device (DMD) and the focal tunable lens (FTL). This system are high-resolution, wide-field optically sectioning and viewing in vivo biological tissue samples without mechanical scanning.

**BISC4-2 9:15**

**Shape based pharmacokinetic fluorescence optical tomography**

Omprakash Gottam, Naren Naik
*Indian Institute of Technology Kanpur, India*

Spatially varying pharmacokinetic rates in a tissue help in identifying abnormal regions since they govern the exchange of fluorophore dye between blood plasma and tissue.

**BISC4-3 9:30**

**Fast spatial domain reconstruction for structured illumination microscopy**

Xing Zhou, Dan Dan, Baoli Yao
*Xi'an Institute of Optics and Precision Mechanics, China*

As a wide-field super-resolution (SR) technique, structured illumination microscopy (SIM) features the merits of fast imaging speed, low excitation intensity and a large field of view.

**BISC4-4 9:45**

**Visible resonance Raman spectroscopy detect key molecular biomarker vibrations to characterize for human brain gliomas**

Cheng-Hui Liu[1], Yan Zhou[2], Binlin Wu[3], Xinguang Yu[4], Gangge Cheng[2], Chunyuan Zhang[1], Cuicui Lu[5], Ke Zhu[6], Robert R. Alfano[1]
*[1]Institute for Ultrafast Spectroscopy and Lasers, USA, [2]Air Force General Hospital, China, [3]Southern Connecticut State University, USA, [4]PLA General Hospital, China, [5]Qian xuesen Laboratory of Space Technology, China, [6]Institute of Physics, Chinese Academy of Sciences (CAS), China*

Key Raman vibrational modes at 1129cm-1 and 1338cm-1 were observed to characterize gliomas using WITec300R visible resonance Raman (VRR) spectrometer. This work may aid neurosurgeons better decide surgical margins of cancers.

# Oral, Friday, 27 April AM

## ICNN <Room 414+415>

**[ICNN8] 9:00-10:30**
**Photonic Crystals**
Chair: C. Schuck
*University of Munster, Germany*

**ICNN8-1 9:00** ***Invited***

**Gan-On-Si Photonic Crystal Cavities**
Nicolas Grandjean
*École polytechnique fédérale de Lausanne, Switzerland*
see abstract book

**ICNN8-2 9:30**

**Machine Learning of The Relationship Between Q-Factors and Structures of Nanocavities**
TAKASHI ASANO, SUSUMU NODA
*Kyoto University, Japan*
We report on the results of machine learning of the relationship between the Q factors and structures of nanocavities using a convolutional neural network, which is aimed at developing more efficient optimization method.

**ICNN8-3 9:45**

**Analysis on Giant Light Scattering near a Dirac Point in a Photonic Crystal**
Yasutomo Ota[1], Satoshi Iwamoto[1,2], Yasuhiko Arakawa[1,2]
*[1]Nanoquine, Japan, [2]IIS, Japan*
We analyze light scattering near a Dirac point in a 2D photonic crystal by electromagnetic simulations. We demonstrate giant light scattering by a tiny cavity embedded in the photonic crystal around the Dirac point frequency.

## IoT-SNAP <Room 413>

**[IoT5] 9:00-9:45**
**Photonics Technologies II**
Chairs: Katsuhiro Shimizu
*Mitsubishi Electric Corporation, Japan*
Yasuhisa Inada
*The Telecommunication Technology Committee, Japan*

**IoT5-1 9:00**

**Short distance radio over multi-mode fiber for SHF band employing directly modulated VCSEL**
Takamitsu Aiba[1], Satoshi Tanaka[1], Toshinori Suzuki[1], Atsushi Kanno[2], Naokatsu Yamamoto[2], Tetsuya Kawanishi[3], Tomohiro Wakabayashi[1]
*[1]YAZAKI CORPORATION, Japan, [2]National Institute of Information and Communications Technology, Japan, [3]Waseda University, Japan*
We evaluate error vector magnitude (EVM) of pre-5G waveform for short distance transmission over multi-mode fibers employing directly modulated VCSEL as carrier frequency of up to 28GHz.

**IoT5-2 9:15**

**High Speed, Cost-Effective Data Transmission Link Based on All-Silicon Optoelectronics Devices for Machine to Machine Communication**
Haike Zhu, Kazuhiro Goi
*Fujikura Ltd., Japan*
We demonstrate high bandwidth all-silicon optoelectronics devices for data transmission. 10-Gb/s NRZ-OOK signal is successfully modulated and detected through 10-km optical fiber.

**IoT5-3 9:30**

**Observation of Charge Persistence Effect in InGaAs/InP Single Photon Avalanche Diode**
Yi-Shan Lee, Sheng-Yu Chien, Kuan-Yu Chen, Shih-Cheng Chang
*National Central University, Taiwan*
We experimentally studied the charge persistence effect in InGaAs SPAD by comparing the investigations under dark and illuminated conditions.

**[IoT6p] 9:45-10:03**
**Poster Short Presentation**
Chairs: Katsuhiro Shimizu
*Mitsubishi Electric Corporation, Japan*
Yasuhisa Inada
*The Telecommunication Technology Committee, Japan*

## LDC <Room 301>

**[LDC8] 9:00-9:45**
**Module/Sensor**
Chair: TBD

**LDC8-1 9:00**

**High-efficient Light Detection with Double-side Mirror Reflectors for Light Scattering-type Particle Sensor**
Kenya Nakai, Nozoami Enoki, Shota Nakahara, Takashi Fujiwara, Masaaki Shimada, Nobuo Takeshita
*Mitsubishi Electric Corp., Japan*
Double-side mirror reflectors structure to detect a scattered light efficiently from small particles for an optical particulate matter sensor is studied in simulation. It enables a light-collection-efficiency to increase and an optical detection-area to expand.

**LDC8-2 9:15**

**Importance of Three-color Simultaneous Measurement of RGB Laser Diode Modules**
Keisuke Hieda, Tomoyuki Maruyama, Fumio Narusawa
*HIOKI E.E. CORPORATION, Japan*
Simultaneous measurement of RGB lasers is important for an accurate evaluation of the optical characteristics of RGB laser diode modules. It is difficult to precisely evaluate their performance if each laser is measured separately.

**LDC8-3 9:30**

**Correlation between Human Perception and Computer-Predicted Daylight Metrics in an Auditorium Building**
Aishanura Handina, Nurul Mukarromah, Rizki A. Mangkuto, R. Triyogo Atmodipoero
*Institut Teknologi Bandung, Indonesia*
Assessments to correlate human perception and computer-predicted metrics of indoor daylighting were conducted in an auditorium in Bandung, Indonesia. The closest relation is found for subjective partially daylit area and the area enclosed with DA150,50%;

**[LDCp9] 9:45-10:27**
**Poster Short Presentation**
Chairs: Sunao Kurimura
*NIMS, Japan*
Tetsuya Yagi
*Mitsubishi Electric Corp., Japan*

## LEDIA <Room 411+412>

**[LEDIA5] 9:15-10:30**
**Characterizations**
Chairs: Tetsuo Narita
*Toyota Central R&D Labs. Inc., Japan*
Jong Kyu Kim
*Pohang University of Sci. and Technol., Korea*

**LEDIA5-1 9:15** ***Invited***

**Nondestructive Analysis of Threading Dislocations in GaN by Multiphoton-Excitation Photoluminescence**
Tomoyuki Tanikawa
*Institute for Materials Research, Tohoku University, Japan*
Threading dislocations in GaN crystals were observed using multiphoton-excitation photoluminescence. Threading dislocations have nonradiative characteristics and they exhibited as dark lines. This method is useful for further investigation on crystal defects in widegap materials.

**LEDIA5-2 9:45**

**Degradation of Electro-Optical Parameters and Electromigration of Hydrogen in (In)AlGaN-based UVB LEDs**
Johannes Glaab[1], Jan Ruschel[1], Tim Kolbe[1], Arne Knauer[1], Jens Rass[1], Neysha Lobo Ploch[1], Markus Weyers[1], Michael Kneissl[1,2], Sven Einfeldt[1]
*[1]Ferdinand-Braun-Institut, Berlin, Germany, Germany, [2]Technische Universitaet Berlin, Berlin, Germany, Germany*
Investigations on the degradation of UVB LEDs reveal that the change of the optical power and voltage is accompanied by electromigration of hydrogen from the p-side into the n-side of the device.

# Oral, Friday, 27 April AM

## LIC <Room 302>

**[LIC5] 9:00-12:00**
**Laser for ignition**
Chair: Yuji Oki
*Kyushu Univ., Japan*

### LIC5-1 9:00 *Invited*

**The future prospects for transparent ceramics**

Tomohisa Takemasa, Katsuhiro Muramatsu, Hideki Yagi, Takagimi Yanagitani
*Konoshima Chemical Co. Ltd., Japan*

### LIC5-2 9:30

**First hohlraum-capsule integrated implosion experiments on the SGIII facility**

Fengjun Ge[1], Shiyang Zou[1], Yiqing Zhao[1], Tingxuan Huang[2], Yudong Pu[2]
*[1]Institute of Applied Physics and Computational Mathematics, China, [2]Research Center of Laser Fusion, China Academy of Engineering Physics, China*

The first hohlraum-capsule integrated implosion experiments were launched on the SGIII facility. We got the highest indirect drive implosion neutron yield in China. The main sources of performance degradation are analysed.

### LIC5-3 9:45

**Magnetooptical Q-switch laser using neodymium yttrium aluminum garnets**

Ryohei Morimoto[1], Taichi Goto[1,2], John Pritchard[3], Mani Mina[3], Takunori Taira[4], Yuichi Nakamura[1], Pang Boey Lim[1], Hironaga Uchida[1], Mitsuteru Inoue[1]
*[1]Toyohashi University of Technology, Japan, [2]JST PRESTO, Japan, [3]Iowa State University, USA [4]Institute for Molecular Science, Japan*

A magnetooptical Q-switch laser with Nd:YAG crystal was demonstrated. The result indicated the magnetooptical Q-switch using a magnetic garnet film can be used with not only isotropic materials but also anisotropic lasing materials. We also grew magnetic garnet films onto single crystalline Nd:YAG substrates via pulsed laser deposition method for integration of magnetooptical Q-switches with microchip lasers.

## LSC <Room 213>

**[LSC10] 9:00-10:00**
**Light Source 2**
Chair: Ken Onda
*Department of Chemistry, Kyushu University, Japan*

### LSC10-1 9:00 *Invited*

**Euv Application Research at NewSUBARU**

Takeo Watanabe
*University of Hyogo, Japan*

The current status and prospect of EUVL technology is introduced, which is the one of the major field of the application research in NewSUBARU including the technologies of large reflectometer, EUV resist, EUV mask.

### LSC10-2 9:30 *Invited*

**Metrological Applications Using Coherent Controllability of Optical Combs**

Akifumi Asahara[1,2], Kaoru Minoshima[1,2]
*[1]University of Electro-Communications, Japan, [2]Japan Science and Technology Agency, ERATO MINOSHIMA Intelligent Optical Synthesizer, Japan*

Versatile coherent control techniques using optical combs are demonstrated. Interferometric phase detection of two overlapped “optical vortex combs” is mainly discussed, which is a novel dual-comb technique utilized for precise evaluation of lateral beam profiles.

## LSSE <Room 316>

**[LSSE7] 9:00-10:30**
**Adaptive Optics**
Chair: Norihito Saito
*RIKEN, Japan*

### LSSE7-1 9:00 *Invited*

**Adaptive optics applications from cells to the universe**

Yotaka Hayano[1,2], Y. Yamada[3,4], M. Hattori[1], H. Takami[1,2], T. Murata[3,4], N. Murata[3,4], N. Miura, S. Oya[1,2]
*[1]National Astronomical Observatory of Japan, Japan, [2]School of Physical Sciences, Japan, [3]National Institute for Basic Biology, Japan*

The overview of adaptive optics concept and technologies in various applications are introduced. In addition, possibility of advanced adaptive optics system, which treats both the phase and the amplitude of optical wave, are proposed.

### LSSE7-2 9:30 *Invited*

**Adaptive Optics for high power laser beam correction in the atmosphere**

Alexis Kudryashov[1,2], Vadim Samarkin[1], Aleksey Rukosuev[1], Julia Sheldakova[1]
*[1]Institute of Geosphere Dynamics, Russian Academy of Sciences, Russia, [2]Moscow Polytechnical University, Russia*

In this presentation we consider two types of deformable mirrors to be used to correct for high-power laser radiation propagating in the atmosphere.

## OMC <Room 418>

**[OMC6] 9:00-10:30**
**OMC VI**
Chair: Kishan Dholakia
*Univ. of St. Andrews, UK*

### OMC6-1 9:00 *Invited*

**TBD**

Juan Jose Saenz
*DIPC, Spain*

TBD

### OMC6-2 9:30

**Nano-particle manipulation using a plasmonic multimer nano-structure**

Shutaro Ishida, K. Sudo, K. Sasaki
*Hokkaido Univ, Japan*

We have demonstrated a nano-particle rotation above plasmon-resonant gold multimer nano-structures with a nanogap and a circularly polarized laser.

### OMC6-3 9:45

**Graphene nanoridges as a directional plasmon launcher**

Sanpon Vantasin[1], Y. Y. Tanaka[1,2], T. Shimura[1]
*[1]The University of Tokyo, Institute of Industrial Science, Japan, [2]Japan Science and Technology Agency, PRESTO, Japan*

The fascinating properties of graphene plasmon such as tunability and extreme wavelength confinement are feasible for nanodevice applications, especially nanosensors and nanomodulators.

## Oral, Friday, 27 April AM

### PLD <Room 212>

**[PLD7] 9:00-10:30**
**Etching and Non-linear crystals**
Chair: Tomosumi Kamimura
*Osaka Insti. of Techn., Japan*

**PLD7-1 9:00**

**Three-dimensional profile of laser-induced surface damage pit of fused silica and its evolution during wet chemical etching**
Taixiang Liu
*China Academy of Engineering Physics, China*
Large-scale high power/energy laser facility is a basis for the research of inertial confinement fusion. In the facility, fused silica plays an irreplaceable role but simultaneously vulnerable during the routine operation of the facility.

**PLD7-2 9:15**

**Combination of reaction ion etching and dynamic chemical etching for improving laser damage resistance of fused silica optical surfaces**
Laixi Sun, J. Huang, H. Liu, X. Ye, J. Wu, X. Jiang, L. Yang, W. Zheng, W. Wu
*China Academy of Engineering Physics, China*
An effective combined process of reaction ion etching (RIE) and dynamic chemical etching (DCE) is applied for significantly improving the damage resistance of fused silica optics while minimizing the removal amount.

**PLD7-3 9:30**

**Inhomogeneity of material removing and its influence on surface morphology of fused silica during HF etching**
Yuan Li[1], K. Yang[2], C. Yao[2], H. Yan[2], X. Yuan[2], L. Yang[2], X. Ju[2]
*[1]Univ. of Science and Technology Beijing, China, [2]Laser Fusion Research Ctr., China Academy of Engineering Physics, China*
The laser induced damage threshold of fused silica optics can be improved by etching in hydrofluoric (HF) acid, due to the removing of the redeposited layer and subsurface defects. While the surface morphology of the fused silica may deteriorate.

**PLD7-4 9:45**

**High laser damage threshold of fused silica by HF etching with multifrequency ultrasonic**
Xin Ye, H. Liu, F. Wang, J. Huang, X. Jiang, W. Zheng
*research center of laser fusion,CAEP, China*
The laser damage precursors in subsurface of fused silica (e.g. photosensitive impurities, scratches and redeposited silica compounds) were mitigated by mineral acid leaching and HF etching with multifrequency ultrasonic agitation, respectively.

# Oral, Friday, 27 April AM

## ALPS <Room 511+512>

**ALPS16-F2-3 10:00**

**Resonant tunnelling diodes versus semiconductor laser with feedback: confronting their oscillating dynamics**

Andreas Karsaklian Dal Bosco[1], Safumi Suzuki[2], Masahiro Asada[2], Hiroaki Minamide[1]
[1]*RIKEN Center for Advanced Photonics, Tera-Photonics Research Team, Japan,* [2]*Tokyo Institute of Technology, Department of Electrical and Electronic Engineering, Japan*

We propose a confrontation of the dynamical properties of oscillating dynamics observed in Resonant Tunnelling Diodes (RTD) and semiconductor lasers subjected to feedback in terms of frequency distribution and evolution with several experimental parameters.

**ALPS16-F2-4 10:15**

**High-speed measurement of terahertz waveform using Yb-doped fiber laser**

Masaaki Tsubouchi, Keisuke Nagashima
*National Institutes for Quantum and Radiological Science and Technology (QST), Kansai Photon Science Institute (KPSI), Japan*

We have realized high-speed measurement of the terahertz (THz) waveform with the 100 kHz Yb-doped fiber laser for intense THz light generation and the vibrating retroreflector for fast scan of the optical delay.

----- Break 10:30-11:00 -----

**[ALPS17-C3] 11:00-11:45**
**Ultrafast Phenomena**
Chair: Hiroki Mashiko
*NTT Basic Research Laboratories, Japan*

**ALPS17-C3-1 11:00**

**Complete characterization of an optical waveform by luminescence from gas plasma**

Nariyuki Saito, Nobuhisa Ishii, Teruto Kanai, Jiro Itatani
*The Institute for Solid State Physics, The University of Tokyo, Japan*

We propose and demonstrate a new all-optical technique for complete waveform characterization of optical pulses using luminescence from gas plasma, which is based on simple physics and an easy setup.

**ALPS17-C3-2 11:15** ***Invited***

**Femtosecond XUV Absorption Spectroscopy Elucidates the Origins of Multimode Vibrational Coherences Induced by Intense Laser Fields**

Zhi-Heng Loh
*Division of Chemistry and Biological Chemistry, School of Physical and Mathematical Sciences, Nanyang Technological University, Singapore*

Femtosecond XUV absorption spectroscopy is used to investigate vibrational coherences created in neutral and ionized iodomethane by intense laser pulses. Contributions to wave packet generation from bond softening, R-selective depletion, and displacive excitation are resolved.

## BISC <Room 419>

**BISC4-5 10:00**

**Long-life plastic optical fiber probes for scanning near-field optical microscope**

Anton Smirnov, Giovanni Dietler, Sergey Sekatskii
*Ecole Polytechnique Fédérale de Lausanne, Switzerland*

Sharpened glass fiber SNOM probes have certain severe drawbacks. We are presenting alternative SNOM probes made from plastic optical fibers. These probes demonstrate an excellent performance in both topographical and optical channels after intense use.

**BISC4-6 10:15**

**Effect of speckle pattern illumination on holographic recording and reconstructio**

Vinu R. V., Darshika Singh
*Rakesh Kumar Singh, IIST, India*

A speckle field illumination technique for recording and reconstruction of the complete wavefront is proposed and experimentally demonstrated and compare with conventional holographic approach. This technique is expected to play an important role in studying the polarization sensitive materials.

**BISC4-7 10:30**

**Isotropic quantitative differential phase contrast microscopic imaging**

Yu-Zi Lin, Kuang-Yuh Huang
*National Taiwan University, Taiwan*

We propose a new illumination method to achieve isotropic differential phase contrast microscopic imaging efficiently. Recover quantitative phase image of thin transparent sample under 2-axis intensity measurements. Improve the accuracy and stability of phase recovery in conventional differential phase contrast microscopy.

----- Break 10:45-11:15 -----

**[BISC5] 11:15-12:15**
**Digital Holographic Microscopy**
Chair: Wataru Watanabe
*Ritsumeikan University, Japan*

**BISC5-1 11:15** ***Invited***

**Incoherent digital holography for biomedical imagin**

Joseph Rosen
*Ben-Gurion Univ of the Negev, Israel*

The evolution of the FINCH incoherent digital holography method is described. Following the review of FINCH, other recently developed self-reference single-channel incoherent hologram recorders, branched out from FINCH, are discussed and several biomedical-related applications are described.

# Oral, Friday, 27 April AM

## ICNN <Room 414+415>

**ICNN8-4 10:00**

**Three-Dimensional Photonic Crystal Nanocavity Fabricated by A Micro-Manipulation Technique Under Optical Microscope Observation**

Takeshi Ishida[1], Shun Takahashi[1,2], Takeyoshi Tajiri[1], Katsuyuki Watanabe[1], Yasutomo Ota[1], Satoshi Iwamoto[1], Yasuhiko Arakawa[1]
*[1]The University of Tokyo, Japan, [2]Kyoto Institute of Technology, Japan*

We fabricated a three-dimensional photonic crystal nanocavity by a micro-manipulation technique under optical microscope observation. The fabrication error was comparable to the previous technique under SEM observation where the electron beam damaged the nanocavity.

**ICNN8-5 10:15**

**Engineering Photoluminescence Characteristics of Nano-Phosphor Using Photonic Structure**

Arvind Kumar Gathania[1], Shashi Thakur[1], Naresh Dhiman[2], Kirtpreet Singh[1]
*[1]National Instt. of Technology, India, [2]Indian Instt. of Info. Techn., India*

YVO4:Eu3+ inverse opal is prepared by using polymythylmethacrylate template and its photonic stop band (PSB) appear at 500nm. We notice that the PL emission intensity of opal near the PSB is enhanced significantly

----- Break 10:30-11:00 -----

**[ICNN9] 11:00-12:00**
**Quantum Optics and Photonics**
Chair: N. Grandjean
*École polytechnique fédérale de Lausanne, Switzerland*

**ICNN9-1 11:00** ***Invited***

**Integrated Quantum Photonics on Silicon Chips**

Carsten Schuck[1,2]
*[1]Physics Institute, University of Munster, Germany, [2]Center for NanoTechnology (CeNTech), Munster, Germany*

We present the integration of quantum light sources, nano-photonic circuit components and superconducting nanowire single-photon detectors with optical waveguides on silicon chips for realizing scalable photonic quantum technology at telecommunication wavelengths.

**ICNN9-2 11:30**

**Fabrication Tolerant Polarization Beam Splitter with Easy Calibration**

Nicolas Abadia[1,3], Md Ghulam Saber[1], Qiaoyin Lu[2], Wei-Hua Guo[2], David V. Plant[1], John F. Donegan[3]
*[1]McGill Univeristy, Canada, [2]Wuhan National Laboratory for Optoelectronics, Huazhong University of Science and Technology, China, [3]Trinity College Dublin, Ireland*

In this work, a novel highly fabrication tolerant polarization beam splitter (PBS) is presented on an InP platform. The experimental results show that an extinction ratio better than 15 dB and an on-chip loss of

## IoT-SNAP <Room 413>

----- Break 10:03-10:30 -----

**[IoT6p] 10:30-12:00**
**IoT-SNAP Poster Session**
**<Exhibition Hall A>**

Poster session program p.127

## LDC <Room 301>

**[LDCp9] 10:30-12:00**
**Poster**
**<Exhibition Hall A>**

Poster session program p.127-

## LEDIA <Room 411+412>

**LEDIA5-3 10:00**

**Microstructure of GaN fin LEDs: Characterization of Structural and Optical Properties by STEM-CL**

Gordon Schmidt[1], F. Bertram[1], P. Veit[1], T. Hampel[1], J. Hartmann[2], F. Steib[2], H. Zhou[2], J. Ledig[2], S. Fündling[2], H.-H. Wehmann[2], A. Waag[2], J. Cristen[1]
*[1]Otto-von-Guericke-University Magdeburg, Germany, [2]Technische Universität Braunschweig, Germany*

Using highly spatially resolved cathodoluminescence microscopy, we present the structural and optical properties of an InGaN/GaN core-shell fin grown by metal organic vapor phase epitaxy on GaN/sapphire template covered with a patterned SiO-mask.

**LEDIA5-4 10:15**

**Spectroscopic Ellipsometry Study on P-Type NiO Films**

Mizuki Ono[1], Kohei Sasaki[2,3], Tomohiro Yamaguchi[1], Masataka Higashiwaki[3], Akito Kuramata[2], Shigenobu Yamakoshi[2], Tohru Honda[1], Takeyoshi Onuma[1,3]
*[1]Kogakuin University, Japan, [2]Tamura Corporation, Japan, [3]National Institute of Information and Communications Technology, Japan*

Impact of thermal annealing in N2 and O2 ambient on optical constants in p-type NiO films were studied using spectroscopic ellipsometry. O2 annealing was found to be preferred to suppress reduction of Ni vacancies.

----- Break 10:30-11:00 -----

**[LEDIA6] 11:00-12:00**
**Growths**
Chair: Tomoyuki Tanikawa
*Institute for Materials Research, Tohoku University, Japan*

**LEDIA6-1 11:00** ***Invited***

**Formation Mechanism of Singular Structure in AlInn Layer Grown on M-GaN substrate by MOVPE**

Yuya Inatomi[1], Akira Kusaba[1], Yoshihiro Kangawa[1,2,3], Kazunobu Kojima[4], Shigefusa Chichibu[3,4]
*[1]Department of Aeronautics and Astronautics, Kyushu University, Japan, [2]RIAM, Kyushu University, Japan, [3]IMaSS, Nagoya University, Japan, [4]IMRAM, Tohoku University, Japan*

We performed theoretical analysis to understand formation mechanisms of singular structures observed in AlInN epitaxial layers grown on low defect density m-plane freestanding GaN substrate by metalorganic vapor phase epitaxy (MOVPE).

**LEDIA6-2 11:30**

**Thermodynamic and Experimental Analyses of Beta-Ga2O3 Growth by Ozone Molecular Beam Epitaxy**

Natsuki Ueda[1], Yohei Sawada[1], Keita Konishi[1], Yoshiaki Nakata[2], Masataka Higashiwaki[2], Yoshinao Kumagai[1]
*[1]Tokyo University of Agriculture and Technology, Japan, [2]National Institute of Information and Communications Technology, Japan*

Growth of Ga2O3 by ozone molecular beam epitaxy (MBE) was analyzed both thermodynamically and experimentally. Unique growth behavior in the experiment can be explained by thermodynamic analysis considering formation of sub-oxide molecules.

# Oral, Friday, 27 April AM

## LIC <Room 302>

### LIC5-4 10:00

**Ignition enhancement by dual-pulse laser-induced spark**

Lydia Wermer[1], Seong-kyun Im[1], Joseph K. Lefkowitz[2], Timothy Ombrello[2]
*[1]University of Notre Dame, USA, [2]Air Force Research Laboratory, USA*

Ignition and flame propagation by single pulse and dual pulse laser induced spark was studied in a fuel lean premixed methane air flow to investigate regions of enhancement by dual pulse laser induced breakdown.

### LIC5-5 10:15

**High damage threshold semiconductor saturable absorber mirror for fiber lasers**

Yan Wang[1], Nan Lin[2], Wanli Gao[1], Huanyu Song[3], Minglie Hu[3], Haiming Li[4], Wenxia Bao[4], Xiaoyu Ma[2], Zhigang Zhang[1]
*[1]Peking University, China, [2]Chinese Academy of Sciences, China, [3]Tianjin University, China, [4]LZ Lasers Inc., China*

We demonstrate a high damage threshold semiconductor saturable absorbs mirror for mode-locked fiber lasers, with a damage threshold of 9.5mJ/cm$^2$, a modulation depth of 11.5%, a saturation fluence of 39.3mJ/cm$^2$, an ISA coefficient of 6.3'10$^2$mJ/cm$^2$.

----- Break 10:30-11:00 -----

### LIC5-6 11:00 *Invited*

**Lens/window-fouling mitigation in laser ignited reciprocating engines**

Sreenath Gupta[1], Bader Almansour[2], Qing Wang[3]
*[1]Argonne National Laboratory, USA, [2]University of Centrakl Florida, USA, [3]Princeton optronics, Inc., USA*

This paper presents results from a strategy that effectively reduces lens fouling, which makes it possible to use laser ignition in natural gas engines on a long-term basis.

### LIC5-7 11:30

**The study of tuning low-mode asymmetries for ignition capsule implosions**

Jianfa Gu, Zhensheng Dai, Shiyang Zou
*Institute of Applied Physics and Computational Mathematics, China*

Low-mode asymmetries have become the major sources of performance degradation in the NIF implosion experiments. We have studies some new tuning methods to improve the implosion symmetry and performance in the NIF ignition experiments.

## LSC <Room 213>

**[LSC11] 10:00-12:15**
**Organic Material 1**
Chair: Toshihiko Shimizu
*Institute of Laser Engineering, Osaka University, Japan*

### LSC11-1 10:00 *Invited*

**Local Structure Study of C-F Bond on Fluorocarbon Polymer Species**

Masao Noumi[1], Kei Kuramoto[1], Nobuhiro Sarukura[2], Kohei Yamanoi[2]
*[1]Daikin Industries, Ltd., Japan, [2]Institute of Laser Engineering,Osaka University, Japan*

The organic C-F bonds investigated by a combined X-ray absorption fine structure experiments and density functional theory calculations. The inner shell level is slightly different depending on the surrounding environment of the F atom.

----- Break 10:30-10:45 -----

### LSC11-2 10:45 *Invited*

**Application of Mid-Infrared Free Electron Laser as an Optical Tool for Breaking Pathogenic Biomolecules**

Takayasu Kawasaki[1], K. Tsukiyama[1,2]
*[1]IR-FEL Research Center, Research Institute for Science and Technology, Organization for Research Advancement, Tokyo University of Science, Japan, [2]Department of Chemistry, Faculty of Science Division I, Tokyo University of Science, Japan*

Mid-infrared free electron laser (MIR-FEL) is a synchrotron-radiation based infrared laser. We describe biomedical application of the MIR-FEL using amyloid fibrils that cause amyloidosis and melanin that causes malignant melanoma of skin as models.

### LSC11-3 11:15 *Invited*

**Time-resolved Vibrational Spectroscopic Studies of Structural Dynamics in Photofunctional Materials**

Ken Onda
*Department of Chemistry, Kyushu University, Japan*

We have investigated structural dynamics in a photoactive liquid crystal and organic electroluminescence materials using time-resolved infrared vibrational spectroscopy, and found that the close correlation between the dynamics and their photofunctions.

## LSSE <Room 316>

### LSSE7-3 10:00 *Invited*

**Adaptive Optics System for cm-sized Debris Removal**

Toshikazu Ebisuzaki, Yoshiyuki Takizawa, Satoshi Wada
*RIKEN, Japan*

Space debris become major obstacles for the future space development. We will discuss the requirements for the adaptive optics system of the laser shooting optics for the debris removal from a space craft.

----- Break 10:30-11:00 -----

**[LSSE8] 11:00-15:00**
**Agri-Photonics**
Chair: Satoshi Wada
*RIKEN, Japan*

### LSSE8-1 11:00 *Invited*

**Context Changes with Advanced Precision Agriculture and Agro-medical Foods in Japan**

Sakae Shibusawa
*Tokyo University of Agriculture and Technology, Japan*

Community-based precision agriculture has involved emerging sensor technology and merged with digital management strategy, resulted in providing transborder solutions in the fields of technology development, business management, policy making for the coming agrobusiness industry.

## OMC <Room 418>

### OMC6-4 10:00

**High-Density Assembly of Micro-Dispersoids by Laser-Induced Bubble and Fluid Flow**

Yasuyuki Yamamoto, S. Tokonami, T. Iida
*Osaka Prefecture University, Japan*

A laser-induced micro-bubble and fluid flow can assemble dispersoids locally (~10 μm) and rapidly from a wide range (~1 cm) by photothermal effect based on CW laser illumination to light-absorptive materials, which have been applied to the bottomup preparation method of nano/micro-structures.

### OMC6-5 10:15

**Motion of Optically Bound Particles in Tractor Beam**

Jana Damková, L. Chvátal, J. Ježek, J. Oulehla, O. Brzobohatý, P. Zemánek
*ISI of the CAS vvi, Czech Republic*

We investigate theoretically and experimentally motion of particle pairs optically bound in tractor beam that is created by retro-reflected wide Gaussian beam.

----- Break 10:30-11:00 -----

**[OMC7] 11:00-12:15**
**OMC VII**
Chair: Yoshihiko Arita
*Univ. of St. Andrews, UK*

### OMC7-1 11:00 *Invited*

**Underdamped and Overdamped Dynamics of Objects in Nonlinear Optical Potentials**

Pavel Zemánek[1], S. Simpson[1], M. Siler[1], P. Jakl[1], J. Damkova[1], V. Svak[1], A. Arzola[2], K. Volke-Sepulveda[3], R. Filip[4]
*[1]Institute of Scientific Instruments of the ASCRvvi, Czech Republic, [2]Instituto de Fisica, Universidad Nacional Autónoma de México, Mexico, [3]Instituto de Fisica, Mexico, [4]Department of Optics, Palacky University, Czech Republic*

We present a few of our recent theoretical and experimental results related to the behavior of micron-scale particles placed into nonlinear optical potentials.

### OMC7-2 11:30

**The Temperature of An Optically Trapped, Rotating Upconverting-Microparticle**

Yoshihiko Arita
*University of St. Andrews, UK*

TBD

## Oral, Friday, 27 April AM

PLD <Room 212>

**PLD7-5 10:00**

**Surface damage of KDP crystal induced by subsurface and bulk defects under exposure to nanosecond 3ω laser**

Feng Geng[1], J. Huang[2], F. Wang[2], H. Liu[2], X. Jiang[2]
*[1]Chengdu Fine Optical Engineering Research Center, China, [2]Research Center of Laser Fusion, China*

We presented laser-induced surface damage properties of a series of KDP crystals produced by different vendors. In situ microscopy system for bright-field, scattering, fluorescence imaging was integrated in our small-aperture damage test facility, which was further used to investigate defect-damage correlation in laser damage experiments.

**PLD7-6 10:15**

**Transient dynamics damage process and multi-physics field simulation of KDP crystal under 355-nm nanosecond laser**

Zhichao Liu[1], H. Yang[2], F. Geng[1], Y. Zheng[3], J. Cheng[2], M. Chen[2], J. Wang[1], Q. Xu[1]
*[1]Chengdu Fine Optical Engineering Research Ctr, China, [2]Harbin Institute of Technology, China, [3]Novaphoton Co.,Lt, China*

TRPP (Time Resolved Pump-Probe) is a versatile tool in ultrafast physics field, it can be employed to study the damage process in KDP crystal and reveal the transient phenomenon, such as energy absorption, plasma formation, shockwave propagation, etc.

**[PLD8] 10:30-12:00**
**Poster Session**
**<Exhibition Hall A>**

Poster session program p.128-

# Oral, Friday, 27 April AM

## ALPS <Room 511+512>

**[Award Ceremony & Closing Remarks] 11:45-12:30**
Fumihiko Kannari
*Department of Electronics and Electrical Engineering, Keio University, Japan*

## BISC <Room 419>

**BISC5-2 11:45**

**Investigations of wavelength resolution and adoptable phase shifts in phase-shifting color digital holography with 2pi ambiguity and wavelength-multiplexed images**
Tatsuki Tahara[1,2], Reo Otani[3], Yasuhiko Arai[1], Yasuhiro Takaki[4]
*[1]Kansai Univ, Japan, [2]PRESTO, Japan Science and Technology Agency, Japan, [3]SIGMAKOKI CO. LTD., Japan, [4]Kansai Univ, Japan, [5]Tokyo University of Agriculture and Technology, Japan*
We investigate wavelength resolution and adoptable phase shifts in phase-shifting color digital holography with 2pi ambiguity and wavelength-multiplexed images.

**BISC5-3 12:00**

**Single-shot incoherent digital holography using parallel phase-shifting radial shearing interferometry**
Syogo Mochida[1], Takahito Fukuda[1], Yasuhiro Awatsuji[1], Kenzo Nishio[1], Osamu Matoba[2]
*[1]Kyoto Institute of Technology, Japan, [2]Kobe University, Japan*
We propose single-shot incoherent digital holography using parallel phase-shifting radial shearing interferometry. We applied this technique to the three-dimensional measurement of objects illuminated by incoherent light and put on different depth positions.

----- Lunch 12:15-13:00 -----

**[BISCp6] 13:00-14:30**
**Poster**
**<Exhibition Hall A>**

Poster session program p.130-

# Oral, Friday, 27 April AM

## ICNN <Room 414+415>

**ICNN9-3 11:45**

**Tunable Plasmonic Probe for Tip-enhanced Near-field Optical Microscopy**

Mingqian Zhang
*Qian Xuesen Laboratory of Space Technology, China*

A tunable plasmonic probe for tip-enhanced near-field optical microscopy is suggested. It consists of two sharp tips and an array of nanostructures. This device allows polarization-controlled tunable plasmonic directing and nano-focusing of the incident light.

----- Lunch Break 12:00-13:30 -----

**[ICNN10] 13:30-14:45**
**III-Nitride Quantum Dots**
Chair: S. Matuso
*NTT, Japan*

**ICNN10-1 13:30** ***Invited***

**Non-polar Nitride Single Photon Sources**

R. A. Taylor[1], C. C. Kocher[1], T. J. Puchtler[1], J. C. Jarman[2], T. Zhu[2], T. Wang[1], L. Nuttall[1], R. A. Oliver[2]
*[1]University of Oxford, UK, [2]University of Cambridge, UK*

Measurements of single photon emission from non-polar InGaN single quantum dots pumped both optically and electrically will be presented. The dots emit at temperatures up to 220K. Electroluminescent emission with a g2 of 0.18 will be discussed.

## IoT-SNAP <Room 413>

**[IoT6p]**

Poster session program p.127

----- Lunch 12:00-13:15 -----

**[IoT7] 13:15-15:25**
**Photonics Technologies III**
Chairs: Haruyoshi Toyoda
*Hamamatsu Photonics K.K., Japan*
Junichi Kitami
*Yazaki Corporation, Japan*

**IoT7-1 13:15** ***Invited***

**Photonic integrated circuit based FMCW coherent LiDAR**

Jerome Bourderionnet
*Thales Research and Technology, France*

We present the demonstration of an integrated Frequency Modulated Continuous Wave LiDAR on a silicon platform. Detection and ranging of a moving target at up to 60m is shown, with less than 5mW emitted power.

## LDC <Room 301>

**[LDCp9]**

Poster session program p.127-

----- Lunch 12:00-13:00 -----

**[LDC10] 13:00-14:30**
**Emerging Display**
Chairs: TBD
Makio Kurashige
*Dai Nippon Printing Co., Ltd., Japan*

**LDC10-1 13:00** ***Invited***

**Holographic Accessed Volumetric Displays**

Kota Kumagai, Yoshio Hayasaki
*Utsunomiya University, Japan*

Volumetric displays with parallel two- and multi-photon excitations using a computer generated hologram displayed on a liquid crystal spatial light modulator are demonstrated.

**LDC10-2 13:30** ***Invited***

**Dynamic Illumination for Spatio-temporal Integration of Unwanted Interference in Holographic Displays**

Fergal Shevlin
*DYOPTYKA, Ireland*

The quality of holographic display imagery is improved using a compact, reliable, optically efficient deformable mirror. So-called subjective speckle that can render text and symbols illegible at viewing distances of several meters, is reduced significantly.

## LEDIA <Room 411+412>

**LEDIA6-3 11:45**

**Heteroepitaxial Growth of e-Ga2O3 Thin Films on c-Plane Sapphire and GaN templates by HVPE**

Mayuko Sato, Nao Takekawa, Keita Konishi, Hisashi Murakami, Yoshinao Kumagai
*Tokyo University of Agriculture and Technology, Japan*

Epitaxial e-Ga2O3 layers were successfully grown by hydrogen-free HVPE using GaCln and O2. It was clarified that phase-purity of e-Ga2O3 films were improved by decreasing the source zone temperature and increasing O2 input partial pressure.

----- Lunch Break 12:00-13:00 -----

**[LEDIA7] 13:00-14:30**
**Advanced Processes**
Chairs: Malgorzata Iwinska
*UNIPRESS, Poland*
Tomohiro Yamaguchi
*Kogakuin University, Japan*

**LEDIA7-1 13:00** ***Invited***

**High Purity in HVPE Method as an Advantage Used for Controllable Doping of GaN - Influence of Different Dopants on Electrical, Optical, and Structural Properties of GaN Crystals**

Malgorzata Iwinska
*Institute of High Pressure Physics Polish Academy of Sciences (Unipress), Poland*

Gallium nitride crystals were grown by HVPE method on high-quality GaN seeds. Different dopants were investigated in order to obtain highly conductive (Si, Ge) and semi-insulating (Mn, Fe, C) material.

**LEDIA7-2 13:30**

**AlN Templates for Low Threading Dislocation Density GaN-on-Si: A Solution to Boost the Adoption of GaN-on-Si for LEDs and µLEDs**

Fabrice Semond, S. Rennesson, G. Gommé, E. Frayssinet, P. Vennégues, J. Massies
*Université Côte d'Azur, CRHEA-CNRS, France*

Production of AlN-on-Si templates by MBE for MOCVD growth of low threading dislocation density GaN is presented. These templates simplify growth of GaN-on-Si and would accelerate adoption of GaN-on-Si for the fabrication LEDs and µLEDs.

# Oral, Friday, 27 April AM

## LIC <Room 302>

**LIC5-8 11:45**

**Optical fiber coupling of high-energy density pulsed lasers for laser ignition**

Wenzhi Qin, Yuan Gao, Duo Tang, Xiangbo Ji, Yong Li, Zhihao Wang, Liang Wang
*Institute of Chemical Materials, CAEP, China*

Two optical fibers with different surface roughness were obtained by grinding their incident faces using grinding papers. The coupling efficiency and damage threshold of the fibers were studied.

----- Lunch 12:00-13:30 -----

**[LICp6] 13:30-14:30**
**Poster Session**
**<Exhibition Hall A>**

Poster session program p.133

## LSC <Room 213>

**LSC11-4 11:45** *Invited*

**Outer-environment-responsive Structure Transformation of Coordination Networks Composed of Multi-Interactive Molecules**

Yumi Yakiyama[1], M. Kawano[2]
*[1]Division of Applied Chemistry, Graduate School of Engineering, Osaka University, Japan, [2]Department of Chemistry, Graduate School of Science and Engineering, Tokyo Institute of Technology, Japan*

Here we introduce several numbers of coordination networks which turned to show structural changes as the responses to the outer environmental change by synchrotron X-ray diffraction study.

----- Lunch 12:15-13:15 -----

**[LSC12] 13:15-15:15**
**Solid-State Structure 1**
Chair: Kazuhiko Misawa
*Department of Applied Physics, Tokyo University of Agriculture and Technology, Japan*

**LSC12-1 13:15** *Oral*

**Increasing the Band Gap of a Perfect LiCaAlF6 Crystal**

Toshihiko Shimizu[1], M. V. Luong[1], M. Cadatal-Raduban[2], M. J. F. Empizo[1], K. Yamanoi[1], Y. Minami[1], N. Sarukura[1], M. Nakai[1], H. Azechi[1], M. H. Pham[3], H. D. Nguyen[3], K. Ichiyanagi[4], S. Nozawa[4], R. Fukaya[4], S. Adachi[4], K. G. Nakamura[5], K. Fukuda[6], Y. Kawazoe[7], K. G. Steenbergen[8], P. Schwerdtferger[8]
*[1]Institute of Laser Engineering, Osaka University, Japan, [2]Institute of Natural and Mathematical Sciences, Massey University, New Zealand, [3]Institute of Physics, Vietnam Academy of Science and Technology, Vietnam, [4]Photon Factory, Institute of Materials Structure Science, High Energy Accelerator Research Organization, Japan, [5]Materials and Structures Laboratory, Tokyo Institute of Technology, Japan, [6]Tokuyama Corporation, Japan, [7]New Industry Creation Hatchery Center, Tohoku University, [8]Centre for Theoretical Chemistry and Physics, The New Zealand Institute for Advanced Study, Massey University, New Zealand*

We report the possibility of increasing the band gap of a LiCAF with calculations and experimental measurements. Our results show that the application of high pressure modifies the band structure for new VUV light sources.

## LSSE <Room 316>

**LSSE8-2 11:45** *Invited*

**Agri-photonics and Agri-robotics for Food Production toward Global Population 9 Billion time**

Naoshi Kondo
*Kyoto University, Japan*

Spectroscopy, imaging and robotics technologies contribute to solve the trade-off global problem, food production and environmental conservation for 9 billion population time by reduction of 1.3 billion tons of food loss and waste.

----- Lunch 12:30-13:30 -----

**LSSE8-3 13:30** *Invited*

**Applications of Agri-Photonics for Quality Assurance of Phalaenopsis**

Suming Chen, Han-Chun Hsu, Chao-Yin Tsai, Yung-Huei Chang
*National Taiwan University, Taiwan*

Hyperspectral imaging system was developed and used to measure internal ingredient contents and external traits of Phalaenopsis leaves. It is feasible to predict the flowering quality of Phalaenopsis using hyperspectral imaging and analysis methods.

## OMC <Room 418>

**OMC7-3 11:45**

**Optical Properties of Nano-Hole Array with Randomly Designed Surface**

Mamoru Tamura, S. Tokonami, T. Iida
*Osaka Prefecture University, Japan*

Various optical properties originated from the surface plasmon resonance have been much studied, as the example of extraordinary optical transmission (EOT) arising in the metallic thin film with a nano-hole array (NHA).

**OMC7-4 12:00**

**Nonlinear Self-Action of Bloch Surface Waves Governed by Gradient Optical Forces**

Daniil Shilkin[1,2], E. V. Lyubin[1], A. A. Fedyanin[1]
*[1]Lomonosov Moscow State University, Russia, [2]Center for Functionalized Magnetic Materials, Immanuel Kant Baltic Federal University, Russia*

Nonlinear self-action of Bloch surface waves (BSWs) at the interface between a one-dimensional photonic crystal and a water suspension of 50-nm polystyrene nanoparticles is experimentally studied.

----- Lunch 12:15-13:00 -----

**[OMCp] 13:00-14:00**
**Poster Session**
**<Exhibition Hall A>**

Poster session program p.129-

## Oral, Friday, 27 April AM

PLD <Room 212>

**[PLD8]**

Poster session program p.128-

----- Lunch 12:00-13:00 -----

**[PLD9] 13:00-15:15**
**Short-pulse Laser**
Chair: Shinji Motokoshi
*Inst. for Laser Technology, Japan*

**PLD9-1 13:00** ***Invited***

**Laser damage metrology in the sub-ps range for the PETAL facility**
Laurent Lamaignère
*Commissariat à l'Énergie Atomique, France*

**PLD9-2 13:30** ***Invited***

**Progress at the high-power laser system of ELI-NP facility**
Daniel Ursescu
*IFIN-HH / ELI-NP, Romania*
High Power Laser System (HPLS) of ELI-NP facility aims to deliver 10PW class pulses (200J, 20fs, at 800nm) on two parallel arms, at a repetition rate of one shot per minute.

## Oral, Friday, 27 April PM

| | | BISC <Room 419> | |
|---|---|---|---|
| | | **[BISCp6]** | |

Poster session program p.130-

----- Break 14:30-15:00 -----

# Oral, Friday, 27 April PM

## ICNN <Room 414+415>

**ICNN10-2 14:00**

**Formation of GaN/AlN Quantum Dots**

Frank Bertram, Hannes Schuermann, Gordon Schmidt, Peter Veit, Juergen Christen, Andre Stittmatter, Armin Dadgar, Christoph Berger
*University of Magdeburg, Germany*

A systematic series of GaN/AlN quantum dot samples with varying growth interruption time after GaN deposition have been investigated by means of STEM as well as CL spectroscopy at low temperatures.

**ICNN10-3 14:15**

**Ultra-Bright, Ultra-Pure Single Photons from InGaN Quantum Dots Embedded in Porous Micropillars**

Helen Springbett[1], Kang Gao[2], Tongtong Zhu[1], Mark Holmes[2], Yasuhiko Arakawa[2], Rachel Oliver[1]
*[1]University of Cambridge, UK, [2]The University of Tokyo, Japan*

We present blue single photon emission from a self-assembled InGaN/GaN quantum dot with a uncorrected g(2)(0) value of ~0.12, achieved through enhancement by a meosporous distributed Bragg reflector micropillars and optimization of excitation conditions.

**ICNN10-4 14:30**

**Investigation of The Fast Time Scale of The Spectral Diffusion in An Ingan Quantum Dot**

Kang Gao[1], Helen Springbett[2], Tongtong Zhu[2], Rachel Oliver[2], Mark Holmes[1,3], Yasuhiko Arakawa[1,3]
*[1]Institute of Industrial Science, University of Tokyo, Japan, [2]University of Cambridge, UK, [3]NanoQuine, University of Tokyo, Japan*

We present a study on the spectral diffusion time-scale from an InGaN QD via photon autocorrelation measurements, to investigate the spectral diffusion phenomena and compare with previous nanosecond scale spectral diffusion results from GaN QDs.

## IoT-SNAP <Room 413>

**IoT7-2 13:45** *Invited*

**Wideband ultrashort pulse fiber lasers and their sensing applications**

Norihiko Nishizawa, Jin Lei, Masahito Yamanaka
*Nagoya University, Japan*

We have been investigating ultra-wideband laser sources using ultrashort pulse fiber lasers and nonlinear fibers. They are useful for optical frequency comb, ultrahigh resolution OCT, and sensing applications.

**IoT7-3 14:15** *Invited*

**3D Scanning - The Fastest Way To Rebuilt Reality**

Manfred Ostermeier, Thomas Strenger
*botspot GmbH, Germany*

Botspot is the world leader in photogrammetric 3D technololgy. Their 3D scanners allow rapid scanning: One click and 0,01 seconds later you get absolutely precise standardized 3D data.

## LDC <Room 301>

**LDC10-3 14:00**

**Holographic Real-time Image Projection with Data Compression**

Paula Adrianna Kochańska, Michał Makowski, Izabela Ducin, Karol Kakarenko, Jarosław Suszek, Marcin Bieda, Adam Kowalczyk
*Warsaw University of Technology, Poland*

New approach to holographic data compression in real-time holographic transmission with on-the-fly data compression and projection in color between Poland and Japan is presented. Data compression algorithm used in transmission is based on bitplanes extraction.

**LDC10-4 14:15**

**Optical Addressing of Phase-Modulating Materials for Holographic Projection of Images**

Joanna Starobrat, Michał Makowski, Piotr Lesiak
*Warsaw University of Technology, Poland*

The efficiency of real-time holography projection is limited by the SLM pixel density. We propose solutions for purely optical addressing: magnetooptical modulation and implementing LC doped with GNP. Holographic writing for both methods is compared.

----- Break 14:30-14:45 -----

## LEDIA <Room 411+412>

**LEDIA7-3 13:45**

**Fabrication of Polarity-Inverted GaN Heterostructure by Surface-Activated Wafer Bonding and Silicon Removal**

Takuya Onodera[1], Masahiro Uemukai[1], Kazuya Takahashi[2], Motoaki Iwaya[2], Isamu Akasaki[2], Yusuke Hayashi[3], Hideto Miyake[3], Maki Kushimoto[4], Heajeong Cheong[5], Yoshio Honda[5], Hiroshi Amano[4,5], Ryuji Katayama[1]
*[1]Graduate School of Engineering, Osaka University, Japan, [2]Faculty of Science and Technology, Meijo Univ., Japan, [3]Graduate School of Regional Innovation Studies, Mie Univ., Japan, [4]Department of Electronics, Nagoya Univ., Japan, [5]DepartInstitute of Materials and Systems for Sustainability, Nagoya Univ.ment of Electronics, Nagoya Univ., Japan*

We succeeded in the fabrication of polarity-inverted GaN heterostructure by utilizing layer transfer process with surface-activated bonding and subsequent removal of the silicon substrate, which is an essential structure for nonlinear optical waveguides.

**LEDIA7-4 14:00**

**Structural Recovery of Mg-ion-Implanted N-polar Bulk GaN Substrates by High-Temperature Heat Treatment**

Sakiko Yamanobe[1], Kento Yoshida[1], Keita Konishi[1], Shinya Takashima[2], Masaharu Edo[2], Yoshinao Kumagai[1]
*[1]Tokyo University of Agriculture and Technology, Japan, [2]Fuji Electric Co., Ltd., Japan*

High-temperature heat treatment of N-polar bulk GaN substrates with Mg-ion-implantation on their surfaces was investigated. It was found that the structural quality can be recovered by heating at 1300 oC without using any capping layer.

**LEDIA7-5 14:15** *Invited*

**P-type Conduction of Mg-ion Implanted N-polar GaN and the Optical Investigation**

Tetsuo Narita[1], K. Kataoka[1], H. Iguchi[1], K. Shima[2], K. Kojima[2], S.F. Chichibu[2,3], M. Kanechika[1], T. Uesugi[1], T. Kachi[3]
*[1]Toyota Central R&D Labs., Inc., Japan, [2]IMRAM, Tohoku University, Japan, [3]IMaSS, Nagoya University, Japan*

We demonstrate p-type conduction by using Mg and hydrogen ion implantation into nitrogen-polar GaN. The optical and electrical properties clearly exhibit the proof of p-type and the existence of point defects due to implantation.

----- Break 14:30-15:15 -----

# Oral, Friday, 27 April PM

## LIC <Room 302>

**[LIC7] 14:30-16:30**
**Advanced applications of laser (2)**
Chair: Takunori Taira
*IMS, Japan*

**LIC7-1 14:30** *Invited*

**Ignition characteristics of laser breakdown and electrical sparks in lean quiescent and turbulent mixtures**
Shinji Nakaya, Mitsuhiro Tsue
*The University of Tokyo, Japan*
Laser breakdown and electrical spark ignition processes were investigated experimentally in lean quiescent and turbulent mixtures for methane/air and propane/air mixtures using a constant volume chamber.

----- Break 15:00-15:30 -----

## LSC <Room 213>

**LSC12-2 13:45** *Invited*

**Present Status of Material Modification Using High-Intense Laser Pulses Ranging from Nano-Sec to Femto-Sec**
Yoshitaka Mori[1], Y. Nishimura[2], A. Sunahara[3], K. Ishii[1], R. Hanayama[1], Y. Kitagawa[1], T. Hioki[4], H. Azuma[5], T. Motohiro[4], O. Komeda[6], T. Sekine[7], Y. Takeuchi[7], T. Watari[7], T. Kurita[7], H. Kimura[7], K. Kabeya[7], Y. Mizuta[7], Y. Kato[7], Y. Sentoku[8], E. Miura[9], A. Iwamoto[10], H. Sakagami[10], T. Jhozaki[11]
*[1]The Graduate School for the Creation of New Photonics Industries, Japan, [2]Toyota Technical Development Corporation, Japan, [3]Perdue Univ., USA, [4]GREMO, Nagoyga Univ., Japan, [5]AICHI SR, Japan, [6]Advanced Material Engineering Div., TOYOTA Motor Corporation, Japan, [7]Hamamatsu Photonics, K. K., Japan, [8]ILE, Osaka Univ., Japan, [9]National Institute of Advanced Industrial Science and Technology, Japan, [10]National Institute for Fusion Science, Japan, [11]Hiroshima Univ., Japan*
Present status of material modification research using Joule-class high-intense laser pulses ranging from nano-sec.

**LSC12-3 14:15** *Invited*

**The Elastic-Plastic Deformation Process of Shock Compressed Silicon Using Time-Resolved Laue Diffraction**
Kouhei Ichiyanagi[1], S. Takagi[2], N. Kawai[3], R. Fukaya[1], S. Nozawa[1], A. Kyono[2], K.G. Nakamura[4], N. Funamori[1], S. Adachi[1]
*[1]Institute of Materials Structure and Science, High Energy Accelerator Research Organization, Japan, [2]Division of Earth Evolution Science, Graduate School of Life and Environmental Sciences. University of Tsukuba, Japan, [3]Institute of Pulse Power Science, Kumamoto University, Japan, [4]Institute of Innovative Research, Tokyo Institute of Technology, Japan*
We report direct lattice-level measurements of the elastic-plastic deformation using time-resolved Laue diffraction of laser-driven shock compressed single crystal silicon. These results will be discussed in detail.

**LSC12-4 14:45** *Invited*

**Characterization of Thermoelectric Materials using Synchrotron Radiation**
Ken Kurosaki[1,2,3]
*[1]Graduate School of Engineering, Osaka University, Japan, [2]Research Institute of Nuclear Engineering, University of Fukui, Japan, [3]JST, PRESTO, Japan*
Recent developments and current research in thermoelectric (TE) materials are briefly summarized. Then, several examples using synchrotron radiation for characterization of TE materials such as filled-skutterudites and Zn4Sb3 are reviewed.

## LSSE <Room 316>

**LSSE8-4 14:00** *Invited*

**Cell detection using dielectric properties of intracellular water in sub-THz region**
Yuichi Ogawa
*Kyoto University, Japan*
I will introduce the cell spectrum data measured by terahertz time domain spectroscopy using femtosecond laser and the device for cell evaluation by semiconductor technology for life science and a bacteriological examination.

**LSSE8-5 14:30** *Invited*

**Application of Optical Technology for Smart Agriculture**
Taro Fukuyama, Norihito Saito, Takayo Ogawa, Tomoki Matsuyama, Masaki Yumoto, Satoshi Wada
*Photonics Control Technology Team, RIKEN center for Advanced Photonics, RIKEN, Japan*
Smart agriculture utilizes robot technology and ICT to aim labor-saving and high quality production. I will introduce the possibility that optical technology can contribute to Smart agriculture.

**[Closing Remarks] 15:00-15:15**
Toshikazu Ebisuzaki
*RIKEN, Japan*

## OMC <Room 418>

**[OMC8] 14:00-15:30**
**OMC VIII**
Chair: Zouheir Sekkat
*Moroccan Foundation for Advanced Science, Innovation and Research, Morocco*

**OMC8-1 14:00** *Invited*

**Resonant Light Scattering Properties of A Single Wavelength-Scale Nanorod Structure**
Donghyeong Kim, H. Ee, J. Kim, M. Seo
*KAIST, Korea*
We investigated resonant light scattering properties of single wavelength-scale metallic or dielectric nanorods in the energy-momentum space. First, high-refractive-index silicon nanostructures supporting strong Mie resonances allow light manipulation beyond the optical diffraction limit.

**OMC8-2 14:30**

**Circular Polarization Dissymmetry of Two-Photon-Induced Photoluminescence from Chiral Plasmonic Nanostructured Metasurfaces**
K. Q. Le, H. Okamoto
*Institute for Molecular Science, Japan*
Chiral nanostructures exhibiting circular dichroism (CD) activities absorb different amounts of left- (LCP) and righthanded circularly polarized (RCP) light.

**OMC8-3 14:45**

**Formation of Optical Vortices with All-Glass Nanostructured Gradient Index Masks**
Krzysztof Switkowski[1,2], A. Anuszkiewicz[3], A. Filipkowski[3], D. Pysz[3], R. Stepien[3], W. Krolikowski[1,4], R. Buczynski[3,5]
*[1]Science Program, Texas A&M University at Qatar, Qatar, [2]Warsaw University of Technology, Warsaw, Poland, [3]Department of Glass/ Institute of Electronic Materials Technology, Poland, [4]Australian National University, Australia, [5]Faculty of Physics, University of Warsaw, Poland*
We report a development of microscopic size gradient index vortex masks using modified stack-and-draw technique, similar to that employed in fabrication of microstructured fibers. Vortex mask has a form of tens of microns thick, all-glass plate.

**OMC8-4 15:00**

**Development of Nanostructured Gradient Index Microlenses for Mid Infrared Applications**
Buczyński, Ryszard[1,2], A. Anuszkiewicz[1], P. Stafiej[1,2], J. Lisowska[1,2], A. Filipkowski[1], D. Pysz[1], j. Cimek[1], M. Trippenbach[1], R. Kasztelanic[1]
*[1]Institute of Electronic Materials Technology, Poland, [2]University of Warsaw, Poland*
Planar surface gradient index (GRIN) optics is well known class of optical microcomponents. The use of these elements is limited to the visible and near infrared range due to constrains of ion exchange-based technology.

## Oral, Friday, 27 April PM

PLD <Room 212>

**PLD9-3 14:00** *Invited*

**Generation of few-cycle millijoule pulses at 5 um employing a ZnGeP2-based OPOCA**

Uwe Griebner
*Max-Born-Institut für Nichtlineare Optik und Kurzzeitspektroskopie, Germany*

A mid-infrared optical parametric chirped pulse amplification (OPCPA) system generating few-cycle pulses with multi-GW peak power at a 1 kHz repetition rate is presented. The system is pumped by a high-energy 2-μm picosecond source to exploit the high nonlinearity of ZnGeP2 (ZGP) crystals for parametric amplification.

**PLD9-4** *Withdraw*

**PLD9-5 14:45**

**Ultra-short pulse induced nonlinear reflection and its applications in laser processing of dielectrics**

Mingying Sun, Y. Guo, J. Zhu
*Shanghai Institute of Optics and Fine Mechanics, China*

We investigate the characteristics of transient reflectivity in ultrafast laser ablation of dielectrics with the Fresnel-Drude model.

**PLD9-6 15:00**

**Combination properties of fluorinated ethylene propylene (FEP) film which may be used as the short pulse laser debris shields**

Shufan Chen
*China Academy of Engineering Physics, China*

Debris mitigation is a major challenge for all high-peak-power lasers system; the impulsive debris will pollute and damage the optical element and diagnostic facility.

## Oral, Friday, 27 April PM

BISC <Room 419>

**[BISC7] 15:00-16:45**
**Optical Diagnosis and Treatment**
Chair: Joseph Rosen
*Ben-Gurion Univ of the Negev, Israel*

**BISC7-1 15:00**

**Quantitative evaluation of healing degree in injured tendons based on orientation analysis of collagen fibers by using Fourier-transform second-harmonic-generation microscopy and its relationship to mechanical property**

Eiji Hase[1], Takeo Minamikawa[2], Katsuya Sato[2], Daisuke Yonekura[2], Mitsuhiko Takahashi[3], Takeshi Yasui[2]
*[1]Japan Sychrotron Radiation Reasearch Institute, Japan, [2]Tokushima Univ., Japan, [3]Tokushima Pref. Cent. Hosp., Japan*

We used Fourier-transform second-harmonic-generation (FT-SHG) microscopy to analyze the orientation of collagen fibers in healing rabbit tendons recovered from an artificial transection and assessed the correlation between the orientation parameter and Young's modulus.

**BISC7-2 15:15**

**Noninvasive estimation of light scattering and hemoglobin concentration in mice cutaneous carcinogenesis through multispectral imaging**

Izumi Nishidate[1], Satoko Kawauchi[2], Shunichi Sato[2]
*[1]Tokyo Univ of Agriculture and Technology, Japan, [2]National Defense Medical College Research Institute, Japan*

The proposed multispectral diffuse reflectance images acquired at isosbestic wavelengths of hemoglobin were able to estimate the total hemoglobin concentration and tissue scattering parameter of mice skin during cutaneous two-stage chemical carcinogenesis.

**BISC7-3 15:30**

**Characterization of cancer metastasis in model mice by multiphoton microscopy and Raman Spectroscopy**

Yusuke Oshima, Shigehiro Koga, Yuji Watanabe
*Ehime Univ, Japan*

In this study, we investigate molecular dynamics in both cancer cells and their environment in xenograft models and spontaneous metastasis models using Raman spectroscopy and nonlinear optical imaging. We are also constructing a custom-designed Raman spectral imaging system to reveal the metastasis process and to evaluate therapeutics toward the clinical application of the technique.

**BISC7-4 15:45**

**Glucose sensing in the presence of scattering particles using decomposition of partial Mueller matrix**

Pradipta Mukherjee, Yukitoshi Otani
*Utsunomiya Univ, Japan*

A Partial Mueller matrix polarimeter retrieves a subset of sample polarization properties that can be useful for specific measurement. A partial Mueller matrix decomposition method is proposed to retrieve the optical rotation and depolarization simultaneously for measuring glucose concentration in the presence of scattering. A dual-photoelastic-modulator based Mueller matrix polarimeter is designed for this purpose. We verify the proposed decomposition method by measuring different glucose concentrations mixed with scattering particles.

# Oral, Friday, 27 April PM

## ICNN <Room 414+415>

----- Break 14:45-15:15 -----

**[ICNN11] 15:15-16:30**
**Solar Cells & Fundamentals**
Chair: S. Matuso
*NTT, Japan*

**ICNN11-1 15:15**

**Enhancement of Power Conversion Efficiency of Silicon Photovoltaic Cell Employing Arrays of Poly(Methyl Methacrylate-Co-Acrylic Acid) Nanospheres Embedded with Metallic Nanoparticles**
Chee-Leong Lee[1], Swee-Yong Chee[2], Wee-Sheng Goh[2], Lai-Kuan Yik[2]
*[1]Wawasao Open University, Malaysia, [2]University of Tunku Abdul Rahman, Malaysia*
We demonstrate a novel light trapping approach using arrays of poly(methyl methacrylate-co-acrylic acid) nanospheres embedded with metallic nanoparticles with the relative enhancement of the power conversion efficiency of 179% if compared to the uncoated sample.

**ICNN11-2 15:30**

**Polarization Dependent Photocurrent in InAs/GaAs Quantum Dot Superlattice Solar Cells**
Yukihiro Harada, Junya Yamada, Daiki Watanabe, Shigeo Asahi, Takashi Kita
*Kobe University, Japan*
We studied the polarization dependent two-step photocurrent in InAs/GaAs quantum dot superlattice solar cells. The observed photocurrent demonstrates the polarization dependence of the intraband transition induced by the mixing between the conduction and valence bands.

**ICNN11-3 15:45**

**Extraction Efficiency of Up-Converted Electrons in Two-Step Photon Up-Conversion Solar Cells**
Shigeo Asahi, Kenta Nishimura, Toshiyuki Kaizu, Takashi Kita
*Kobe University, Japan*
Our newly proposing two-step photon up-conversion solar cell (TPU-SC) utilizes the two-step up-conversion phenomenon, which comprises wide gap semiconductor (WGS) and narrow gap semiconductor (NGS).

## IoT-SNAP <Room 413>

**IoT7-4 14:45**

**Fiber length measurement for linear-cell distributed radar systems based on radio over fiber technique**
Atsushi Kanno[1], Naokatsu Yamamoto[1], Keisuke Ohara[2], Hideyuki Sotobayashi[2], Tetsuya Kawanishi[1,3]
*[1]NICT, Japan, [2]Aoyama Gakuin University, Japan, [3]Waseda University, Japan*
Precise measurement technique of path length differences in distributed radar systems is proposed and demonstrated using transmitted radar signals.

**IoT7-5 15:00**

**E1-compliant SFP+ OLT Transceiver for High Power Budget**
Satoshi Shirai[1], Satoshi Yoshima[1], Masaki Noda[1], Tetsuro Ashida[2], Yusuke Mitsui[2], Kazuyuki Ishida[1]
*[1]Mitsubishi Electric Corporation Information Technology R & D Center, Japan, [2]Mitsubishi Electric Corporation Communication Networks Center, Japan*
We developed an SFP+ size E1-compliant optical transceiver for XG-PON1 systems with a high minimum receiver sensitivity of -32.3 dBm, a rapid receiver settling time of under 64.3 ns, and a high optical output power

**[Closing Remarks] 15:15-15:25**
Norihiro Hagita
*ATR Intelligent Robotics and Communicatuon Laboratories, Japan*
Ronald Freund
*Fraunhofer Heinrich Hertz Institute, Germany*

## LDC <Room 301>

**[LDC11] 14:45-16:00**
**Optical Components**
Chairs: Nan Ei Yu
*Gwangju Institute of Science and Technology, Korea*
Junichi Kinoshita
*Osaka University, Japan*

**LDC11-1 14:45** ***Invited***

**Tri-Tone Freeforms**
Matthew E. Brand
*Mitsubishi Electric Research Laboratory, USA*
We find a closed-form solution for the shape of the refractive surface that uniformly irradiates a disk from a Lambertian point light source, then algebraically tailor this surface to project tri-tone graphics.

**LDC11-2 15:15** ***Invited***

**Capabilities in Production of Components and Sub-Assemblies for LIDAR**
Jan Heller
*JENOPTIK Polymer Systems GmbH, Geramny*
The challenges in the production of components and sub-modules for LIDAR applications.

**LDC11-3 15:45**

**High-Speed Multi-Diffraction-Type Electro-Optic Deflector Using Polarization-Reversed Structures**
Yuta Hayashi[1], Hiroshi Murata[1], Atsushi Sanada[1], Masahide Okazaki[2], Masato Ishino[1], Kazuhisa Yamamoto[1]
*[1]Osaka University, Japan, [2]SCREEN Holdings Co., Ltd., Japan*
We have proposed a new multi-diffraction-type electro-optic deflector using polarization-reversed structures, which can deflect visible laser beams with a high speed. The operational principle, design, and experimental results of the proposed deflector are reported.

## LEDIA <Room 411+412>

**[LEDIA8] 15:15-16:45**
**Extended Wavelength Devices**
Chairs: Bao-Ping Zhang
*Xiamen University, China*
Young-Joo Kim
*Yonsei University, Korea*

**LEDIA8-1 15:15** ***Invited***

**Arrays of Truncated Cone AlGaN Deep-Ultraviolet Light-Emitting Diodes for Efficient Outcoupling of in-Plane Emission**
Jong Kyu Kim
*POSTECH, Korea*
We present 280 nm AlGaN Deep-ultraviolet (DUV) light-emitting diodes (LEDs) having arrays of truncated cone (TC) shaped active mesas with MgF2/Al reflectors on the inclined sidewalls to effectively extract the intrinsically strong transverse-magnetic (TM) polarized emission.

**LEDIA8-2 15:45**

**Design of Transverse Quasi-Phase-Matched AlN Waveguide for Deep UV Second Harmonic Generation**
Shuhei Yamaguchi[1], Masahiro Uemukai[1], Kazuya Takahashi[2], Motoaki Iwaya[2], Isamu Akasaki[2], Yusuke Hayashi[3], Hideto Miyake[3], Tomoya Yamada[1], Yasufumi Fujiwara[1], Ryuji Katayama[1]
*[1]Graduate School of Engineering, Osaka University, Japan, [2]Faculty of Science and Technology, Meijo University, Japan, [3]Graduate School of Regional Innovation Studies, Mie University, Japan*
In order to realize high efficiency deep ultraviolet second harmonic generation, a polarity-inverted multilayer AlN-waveguide-based novel device structure, called as the transverse quasi-phase-matched structure, are proposed and designed based on the numerical simulation.

# Oral, Friday, 27 April PM

## LIC <Room 302>

**LIC7-2 15:30**

**Investigation on the influence of optical windows on laser ignition thresholds**

Yong Li, Duo Tang, Xiangbo Ji, Wenzhi Qin, Yuan Gao, Zhihao Wang, Liang Wang
*Institute of Chemical Materials, CAEP, China*

Simulations and experiments were conducted to study influences of optical windows on pyrotechnics during laser ignition. Results indicated that K9 glass was the best choice for laser igniter to realize reliable firing of pyrotechnics and sealing of igniter.

**LIC7-3 15:45**

**LIBS system for trace impurity detection in semiconductor manufacturing process**

Rakesh Bhandari[1], Naoya Ishigaki[1], Jiro Saikawa[1], Koji Tojo[1], Yoshitada Ito[1], Takashi Ono[1], Takunori Taira[2]
*[1]Shimadzu Corporation, Japan, [2]Institute for Molecular Science, Japan*

We report, for the first time, a double-pulse LIBS system that can quantitatively detect trace metal impurities in a semiconductor manufacturing process. It optimizes process quality while reducing costs and adverse effects on the environment.

**LIC7-4 16:00** ***Invited***

**Expanding real world applications by ubiquitous power lasers based on giant micro-photonics**

Yuji Sano
*ImPACT, Japan Science and Technology Agency, Japan*

Giant micro-photonics is an indispensable technology to realize ubiquitous power lasers. ImPACT, a five-year national program until March 2019, is strongly supporting R&Ds on the giant micro-photonics to materialize ultra-compact high-power lasers and various applications.

**[Closing Remarks] 16:30-16:45**

## LSC <Room 213>

----- Break 15:15-15:45 -----

**[LSC13] 15:45-17:45**
**Solid-State Structure 2**
Chair: Yumi Yakiyama
*Division of Applied Chemistry, Graduate School of Engineering, Osaka University, Japan*

**LSC13-1 15:45** ***Invited***

**Time-Resolved Electron Diffraction Study: Photoinduced Oxygen Transportation in EuBaCo2O5.38**

Masaki Hada[1], Y. Okimoto[2], N. Keio[1], T. Asaka[3], A. Ozawa[2], T. Suzuki[3], K. Onda[4], M. Saigo[4], T. Nishikawa[1], Y. Yamashita[1], T. Yokoya[1,5], J. Matsuo[6], N. Abe[7], T. Arima[7], Y. Hayashi[1], S. Kosihara[2]
*[1]Graduate School of Natural Science and Technology, Okayama University, Japan, [2]Graduate School of Science and Engineering, Tokyo Institute of Technology, Japan, [3]Frontier Research Institute for Materials Science, Nagoya Institute of Technology, Japan, [4]Department of Chemistry, Faculty of Science, Kyushu University, Japan, [5]Research Institute for Interdisciplinary Science, Okayama University, Japan, [6]Quantum Science and Engineering Center, Kyoto University, Japan, [7]Department of Advanced Materials Science, Graduate School of Frontier Science, the University of Tokyo, Japan*

In this presentation, we will introduce the recent combined study of time-resolved electron diffraction and optical pump-probe measurements on a perovskite-typed cobalt oxide.

**LSC13-3 16:15** ***Invited***

**Spectroscopy of Praseodymium-doped APLF Glass Scintillator Using Laser and Synchrotron Radiation**

Marilou Cadatal-Raduban[1], M. J. F. Empizo[2], T. Murata[3], Y. Minami[2], K. Kawano[2], K. Yamanoi[2], T. Shimizu[2], N. Sarukura[2], M. Guzik[4], Y. Guyot[5], G. Boulon[5]
*[1]Institute of Natural and Mathematical Sciences, Massey University, New Zealand, [2]Institute of Laser Engineering, Osaka University, Japan, [3]Faculty of Education, Kumamoto University, Japan, [4]Faculty of Chemistry, University of Wroclaw, Poland, [5]Univ Lyon, Université Claude Bernard Lyon1, CNRS, Institut Lumière Matière, France*

Temperature-dependent optical properties of Praseodymium-doped 20Al(PO3)3-80LiF (APLF) glass scintillator are investigated in the ultraviolet and vacuum ultraviolet regions using laser and synchrotron radiation. Results confirm its fast and intense emission across wide range of temperatures.

## OMC <Room 418>

**OMC8-5 15:15**

**Optical Properties of Nanostructured Gradient Index Vortex Masks**

Alicja Anuszkiewicz[1], J. Lisowska[1,2], A. Filipkowski[1], R. Kasztelanic[1], K. Switkowski[3], M. Trippenbach[2], W. Królikowski[4,5], D. Pysz, J. Cimek[5,6], R. Buczyński[1,2]
*[1]Institute of Electronic Materials Technology, Poland, [2]University of Warsaw, Poland, [3]Warsaw University of Institute of Electronic Materials Technology, Poland, [4]Laser Physics Technology, Poland, [5]Texas A&M University at Qatar, Qatar, [6]Centre, Research School of Physics and Engineering, Australian National University, Australia*

We have introduced recently a new approach for creating optical vortices by using nanostructured gradient index (GRIN) transmission masks. A nanostructured mask is composed of glass rods with diameter 3-5 times smaller than the operating wavelength.

----- Break 15:30-15:45 -----

**[OMC9] 15:45-17:45**
**OMC IX**
Chair: Masaaki Ashida
*Osaka Univ., Japan*

**OMC9-1 15:45**

**Photoinduced Force Microscopy Imaging Using Heterodyne-FM Technique**

Junsuke Yamanishi, M. Tsujii, Y. Naitoh, Y. Li, Y. Sugawara
*Osaka University, Japan*

Photoinduced force microscopy (PiFM) is a promising technique to visualize nanometer optical imaging.

**OMC9-2 16:00**

**Magnetic Spin Modulation by Optical Vortex-Induced Spin-Spin Interaction**

Yutaro Goto[1], N. Yokoshi[1], H. Ishihara[1,2]
*[1]Osaka Prefecture University, Japan, [2]Osaka University, Japan*

We investigate how an optical vortex radiation modulates magnetic spin order of a metallic chiral magnet. The optical vortex carries its intrinsic orbital angular momentum and has a toroidal field intensity, hence such a helical beam is expected to couple to angular momentum of electrons.

**OMC9-3 16:15**

**Adaptive Optical System for Laser Beam Formation**

J. V. Sheldakova
*Active Optics Night N Ltd, Russia*

Beam shaping tasks are widely used in many applications such as laser machining, laser fusion, different medical applications. Use of adaptive optics allows to modify the wavefront profile to get the desired intensity distribution in the far-field.

**OMC9-4 16:30**

**Electrochemical Control of Ultra-Small Gap Distance at Metal Nanodimer Creating Highly Localized Plasmonic Field**

Kei Murakoshi, X. Li, H. Minamimoto, S. Oikawa
*Hokkaido Univ, Japan*

The optical property of plasmon-active metal nano dimer structure strongly depends on its shape and gap distance. Thus, the precise control of metal nano structure has been receiving much attention in various field.

Oral Program

## Oral, Friday, 27 April PM

PLD <Room 212>

----- Break 15:15-15:45 -----

**[PLD10] 15:45-17:00**
**Damage Measurement and Defects**
Chair: Takahisa Jitsuno
*Osaka University, Japan*

**PLD10-1 15:45**

**Optical modified lateral shearing interferometer for on-line damage morphology measurement**
Jie Li, R. Ba, X. Zhou, Y. Zheng, L. Ding, B. Chen, J. Yuan
*China Academy of Engineering Physics, China*
Laser-induced damage resistence of optical components is one of the critical factor in high power laser systems.

**PLD10-2 16:00**

**The distribution, specifies, and absorption of precursors responsible for bulk damage initiation in doubler KDP crystals at different wavelengths**
Yinbo Zheng, R. Ba, J. Li, X. Zhou, L. Ding, J. Yuan, H. Xu, J. Na, Y. Li, B. Chen
*China Academy of Engineering Physics, China*
This work presents the characteristics of precursors responsible for bulk damage initiation in type I doubler KDP crystals under different exposure wavelengths and fluences combinations.

**PLD10-3 16:15**

**Shape dependence of downstream light intensification caused by flaws**
Zhaoyang Jiao, M. Sun, L. Ren, Y. Guo, R. Wu, Y. Zhang, J. Zhu
*Shanghai Institute of Optics and Fine Mechanics, China*
In high power laser system, the upstream flaw could induce light intensification in the downstream, thus damaging the optical component.

**PLD10-4 16:30**

**Mixture modulation to incident laser by surface defect and contaminant on fused silica**
H. Wang, Z. Chen, Huapan Xiao, J. Wang, N. Yu
*Xi'an Jiaotong Univ., China*
It is inevitable that surface defect and contaminations would be generated during the grinding and polishing processes of optical components.

**[Closing remarks] 16:45-17:00**

## Oral, Friday, 27 April PM

BISC <Room 419>



**BISC7-5 16:00**

**Quantitative in situ time-series evaluation of osteoblastic collagen synthesis under cyclic strain using second-harmonic-generation microscopy**

Katsuya Sato[1], Eiji Hase[2], Takeo Minamikawa[1], Takeshi Yasui[1]
*[1]Tokushima University, Japan, [2]Japan synchrotron radiation research institute, Japan*

The aim of this study is to provide an in situ method to non-invasively monitor osteoblastic collagen synthesis under mechanical stimulation. We applied second-harmonic-generation (SHG) microscopy to monitor the collagen fibers produced by osteoblast-like cells. To evaluate the influence of mechanical stimulation on collagen synthesis and maturation, we compared SHG images of osteoblast-produced collagen fibers with and without a cyclic stretch stimulus. We acquired SHG images every 7 days for 3 weeks at different stimulus conditions. Image analysis of the average SHG intensity indicated that the amount of osteoblastic collagen synthesis was significantly enhanced by the cyclic stretch compared with the the non-stretched condition, while there was no significant difference between the two stimulus conditions. Furthermore, the maturity of the collagen fibers was not affected in the early stage of bone formation by the mechanical stimulus.

**BISC7-6 16:15**

**Fluid dynamic modeling and comparison of the intraocular pressure changes in eyes with SMILE and LASIK**

Kuo-Jen Wang[1], Cheliang Tsai[1], I-Jong Wang[2]
*[1]Crystalvue Medical Corp, Taiwan, [2]National Taiwan University Hospital, Taiwan*

We developed an intraocular pressure analytic model utilizing fluid dynamics, solid mechanics, and ray-tracing technique to simulate the air-puff noncontact tonometry for post-SMILE and post-LASIK IOP measurement.

**BISC7-7 16:30**

**Enhanced therapeutic effect of an antitumor agent on malignant glioma in rats by photomechanical wave-based transvascular drug delivery**

Yumiko Koshi[1], Izumi Nishidate[1], Shunichi Sato[2]
*[1]Tokyo University of Agriculture and Technology, Japan, [2]National Defense Medical College Research Institute, Japan*

We used a photomechanical wave (PMW) to enhance the delivery efficiency of an antitumor drug, temozolomide (TMZ) in a F98 rat glioma model, and showed that therapeutic effect of TMZ was improved by PMW application.

**[Closing Remark & Award Ceremony] 16:45-17:00**

Osamu Matoba
*Kobe University, Japan*

# Oral, Friday, 27 April PM

## ICNN <Room 414+415>

**ICNN11-4 16:00**

**Saturation of Two-Photon Absorption in Layered Transition Metal Dichalcogenides: Experiment and Theory**

Ningning Dong[1], Yuanxin Li[1], Saifeng Zhang[1], Niall McEvoy[2], Riley Gatensby[2], Georg S. Duesberg[2], Jun Wang[1]
*[1]Chinese Academy of Sciences, China, [2]Trinity College Dublin, Ireland*

The saturation of two-photon absorption (TPA) in four types of layered transition metal dichalcogenides (TMDCs) (MoS2, WS2, MoSe2, WSe2) was systemically studied both experimentally and theoretically.

**ICNN11-5 16:15**

**Enhanced Laser-Damage Threshold and Nonlinear Optical Performances of Layered MoS2 Nanofilms Through Generation of MoO3 and Sulfur Vacancies**

Xiaoyan Zhang[1], Yafeng Xie[1], Jiawei Huang[1], Saifeng Zhang[1], Jun Wang[1,2]
*[1]Shanghai Institute of Optics and Fine Mechanics (SIOM) Chinese Academy of Sciences, China, [2]State Key Laboratory of High Field Laser Physics Shanghai Institute of Optics and Fine Mechanics Chinese Academy of Sciences, China*

Layered MoS2 nanofilms with improved laser-damage threshold and tunable nonlinear optical performances for femtosecond laser pulses were fabricated via polyelectrolyte assisted solvothermal method.

**[CLOSING] 16:30-16:45**
Yasuhiko Arakawa
*The University of Tokyo, Japan*

## LDC <Room 301>

**[LDC12] 16:00-16:30**
**Post Deadline**
Chairs: Sunao Kurimura
*NIMS, Japan*
Tetsuya Yagi
*Mitsubishi Electric Corp., Japan*

**LDC12-1 16:00**

**Evaluation of Key Influence Factors to Luminance Lifetime for Laser Projection TV**

Ruhai Guo, Weidong Liu, Xianrong Liu, Houjian Zhou
*Hisense Group limited company, China*

Nowadys, the luminance lifetime of laser projection TV is often defined by its laser source lifetime, such as 25000hr because the specification of semiconductor laser diode.

**LDC12-2 16:10**

**Applicability of CIELAB Volume Metric to the Latest Electronic Display with Eye Adaptation at Medium Grey Scale or with White Boosting**

Hidefumi Yoshida[1], Keita Hirai[2], Yoko Mizokami[2]
*[1]Sharp Corporation, Japan, [2]Chiba University, Japan*

We found that it is appropriate to adopt CIELAB for checking if the emissive display replicates the original source precisely, but not appropriate if the adaptation point of eyes is at a medium grey scale.

**LDC12-3 16:20**

**Design and Simulation of a Diffractive Diffuser for Optimizing Speckle Contrast in a Laser MEMS Sscanning Head-Up Displays**

Giang Nam Nguyen, Ryo Kajiura, Axel Torschmied
*Visteon Electronics Germany, Germany*

A Diffractive Optical Element is designed as a spot array generator, taking into account the profile and pitch of the laser scanning beam, resulting in a diffusing pattern with low speckle contrast.

**[Award Ceremony] 16:30-16:40**
Chairs: Sunao Kurimura
*NIMS, Japan*
Tetsuya Yagi
*Mitsubishi Electric Corp., Japan*

**[Closing Talk] 16:40-16:45**
Hiroshi Murata
*Osaka University, Japan*

## LEDIA <Room 411+412>

**LEDIA8-3 16:00**

**Demonstration of Red Vertical-Microcavity LEDs with Eu-Doped GaN as an Active Layer**

Keishi Shiomi, Tomohiro Inaba, Jun Tatebayashi, Yasufumi Fujiwara
*Osaka University, Japan*

We report on the demonstration of electrically-driven red vertical-microcavity light-emitting-diodes (LEDs) with Eu-doped GaN as an active layer cladded by AlInN/GaN and dielectric ZrO2/SiO2 distributed Bragg reflectors as bottom and top microcavities, respectively.

**LEDIA8-4 16:15** *Invited*

**Fabrication of VCSELs Emitting in the 'Green Gap'**

Bao-Ping Zhang
*Department of Electronic Engineering, Xiamen University, China*

VCSELs emitting in the spectral range from 479.6 nm to 565.7 nm, covering most of the 'green gap', are demonstrated. These devices are featured with low threshold current, continuous-wave lasing at room temperature.

**[LEDIA9] 16:45-17:30**
**Tutorial Session**
Chair: Yoshinao Kumagai
*Tokyo University of Agriculture and Technology, Japan*

**LEDIA9-1 16:45** *Invited*

**Modeling and Process Design of III-nitride MOVPE**

Yoshihiro Kangawa[1,2], Pawel Kempisty[2,3], Kenji Shiraishi[2]
*[1]Kyushu University, Japan, [2]Nagoya University, Japan, [3]IHPP, PAS, Poland*

The knowledge of atomistic-scale phenomena on growth surface is indispensable to optimize the growth conditions of thin films. We developed a physical model for investigating unintentional doping in GaN MOVPE by an ab initio-based approach.

**Closing Remarks 17:30-17:45**

# Oral, Friday, 27 April PM

## LSC <Room 213>

**LSC13-4 16:45** *Invited*

**Pump-Probe Study of Electron- and Lattice-Dynamics in Semiconductors by Using Laser and Sr X-Ray Beams**

Yoshihito Tanaka
*Graduate School of Material Science, University of Hyogo, Japan*

Fast photostriction and X-ray induced optical property of semiconductors have been investigated by time-resolved X-ray diffraction and transient absorption spectroscopy in the near infrared region using synchrotron X-ray and laser pulses.

**LSC13-5 17:15** *Invited*

**Femtosecond Time-Resolved X-Ray Absorption Spectroscopy of Anatase TiO2 Nanoparticles Using the Spring-8 Angstrom Compact Free-Electron Laser**

Kazuhiko Misawa[1,2]
*[1]Department of Applied Physics, Tokyo University of Agriculture and Technology, Japan, [2]Institute of Global Innovation Research, Tokyo University of Agriculture and Technology, Japan*

We describe time-resolved X-ray absorption spectroscopy of anatase TiO2 nanoparticles using a synchronized 268-nm femtosecond laser. We observed ultrafast reduction of Ti through localization into shallow traps, and subsequent structural distortion near the surface.

**[Closing Address] 17:45-18:00**
Nobuhiko Sarukura
*Institute of Laser Engineering, Osaka University, Japan*

## OMC <Room 418>

**OMC9-5 16:45**

**Numerical Study on Dynamical Behavior of Nanoparticles in Optical Vortex**

Ryo Nagura, T. Tsujimura, S. Kawano
*Osaka University, Japan*

When nanoparticles are exposed to an optical field with orbital angular momentum, i.e., optical vortex, they are swirled around the optical axis.

**OMC9-6 17:00**

**Sensitivity Enhancement of Surface Plasmon Resonance Imaging Sensor with Structural Parameter Optimization Based on Polarization Contrast Modulation**

Yi Sun, Y. Gao, T. Yang, X. Ma, X. Wang
*Zhejiang University, China*

With the fast growing need of biosensors for high-throughput and high-sensitivity detection, the surface plasmon resonance imaging (SPRi) sensing technology has been developed rapidly.

**OMC9-7 17:15**

**Energy, Linear Momentum, and Angular Momentum Exchange between an Electromagnetic Wave-Packet and a Small Particle**

Masud Mansuripur
*College of Optical Sciences Univ of Arizona, USA*

The goal of the present article is to illustrate the mechanisms of exchange of energy as well as those of linear and angular momenta between an electromagnetic (EM) wave-packet propagating in free space and a small particle that acquires an induced polarization upon encountering the wave-packet.

**OMC9-8 17:30**

**Exploiting Scattering for Single-Shot Measurement of the Orbital Angular Momentum Spectrum of Light Fields**

Lei Gong, Qian Zhao, Hao Zhang, Xinyao Hu, Yinmei Li
*University of Science and Technology of China, China*

In this paper, we propose a novel technique to coherently measure the OAM spectrum of light fields in a single shot manner by exploiting a scattering optical element.

**[Closing Remark] 17:45-17:55**
Takashige Omatsu
*Chiba University, Japan*

NOTE

# Poster Session <Exhibition Hall A>

## Thursday, 26 April

### HEDSp11 10:30-12:00

#### HEDSp11-1

**Exploration of efficient laser-driven plasma acceleration using an intense mid-infrared laser pulse**

Eisuke Miura[1], Shin-Ichi Masuda[2], Eiji Takahashi[3]
*[1]AIST, Japan, [2]Osaka University, Japan, [3]RIKEN, Japan*

We discuss the feasibility of efficient laser-driven plasma acceleration using an intense mid-infrared laser pulse through particle-in-cell simulations. The number of accelerated electrons is enhanced using a 1.5μm laser pulse.

#### HEDSp11-2

**Probing ultrafast motion of critical surface pushed by multi-pico-second relativistic radiation pressure**

Yugo Ochiai[1], Sadaoki Kojima[2], Shunsuke Inoue[2], Masayasu Hata[1], Natsumi Iwata[1], Yasunobu Arikawa[1], Alessio Morace[1], Shouhei Sakata[1], Seungho Lee[1], Kazuki Matsuo[1]
*[1]Institute of Laser Engineering, Osaka University, Japan, [2]Advanced Research Center for Beam Science, Institute for Chemical Research, Kyoto University, Japan*

The ultrafast motion of critical surface is important key to understand during multi-picosecond interaction.
We designed frequency-resolved optical gating to observed the ultrafast plasma motion with high temporal-resolution (~150 fs) and wavelength resolution (~0.2 nm).

#### HEDSp11-3

**Gamma-ray Generation from Plasma-based resonant Wiggler**

Bifeng Lei, Jingwei Wang, Vasily Kharin, Matt Zepf, Sergey Rykovanov
*Helmholtz Institute Jena, Germany*

A flexible gamma-ray radiation source based on the resonant laser plasma wakefield wiggler is proposed. The wiggler is achieved by inducing centroid oscillations of a short laser pulse in a plasma channel. The photon generation

#### HEDSp11-4

**Investigation of plasma parameters from Cu wire/Al foil combined target heated by high intensity LFEX laser pulse**

Daniil Golovin[1], Akifumi Yogo[1], Tatiana Pikuz[2,3], Anatoly Faenov[2,3], Maria Alkhimova[3,4], Igor Skobelev[3,4], Sergey Pikuz[3,4], Yuki Abe[1], Yasunobu Arikawa[1], Keisuke Koga[1], Kazuki Okamoto[1], Satoru Shokita[1], Hiroaki Nishimura[1]
*[1]Institute of Laser Engineering, Osaka University, Japan, [2]Graduate School of Engineering, Osaka University, Japan, [3]Joint Institute for High Temperatures, Russian Academy of Sciences, Russia, [4]National Research Nuclear University (MEPhI), Russia*

In our research we propose and applied two channels focusing spectrometer with spatial resolution (FSSR), to observe X-ray radiation of plasma from the target, heated by high-intensity LFEX laser.

#### HEDSp11-5

**Stabilization of LWFA injector electron beam using pulse solenoid**

Yusuke Tanizawa, Akihiro Ueno, Gakujun Toran, Hirokazu Takeuchi, Masahiro Yano, Yasuo Sakai, Junpei Ogino, Takamitsu Otsuka, Keiichi Sueda, Hirotaka Nakamura, Jin Zhan, Naveen Pathak, Alexey Zhidkov, Shinichi Masuda, Tomonao Hosokai, Ryosuke Kodama

We proposed a pulse-driven solenoid capable of focusing high-energy electrons and evaluated the relation between the applied voltage and the selected energy of the electron beams.

#### HEDSp11-6

**Measurement of high-order harmonics generated from relativistic plasma in gas target**

Akito Sagisaka[1], Alexander S. Pirozhkov[1], Timur Zh. Esirkepov[1], Tatiana A. Pikuz[2,3], Anatoly Ya. Faenov[3,4], Sergei V. Bulanov[1,5], Koichi Ogura[1], Hideyuki Kotaki[1], Yukio Hayashi[1], Yuji Fukuda1, James K. Koga[1], Kiminori Kondo[1], Tetsuya Kawachi[1], Hiromitsu Kiriyama[1], Masaki Kando[1]
*[1]National Institutes for Quantum and Radiological Science and Technology, Japan, [2]PPC and Graduate School of Engineering, Osaka University, Japan, [3]Joint Institute for High Temperatures, Russian Academy of Sciences, Russia, [4]Open and Transdisciplinary Research Initiatives, Osaka University, Japan, [5]Institute of Physics ASCR, v.v.i. (FZU), ELI-Beamlines Project, Japan*

High-order harmonics generated from relativistic plasma driven by Ti:sapphire laser in helium gas target are measured.

#### HEDSp11-7

**Interaction of multi-PW class laser pulses with underdense plasmas**

Masahiro Yano, Alexei Zhidkov, Ryosuke Kodama

For the first time the interaction of multi-PW laser pulses with underdense plasma, in the regime of strong relativistic wave-breaking, is investigated via 3D particle-in-cell simulation

#### HEDSp11-8

**Development of a multi keV x-ray backlighter source based on laser irradiation of extended cluster gases**

Hazel Lowe[1,2], S .Patankar[2,3], S. Giltrap[2], N. H. Stuart[2], T.S. Robinson[2], E.T. Gumbrell[3,4], R.A. Smith[2]
*[1]KPSI, QST, Japan, [2]Imperial College London, UK, [3]LLNL, USA, [4]AWE Aldermaston, UK*

We will show the estimation of the characteristics of the X-ray beam generated by extremely short period undulatorand design of quadrupole magnets and with magnets to transfer very low emittance electron beam into undulator.

#### HEDSp11-9

**On the effect of high intensity laser prepulse on laser wakefield acceleration**

Hakujun Toran

In this poster, I will explain the effect of laser prepulse on electron injection of staging acceleration using laser wakefield acceleration.

#### HEDSp11-10

**Investigation of Discharged plasma guiding channel for staged laser wakefield acceleration**

Yasuo Sakai, Tomonao Hosokai, Naveen Pathak, Alexey Zhidkov, Akihiro Ueno, Hakujyun Toran, Hirokazu Takeuchi, Yusuke Tanizawa, Masahiro Yano, Takamitsu Otsuka, Junpei Ogino, Keiichi Sueda, Hirotaka Nakamura, Jin Zhang, Shinichi Masuda, Ryousuke Kodama
*Osaka University, Japan*

Aiming to produce an optical guiding channel to produce GeV class electron beam acceleration, optimum discharged plasma condition including discharge system will be investigated.

#### HEDSp11-11

**Performance of High energetic X-ray detector by using X-ray generator**

Yukio Hayashi, Hideyuki Kotaki, Nobuhiko Nakanii, Kai Huang, Michiaki Mori, Masaki Kando
*KPSI, QST, Japan*

We make the X-ray spectrometer for betatron X-rays measurement. Recently, the spectrometer was tested with an X-ray generator. In the conference, we will explain the result of this test.

#### HEDSp11-12

**Detection of alpha particles from 7Li(p,a)4He/19F(p,a)16O reactions by etching of CR-39 using potassium hydroxide ethanol solution**

Yosuke Nishiura[1,2], Shunsuke Inoue[1,2], Kensuke Teramoto[1,2], Sadaoki Kojima[2], Yoshihide Nakamiya[2], Masaki Hashida[1,2], Shuji Sakabe[1,2]
*[1]Department of Physics, Graduate School of Science, Kyoto University, Japan, [2]Advanced Research Center for Beam Science, Institute for Chemical Research, Kyoto University, Japan*

By etching of CR-39 using A solution, we have demonstrate the discrimination between protons and alpha particles to know the availability of this method to the applications of laser accelerated ions

#### HEDSp11-13

**How to measure the parameters of a nonlinear electrodynamics model by focusing axially-symmetric polarized laser in vacuum**

Takumi Hara, Ryousuke Kodama

In this paper, we show that the two parameters that characterize nonlinear electrodynamics models could be measured by focusing the axially-symmetric polarized laser in vacuum.

#### HEDSp11-14

**Asymmetry Terahertz Radiation from a Thin Foil Irradiated by Ultrashort Relativistic Laser Pulse**

Shota Tajima[1], Zhan Jin[2], Takuya Fukuda[1,3], Ryosuke Kodama[1,2,3]
*[1]Graduate School of Osaka University, Japan, [2]Photon Pioneers Center, Osaka University, Japan, [3]Graduate School of Utsunomiya University, Japan, [4]Institute of Laser Engineering, Osaka University, Japan*

TBD

#### HEDSp11-15

**Terahertz Radiation from Laser Created Plasma by Applying a Transverse Static Electric Field**

Takuta Fukuda[1], Zhan Jin[2], Noboru Yugami[1], Yasuhiko Sentoku[3], Hitoshi Sakagami[4], Hideo Nagatomo[3], Ryousuke Kodama[3]
*[1]Utsunomiya University, Japan, [2]Photon Pioneers Center. Osaka University, Japan, [3]ILE Osaka University, Japan, [4]National Institute for Fusion Science, Japan*

We have observed that a significantly increased THz emission intensity in the forward direction when the transverse static electric field is applied to the plasma.

#### HEDSp11-16

**Experimental investigation of electron and proton acceleration scaling to ultra-high intensity pulses**

Nicholas P. Dove[1], Mamiko Nishiuchi[1], H. Sakaki[1], M.A. Alkhimova[2], A. Ya. Faenov[3,4], Y. Fukuda[1], H. Kiriyama[1], A. Kon[1], K. Kondo[1], T. Miyahara[1,5], K. Nishitani[1,5], K. Ogura[1], T.A. Pikuz[3,4], A.S. Pirozhkov[1], A. Sagisaka[1], M. Kando[1]
*[1]National Institutes for Quantum and Radiological Science and Technology, Japan, [2]National Research Nuclear University (MEPhI), Russia, [3]Osaka University, Japan, [4]Joint Institute for High Temperatures, Russian Academy of Sciences, Russia, [5]Kyushu University, Japan*

We investigated electron and proton acceleration using the ultra-high intensity J-KAREN-P laser. The electron temperature is found to be spot size dependent, and protons show the most favourable intensity scaling when increasing laser energy.

#### HEDSp11-17

**Recent progress on multi-stage laser wakefield acceleration at LAPLACIAN**

T. Otsuka[1,2], J. Ogino[2], K. Sueda[2], N. Nakanii[3], M. Mori[3], H. Kotaki[3], H. Kai[3], Y. Sakai[2], N. C. Pathak[2], S. Masuda[2], H. Nakamura[4], A. G. Zhidkov[2], Z. Jin[2], A. Ueno[4], H. Toran[4], M. Kando[3], T. Hosokai[2], R. Kodama[2,4,5]
*[1]Department of Optical Engineering, Graduate School of Utsunomiya University, Japan, [2]Photon Pioneers Center, Osaka University, Japan, [3]National Institutes for Quantum and Radiological Science and Technology, Japan, [4]Graduate School of Engineering, Osaka University, Japan, [5]Institute of Laser Engineering, Osaka University, Japan*

Multistage acceleration scheme has been proposed for improving stability and repeatability. To achieve GeV-class electron with multistage acceleration scheme, we constructed platform for multistage LWFA.

#### HEDSp11-18

**LPA Generated Electron Bunch Transport for in a Manipulation Line**

Driss Oumbarek
*SOLEIL, France*

TBD

#### HEDSp11-19

**Fast time-resolved imaging method with Imaging Plates**

Masahiro Yoshida[1], Sadaoki Kojima[2], Shunsuke Inoue[1,2], Yoshihide Nakamiya[2], Masaki Hashida[1,2], Shuji Sakabe[1,2]
*[1]Department of Physics, Graduate School of Science, Kyoto University, Japan, [2]Advanced Research Center for Beam Science, Institute of Chemical Research, Kyoto University, Japan*

TBD

Poster Program

# Poster Session <Exhibition Hall A>

## Thursday, 26 April

### LSSEp4 10:30-12:00

**LSSEp4-1**

**Development of Polarization Imaging Camera by Femtosecond Laser Microfabrication**

Takuya Okamoto, Yuya Yamada, Takafumi Ohfuchi, Naoaki Fukuda, Takuya Okamoto, Yuya Yamada, Takafumi Ohfuchi, Naoaki Fukuda, Toshio Takiya
*Hitachi Zosen Corporation, Japan*

Our research group developed a new polarization imaging camera equipped with micro-array waveplates manufactured using femtosecond laser microfabrication. Demonstration result indicated that the developed camera is useful for detecting transparent substances.

**LSSEp4-2**
**Energy Production and Transmission**

**Recyclable metal air cell using sintered Zn pastes with reduced Zn nanoparticles by pulse laser ablation in liquids**

Taku Saiki[1], Ryuuta Ishii[1], Seiji Taniguchi[2]
*[1]Kansai University for laser Engineering, Japan, [2]Institute for Laser Technology, Japan*

Zn-paste Mg air cell was fabricated for energy cycle using solar-pumped pulse lasers and metals. Zn oxide were reduced to Zn nanoparticles by using high-repetitive laser pulses. Pastes with the reduced Zn nanoparticles were sintered.

**LSSEp4-3**
**Energy Production and Transmission**

**Introduction of a New Thermal Storage Power Station**

Akihiko Nishimura[1], Yusuke Takenaka[1], Kunio Saegusa[1], Seiji Hiroki[1], Toru Fujino[2], Tamio Amano[2], Toru Okazaki[3], Kazuo Yoshida[3]
*[1]Japan Atomic Energy Agency, Japan, [2]IML-Tokyo Sokki Kenkyujo, Japan, [3]The Institute Applied Energy, Japan*

A new thermal storage power station is introduced. Molten salt is used for heat storage. Heat resistant FBG sensors produced by picosecond laser processing are presented for structure monitoring.

**LSSEp4-4**
**Infrastructure (Nondestructive Testing)**

**Proposal of In-Service Monitoring using a Deformed Steel Bar Combined with Heat Resistant FBG Sensors**

Yuhei Nishio[1], Akihiko Nishimura[2], Yusuke Takenaka[2], Hiroshi Suzuki[2], Manabu Kanematsu[1]
*[1]Tokyo University of Science, Dep. Architecture, Japan, [2]Japan Atomic Energy Agency, Japan*

Proper measurement method under high temperature is required for understanding fire resistance of reinforced concrete structure. The authors attempt to install heat resistant FBG sensors in reinforced concrete for monitoring steel bar deformation.

**LSSEp4-5**
**Infrastructure (Nondestructive Testing)**

**Preliminary Investigation toward Inspection of Anchorage Strength for Buried Bolt by Laser Hammering Method**

Katshiro Mikami, Noboru Hasegawa, Toshiyuki Kitamura, Hajime Okada, Shuji Kondo, Masaharu Nishikino, Tetsuya Kawachi
*National Institutes for Quantum and Radiologically Science and Technology, Japan*

A buried bolt in tunnel is an essential part, for example, a roof panel is bolted by chemical anchor bolt. As a preliminary investigation, bolts buried into polyurethane forms were evaluated.

**LSSEp4-6**
**Remote Sensing**

**Estimation of the second-order spatial correlation properties of a one-dimensional rough surface from polarization sensitive bistatic measurements**

Jonathan Alejandro Franco, Oscar G. Rodríguez-Herrera
*Universidad Nacional Autónoma de México (UNAM), Mexico*

We present a scatterometer to estimate the second-order spatial correlation properties of a one-dimensional rough surface from polarization sensitive bistatic measurements with promising applications in remote sensing.

**LSSEp4-7**
**Laser-Induced Breakdown Spectroscopy**

**Broadening and Shift of Emission Lines in Femtosecond Laser Induced Plasma Filament**

Alexey Ilyin[1,2], S. S. Golik[1,2], K. A. Shmirko[1,2], A. Yu. Mayor[1,2], D. Yu. Proschenko[2,3]
*[1]Institute of Automation and Control Processes, Russia, [2]Far Eastern Federal University, Russia, [3]Maritime State University, Russia*

Temporal behavior of emission lines (N I and O I) width and shift is investigated with subnanosecond resolution. Filament was induced by femtosecond pulses (800 nm, 1 mJ, 48 fs, 1 kHz) in air.

**LSSEp4-8**
**Laser-Induced Breakdown Spectroscopy**

**Investigation of the spectral and temporal characteristics of plasma radiation in the case of breakdown on the surface of aqueous solutions generated by single laser pulses of femtosecond duration**

Sergey Golik[1,2], A. A. Ilyin[1,2], D. Yu. Proschenko[1,2], A. Yu. Mayor[1,2], Yu. S. Tolstonogova[1,2], M. Yu. Babiy[1], A. V. Borovsky[1], T. M. Agapova[1]
*[1]Far Eastern Federal University, Russia, [2]Institute of Automation and Control Processes, Russia*

Spectral and temporal characteristics of plasma were studied in the femtosecond LIBS of aqueous solutions to determine the optimal excitation and registration parameters

### SLPCp8 10:30-12:00

**SLPCp8-1**

**Investigate of the laser cladding process by blue diode laser**

Ritsuko Higashino[1], Masahiro Tsukamoto[1], Yuji Sato[1], Nobuyuki Abe[1], Kohei Asano[1], Takahisa Shobu[2], Yoshinori Funada[3]
*[1]Joining and Welding Research Institute, Osaka University, Japan, [2]Japan Atomic Energy Agency, Japan, [3]Industrial Research Institute of Ishikawa, Japan*

In order to clarify the mechanism of copper layer formation, the layer formation process when forming a copper layer using a blue direct diode laser was observed using in situ X ray observation technique.

**SLPCp8-2**

**Pure copper layer formation on stainless steel plate with blue diode laser induced coating system**

Takahiro Hara[1], Masahiro Tsukamoto[2], Kohei Asano[1], Yuji Sato[2], Ritsuko Higashino[2], Yoshinori Funada[3], Nobuyuki Abe[2]
*[1]Graduate School of Engineering, Osaka University, Japan, [2]Joining and Welding Research Institute, Osaka University, Japan, [3]Industrial Research Institute of Ishikawa, Japan*

The pure copper layer was formed on the stainless steel plate with blue direct diode laser induced coating system in order to clarify the coating mechanism.

**SLPCp8-3**

**Simple estimation method to calculate absorbed power distribution for selective laser melting**

Tomomasa Ohkubo[1], Yuji Sato[2], Toshi-Taka Ikeshoji[3], Ei-ichi Matsunaga[1], Masahiro Tsukamoto[2]
*[1]Department of Mechanical Engineering, Tokyo University of Technology, Japan, [2]Joining and Welding Research Institute, Osaka University, Japan, [3]Fundamental Technology for Next Generation Research Institute, Kindai University, Japan*

We propose a simple estimation model to calculate absorbed power distribution including depth direction using ray-tracing. A surrounding box which has cyclic boundaries enable to reduce the calculation cost.

**SLPCp8-4**

**Selective laser melting of NdFeB magnetic powers**

Chung-Yo Chen[1], Chung-Wei Cheng[1], Mi-Ching Tsai[2], Tsung-Wei Chang[2], Wen-Cheng Chang[3], An-Chen Lee[1]
*[1]Department of Mechanical Engineering, National Chiao Tung University, Taiwan, [2]Department of Mechanical Engineering, National Cheng Kung University, Taiwan, [3]Department of Physics, National Chung Cheng University, Taiwan*

This study utilized a self-developed multi-beams SLM system to fabricate NdFeB structures from $Nd_2Fe_{14}B$ powders. The advantages are that the distance between the multi-beams, pulse duration, repetition rate, and scanning strategy can all be controlled.

**SLPCp8-5**

**Bead-on welding of copper film using 100W blue diode laser**

Kento Morimoto[1], Masahiro Tsukamoto[2], Shin-ichiro Masuno[2], Yuji Sato[2], Kazuyuki Azumi[1], Yoshihiko Hayashi[1,2], Nobuyuki Abe[2]
*[1]Osaka Fuji Corporation, Japan, [2]Joining and Welding Research Institute , Osaka University, Japan*

Bead-on welding for the pure copper film was carried out using a blue diode laser. The bead was formed on the pure copper film without pore and crack by using the blue diode laser.

**SLPCp8-6**

**Influence of intensity distribution on surface quality in high speed laser welding of aluminum alloy**

Martin Ruthandi Maina[1], Yasuhiro Okamoto[1], Akira Okada[1], Matti Närhi[2], Jarno Kangastupa[2], Jorma Vihinen[3]
*[1]Nontraditional Machining Laboratory, Okayama University, Japan, [2]Corelase Oy, Finland, [3]Laser Application Laboratory, Tampere University of Technology, Finland*

Experimental and numerical investigations were performed in high speed laser welding of aluminium alloy. In order to achieve deep penetration with stable welding phenomena and ensure good surface quality, adjustable ring-mode fiber laser was used.

**SLPCp8-7**

**Experimental characterization of the interaction dynamics of cw-laser radiation with metal samples in the $10^5$W/cm² regime**

Dominic Heunoske, Sebastian Schäffer, Marcel Goesmann, Jens Osterholz, Mathias Wickert
*Laser technologies, Fraunhofer EMI, Germany*

At Laser intensities above $10^5$kW/cm² material evaporates and affects the energy transfer from laser to metal sample. A systematic experimental study was performed using high-speed cameras, time- and space- resolved emission spectroscopy and interferometry

**SLPCp8-8**

**Laser metal bumping with SUS316L molten powder jet by blue diode laser for steel / carbon fiber reinforced thermoplastics joint**

Kiyokazu Yasuda[1], Yuki Uchida[1], Rennosuke Tamura[1], Takahiro Hara[2], Yuji Sato[2], Masahiro Tukamoto[2]
*[1]Division of Materials and Manufacturing Science, Osaka University, Japan, [2]Joining and Welding Research Institute, Osaka University, Japan*

Laser Metal Bumping (LMB) was conducted with multi-fiber focused blue LD lasers. The surface morphology on mild steels by LMB turned to be from bead-like to isolated bump type, effective for strengthening steel / CFRTP joints.

# Poster Session <Exhibition Hall A>

## Thursday, 26 April

### SLPCp8 10:30-12:00

**SLPCp8-9**

**Effect of laser peening on aluminum alloy 7075**

Ryotaro Oka[1], Shin Toyokura[1], Manabu Heya[2], Miho Tsuyama[1], Hitoshi Nakano[1]
*[1]Department of Electrical and Electronic Engineering, Faculty of Science and Technology, Kindai University, Japan, [2]Department of Electronic Information and Communication Engineering, Faculty of Engineering, Osaka-Sangyo University, Japan*

This study is to clarify various characteristics when laser peeening treatment is performed on aluminum alloy 7075 which is usually used for aircraft parts.

**SLPCp8-10**

**Control of plasma confinement layer for improving laser peening effect**

Akihiro Hata[1], Naoya Ehara[1], Manabu Heya[2], Miho Tsuyama[1], Hitoshi Nakano[1]
*[1]Electrical and Electronic Engineering, Faculty of Science and Technology, Kindai University, Japan, [2]Electronic information and Communication Engineering, Faculty of Engineering, Osaka-Sangyo University, Japan*

Water which has high acoustic impedance and high laser transmittance is chosen as the plasma confinement layer. In this study, the water temperature is varied to improve the laser peening effect.

**SLPCp8-11**

**Effect of control of acoustic impedance in plasma confinement layer on laser peening**

Miho Tsuyama[1], Naoya Ehara[1], Kazuma Yamashita[1], Manabu Heya[2], Hitoshi Nakano[1]
*[1]Faculty of Science and Engineering, Kindai University, Japan, [2]Faculty of Engineering, Osaka-sangyo University, Japan*

The present study aimed to control the plasma confinement layer on laser peening. The plasma confinement layer contributes to the increase in the shock wave pressure by suppressing the expansion of the laser-produced plasma.

**SLPCp8-12** *Canceled*

**SLPCp8-13** *Canceled*

**SLPCp8-14**

**Formation behavior of laser induced periodic surface structures in various media**

Tomoki Kobayashi[1], Tomohiro Wakabayashi[2], Yuichi Takushima[3], Jiwang Yan[1]
*[1]Mechanical Engineering, Keio University, Japan, [2]Yazaki corporation, Japan, [3]Optoquest, Japan*

Laser-induced periodic surface structure (LIPSS) was formed on the stainless tool steel by irradiating a picosecond pulsed laser in various types of media. Different surface morphologies were observed on the material surface, depending on the types of media.

**SLPCp8-15**

**Analytical approach to hydrophobic properties of micro patterns carbonized by 355nm UV laser**

Gyeongju Je[1], Bosung Shin[1,2], Hyesu Kim[1], Junhan Park[1]
*[1]Cogno-Mechatronics Engineering, Pusan National University, Korea, [2]Optics & Mechatronics Engineering, Pusan National University, Korea*

Carbonized patterning using 355nm UV laser was conducted to impart hydrophobicity on polyimide film and analyzed contact angle according to the properties of patterns.

**SLPCp8-16**

**Femtosecond laser coloration with nanoparticles formed on titanium plate**

Shogo Nishino[1,2], Masaki Hashida[1,2], Hitoshi Sakagami[3], Yuki Furukawa[1,2], Sadaoki Kojima[2], Shunsuke Inoue[1,2], Shuji Sakabe[1,2]
*[1]Graduate School of Science, Kyoto University, Japan, [2]Advanced Research Center for Beam Science, Institute for Chemical Research, Kyoto University, Japan, [3]National Institute for Fusion Science, Japan*

Coloration on titanium surface by femtosecond laser pluses is demonstrated and the correlation of color and formed nanoparticles on the surface is discussed. It has been found that color depends on particle size distribution.

**SLPCp8-17**

**Volumetric graphics of microbubbles in gold nanoparticle-dispersed glycerin using femtosecond laser pulses**

Taisei Chiba, Kota Kumagai, Yoshio Hayasaki
*Center for Optical Research and Education (CORE), Utsunomiya University, Japan*

We have demonstrated the generation of femtosecond laser-induced microbubbles in glycerin containing gold nanoparticles. Gold nanoparticles reduced the energy for the generation of microbubbles and the expansion of the generation region in the axial direction.

**SLPCp8-18**

**Micro and nano structured membranes for the use in AlGaN/GaN- MEMS and pressure sensors, microfluidic applications and bioengineering**

Johann Karl Zehetner[1], Stephan Kasemann[1], Gabriel Vanko[2], Jaroslav Dzuba[2], Tibor Lalinsky[2], Sylvia Nürnberger[3]
*[1]Research Centre for Microtechnology, University of Applied Sciences, Austria, [2]Institute of Electrical Engineering, Slovak Academy of Sciences, Slovak, [3]Department of Trauma Surgery, Medical University of Vienna, Austria*

By polarization determined femtosecond laser ablation combined with reactive ion etching we fabricated membranes in Si and SiC for pressure sensors and 300µm long needles on top of 10µm thick membranes for biomimetic microfluidic systems

**SLPCp8-19** *Move to Session 4*

**SLPCp8-20**

**Three-dimensional Cu-based microfabrication using femtosecond laser induced internal writing**

Mizue Mizoshiri, Yukinari Kondo, Seiichi Hata
*Graduate School of Engineering, Nagoya University, Japan*

Three-dimensional Cu-based microstructures were fabricated using femtosecond laser induced internal writing. Localized plasmon enhancement and heat accumulation were selectively used to sinter single and multi-layers of $Cu_2O$ NSs.

**SLPCp8-21** *Canceled*

**SLPCp8-22**

**Ablation by double pulse irradiation by femtosecond laser with different delay time**

Masahito Katto[1], Kensuke Nakajima[2], Sho Kuronita[2], Masahiro Tsukamoto[3], Masanori Kaku[2], Atsushi Yokotani[2]
*[1]CRCC, University of Miyazaki, Japan, [2]Faculty of Engineering, University of Miyazaki, Japan, [3]JWRI, Osaka University, Japan*

We examined the ablation traces on the Si surface irradiated by the double pulses of fs-laser. In the near threshold range, energy deposition by 1st pulse was affected the 2nd pulse until the 250 ps. Above the threshold the HAZ did not grown after the time interval of 50 ns. These results were explained by the energy transfer from electrons to lattice and thermal diffusion.

**SLPCp8-23**

**Holographic laser processing using femtosecond second harmonic generation**

Ryo Onoda, Satoshi Hasegawa, Yoshio Hayasaki
*Center for Optical Research and Education (CORE), Utsunomiya University, Japan*

In order to perform efficient fabrication of diffractive optical elements based on refractive index modification inside a transparent material, holographic laser processing using femtosecond second-order harmonic generation was demonstrated.

**SLPCp8-24**

**Holographic complex-amplitude modulation for generating sub-diffraction-limit spot applied to laser material processing**

Satoshi Hasegawa[1], Cao Hoai Vu[1], Yusuke Ogura[2], Jun Tanida[2], Yoshio Hayasaki[1]
*[1]Center for Optical Research and Education (CORE), Utsunomiya University, Japan, [2]Graduate School of Information Science and Technology, Osaka University, Japan*

We demonstrated the holographic complex-amplitude modulation for generating the sub-diffraction-limit spot applied to laser processing. The modulation is based on the regulation of the intensity and phase between the center and surrounding beams. In the presentation, a result of femtosecond laser processing using the sub-diffraction-limit spot will also be discussed.

**SLPCp8-25**

**Direct-writing properties of Cu-Ni-based thermoelectric micropatterns formed by femtosecond laser reductive sintering at low writing speed**

Kenta Nishitani, Seiichi Hata, Junpei Sakurai, Mizue Mizoshiri
*Department of micro-nano mechanical science and engineering, Graduate School of Engineering, Nagoya University, Japan*

P-type Cu-Ni and n-type $Cu_2O$ thermoelectric micropatterns were selectively fabricated by femtosecond laser reductive sintering of CuO/NiO mixed nanoparticles. These micropatterns were formed at low writing speed without damage created by stage acceleration.

**SLPCp8-26**

**The study of multi-angle drilling by Nd: YAG nanosecond laser on 27G needle and electrochemical polishing**

Hsin Hao Su[1], Wei Te Wu[1], Chien Hsing Chen[2], Jian Neng Wang[3]
*[1]Department of Biomechatronics Engineering, National Pingtung University of Science and Technology, Taiwan, [2]Department of Physics, National Chung Cheng University, Taiwan, [3]Department of Civil and Construction Engineering, National Yunlin University of Science and Technology, Taiwan*

In this study, a series of multi-angle holes were drilled in the 27G dental irrigation needle. We used a nano-second pulsed laser source. Therefore, we used electrochemical polishing technology to improve the HAZ situation.

**SLPCp8-27**

**Characterization a poly-silicon thin film formed by the laser annealing with a high-power blue laser diode**

Young-Hwan Choi, Hyun Yeol Ryu, Han-Youl Ryu
*Physics, Inha University, Korea*

We report on the crystallization of a-Si thin film by the annealing with a high-power blue laser diode, and the crystallinity of the annealed poly-Si was characterized by XRD, ellipsometry, and Raman measurements.

**SLPCp8-28**

**Piercing of PTFE sheet by short pulse $CO_2$ laser**

Hayato Goto[1], Yuta Ishikawa[1], Kazuyuki Uno[1], Takahisa Jitsuno[2]
*[1]University of Yamanashi, Japan, [2]Institute of Laser Engineering, Osaka University, Japan*

We pierced PTFE by a short pulse $CO_2$ laser. The short laser pulse with the pulse tail with the fluence of about 7.5 J/cm$^2$ produced a through hole.

**SLPCp8-29**

**Characterization of two-photon laser exposure patterns in photoresist via photoluminescence quenching**

Edy Yulianto, Subhashri Chatterjee, Vygantas Mizeikis
*Research Institute of Electronics, Shizuoka University, Japan*

We report on imaging of latent 3D photo exposure patterns in photoresist exposed via two-photon absorption prior to their development. This technique can be used to reveal useful features of photo exposure, such as spatial distribution, laser modification threshold etc.

# Poster Session <Exhibition Hall A>

## Thursday, 26 April

### SLPCp8 10:30-12:00

**SLPCp8-30**

**Post-fabrication spectral tuning of perfect-absorber metasurface structures fabricated by direct laser write technique**

Subhashri Chatterjee[1], Edy Yulianto[1], Ihar Faniayeu[1,2], Vygantas Mizeikis[1]
*[1]Research Institute of Electronics, Shizuoka University, Japan, [2]Department of General Physics, Gomel State University, Belarus*

We investigate posibilites to tune resonance wavelength of perfect absorber structures fabricated by Direct Laser Write (DLW) technique by varying thickness of the metallic film deposited conformally on the structures.

**SLPCp8-31** *Withdraw*

**SLPCp8-32**

**Laser micro incising to wood surface - Perforations enable penetration of chemicals for wood modification -**

Satoshi Fukuta[1], Masaki Nomura[1], Koji Wakabayashi[2]
*[1]Industrial Research Center, Aichi Center for Industry and Science Technology, Japan, [2]Laser Technical Center, Laserx Co., Ltd., Japan*

We proposed "Laser Micro Incising" for wood, a new technique applying short pulse laser. The perforations on wood surface processed by the laser enabled permeation of chemicals, and chemical modification of wood could be performed.

**SLPCp8-33**

**Measurement and analysis of material properties using laser induced breakdown spectroscopy**

Sangwoo Yoon, Jihoon Kim, Joohan Kim
*Department of Mechanical Engineering, Seoul National University of Science and Technology, Korea*

LIBS is generally used to measure elemental distribution, but the plasma signal from the ablation of the material has a lot of information about the material and can analyze spectroscopic signals to confirm the various properties of the specimen.

**SLPCp8-34** *Withdraw*

**SLPCp8-35** *Canceled*

**SLPCp8-36** *Canceled*

**SLPCp8-37** *Canceled*

### XOPTp9 10:30-12:00

**XOPTp9-1**

**Feasibility study of phase-contrast X-ray micro-CT using diffraction enhanced imaging**

Akio Yoneyama[1,2], Rika Baba[2], Kazuyuki Hyodo[3]
*[1]Saga Light Source, Japan, [2]Hitachi Ltd., Japan, [3]High Energy Accelerator Research Organization, Japan*

We developed a phase-contrast X-ray micro CT system using diffraction enhanced imaging method. The results of feasibility observation of a polymer sphere show that the spatial resolution was about 3 um.

**XOPTp9-2**

**X-ray stroboscopic phase tomography with Talbot interferometer and white synchrotron radiation**

Yanlin Wu, Hidekazu Takano, Atsushi Momose
*Tohouk University, Japan*

Here, we report time-resolved X-ray phase tomography using Talbot interferometer combine with stroboscopic techniques, which are applicable when the process to be imaged is periodic with microsecond order temporal resolution.

**XOPTp9-3**

**Development of X-ray phase laminography microscope based on grating interferometry**

Hidekazu Takano[1], Karol Vegso[2], Masato Hoshino[2], Yanlin Wu[1], Atsushi Momose[1,2]
*[1]Tohoku University, Japan, [2]Japan Synchrotron Radiation Research Institute, Japan*

An X-ray phase laminography microscope was demonstrated using 9 keV X-ray of SPring-8 37XU. The system was composed by an X-ray microscope using a FZP and by a Tolbot interferometer using X-ray transmission gratings.

**XOPTp9-4**

**Imaging thermoresponsive gold nanoparticles in solution by X-ray laser diffraction**

Akihiro Suzuki[1], Takashi Kimura[1], Ryo Iida[2], Hideyuki Mitomo[1,5], Yasumasa Joti[3], Yoshitaka Bessho[4], Ken-ichi Niikura[6], Kuniharu Ijiro[1,5], Yoshinori Nishino[1]
*[1]Research Institute for Electronic Science, Hokkaido University, Japan, [2]Graduate School of Chemical Sciences and Engineering, Hokkaido University, Japan, [3]Japan Synchrotron Radiation Research Institute, Japan, [4]Academia Sinica, Taiwan, [5]Global Institution for Collaborative Research and Education, Hokkaido University, Japan, [6]Nippon Institute of Technology, Japan*

By adding sample temperature control function to pulsed coherent X-ray solution scattering (PCXSS), we realized nanostructure imaging of gold nanoparticles, which self-assemble in solution due to temperature changes.

**XOPTp9-5**

**Parametric-Down Conversion of X-rays into the Optical Regime**

Aviad Schori[1], Christina Bomer[2], Denis Borodin[1], Steve Collins[3], Bllanka Detlefs[4], Marco Moretti Sala[4], Shimon Yudovich[1], Sharon Shwartz[1]
*[1]Bar-Ilan University, Israel, [2]European XFEL, Germany, [3]Diamond Light Source, UK, [4]European Synchrotron Radiation Facility, France*

We observed parametrically down converted x-ray signal photons that correspond to idler photons at optical wavelengths. The results demonstrate a new method for probing valence-electron charges and microscopic optical responses of crystals with atomic-scale resolution.

**XOPTp9-6**

**Study of silicon microstructures by x-ray high resolution diffractometry based on refractive optics**

Petr Ershov[1], Alexander Barannikov[1], Ivan Lyatun[1], Dmitriy Zverev[1], Sergey Kuznetsov[2], Vyacheslav Yunkin[2], Irina Snigireva[3], Anatoly Snigirev[1]
*[1]Immanuel Kant Baltic Federal University, Russia, [2]Institute of Microelectronics Technology and High-Purity Materials, Russia, [3]European Synchrotron Radiation Facility, France*

We propose and demonstrate the new X-ray optical diffractometry technique based on Compound Refractive Lenses(CRL) to study different Si microstructures. The unique results presented in that work, shows perspectives of future technique applications.

**XOPTp9-7**

**SwissFEL photon diagnostics for soft, tender and hard X-rays**

Christopher A. Arrell, Jens Rehanek, Pavle Juranic, the SwissFEL team
*Paul Scherrer Institut, Switzerland*

Photon diagnostics in use on the hard X-ray branch (Aramis) of SwissFEL and those planned for the tender X-ray and the future soft X-ray branch (Athos) are presented.

**XOPTp9-8**

**Synchrotron radiation-based anomalous dispersion X-ray powder diffraction studies of Pb/Bi distributions in ferroelectric oxides**

Kun Lin[1], Yili Cao[1], Kenichi Kato[2], Xianran Xing[1]
*[1]University of Science and Technology Beijing, China, [2]RIKEN SPring-8 Center, Japan*

Synchrotron radiation-based anomalous dispersion X-ray powder diffraction technique was successfully used to reveal the ordered Pb/Bi distributions in a tungsten bronze oxide $PbBiNb_5O_{15}$ and disordered Pb/Bi distributions in perovskite oxides $(1-x)PbTiO_3$-$xBiFeO_3$ and $(1-x)PbTiO_3$-$xBi(Zn_{1/2}Ti_{1/2})O_3$.

**XOPTp9-9** *Canceled*

**XOPTp9-10**

**Theory and fabrication feasibility of ultra short focal length refractive lenses for hard X-Rays**

Lucia Alianelli, John Sutter, Kawal Sawhney
*Diamond Light Source Ltd, UK*

We discuss refractive lens designs, and materials currently used for synchrotron applications and the fabrication requirements to produce an aberration-free refractive lens for focusing to s = 20 nm, based on new designs.

**XOPTp9-11**

**X-ray refractive parabolic axicon lens**

Dmitrii Zverev[1], Alexandr Barannikov[1], Irina Snigireva[2], Anatoly Snigirev[1]
*[1]Immanuel Kant Baltic Federal University, Russia, [2]European Synchrotron Radiation Facility, France*

An X-ray axicon, as novel type of beam-shaping optical element is proposed and demonstrated. Under coherent X-ray illumination, the parabolic axicon generates Bessel-like beam along the optical axis and ring-shaped beam at the imaging distance.

**XOPTp9-12**

**Phase-contrast imaging using X-ray nanointerferometer based on Si refractive bilenses**

Dmitrii Zverev[1], Victor Kohn[2], Irina Snigireva[3], Anatoly Snigirev[1]
*[1]Immanuel Kant Baltic Federal University, Russia, [2]Russian Research Center Kurchatov Institute, Russia, [3]European Synchrotron Radiation Facility, France*

We have demonstrated phase-contrast technique using X-ray nanointerferometer based on Si refractive bilenses. Proposed phase-contrast imaging technique will allows to study natural and advanced man-made nanoscale materials.

**XOPTp9-13**

**Beryllium X-ray optical properties: from refractive lens to diffuser**

Ivan Lyatun[1], Peter Ershov[1], Svetlana Medvedeva[1], Elena Kozlova[2], Maxim Sheverdyaev[2], Vladimir Volkov[3], Alexandr Semenov[2], Vladimir Gorlevsky[2], Valery Savin[1], Irina Snigireva[4], Anatoly Snigirev[1]
*[1]Immanuel Kant Baltic Federal University, Russia, [2]A. A. Bochvar High-Technology Scientific Research Institute for Inorganic Materials, Russia, [3]Russian Academy of Sciences, Russia, [4]European Synchrotron Radiation Facility, France*

Almost all beryllium grades are sintered materials, which have internal micro- and nanograine structure and relatively high BeO concentration. BeO forms a inhomogeneous internal structure in beryllium which leads to strong ultra-small angular X-ray scattering.

# Poster Session <Exhibition Hall A>

## Thursday, 26 April

### XOPTp9 10:30-12:00

**XOPTp9-14**

**2D polymer refractive microlenses fabricated by additive technology**

Aleksandr Barannikov[1], Ksenya Abrashitova[1,2], Vladimir Bessonov[2], Alexander Petrov[1,2], Natalya Kokareva[2], Kirill Safronov[2], Petr Ershov[1], Nataliya Klimova[1], Ivan Lyatun[1], Vyacheslav Yunkin[3], Maxim Polikarpov[1], Irina Snigireva[4], Andrey Fedyanin[2], Anatoly Snigirev[1]
*[1]Immanuel Kant Baltic Federal University, Russia, [2]Lomonosov Moscow State University, Russia, [3]Russian Academy of Science, Russia, [4]European Synchrotron Radiation Facility, France*

This paper is presents the new X-ray refractive lense manufacturing technology, wich gives the possibility to overcome the limits of other popular techniques.

**XOPTp9-15**

**Mini-Trasfocator for X-ray Microscopy**

Aleksandr Barannikov, Petr Ershov, Anatoly Lushnikov, Ivan Lyatun, Anton Narikovich, Igor Panormov, Maxim Polikarpov, Aleksandr Sinitsyn, Dmitry Zverev, Anatoly Snigirev
*Immanuel Kant Baltic Federal University, Russia*

We propose an X-ray Mini-Trasfocator for X-ray microscopy, introscopy and related applications. This device based on parabolic refractive lenses can be used for adjustment of the lens assembly by mechanical movement of the lenses one-by-one.

**XOPTp9-16**

**High-aspect-ratio X-ray optical devices fabricated from Pt-based metallic glass**

Wataru Yashiro[1], Masanari Datekyu[2], Masashi Nakao[3], Yoshiki Kohmura[4], Hidemi Kato[2]
*[1]Institute of Multidisciplinary Research for Advanced Materials, Tohoku University, Japan, [2]Institute of Materials Research, Tohoku University, Japan, [3]Micro System Integration Center,Tohoku University, Japan, [4]RIKEN SPring-8 Center, Japan*

In general, hard-X-ray optical devices essentially requires high-aspect-ratio structures because of weak interaction of hard X-rays with matters. Recently, we successfully fabricated high-aspect-ratio transmission gratings, and even an FZP, by Pt-based metallic glass imprinting.

**XOPTp9-17**

**Two-dimensional VLS gratings from Berlin (NOB GmbH)**

Heike Loechel
*Neutron Optics Berlin, Germany*

A new approach for 2-dimensional variable space (VLS) gratings was implemented at Neutron Optics Berlin GmbH for wavelength dispersive spectrometry and ultra-fast time-resolved monochromators. These diffractive optical elements provide new options in the XUV and X-ray range with up to 5000 lines/mm.

**XOPTp9-18**

**Depelopment of Channel-cut Crystal X-ray Monochromators for Low-emittance X-ray Sources Using High-presicion Plasma Etching**

Yuki Morioka[1], Takashi Hirano[1], Yasuhisa Sano[1], Satoshi Matsuyama[1], Taito Osaka[2], Tetsuo Katayama[3], Makina Yabashi[2], Kazuto Yamauchi[1]
*[1]Osaka University, Japan, [2]RIKEN SPring-8 Center, Japan, [3]Japan Synchrotron Radiation Research Institute, Japan*

In order to eliminate subsurface damage on inner-walls of channel-cut crystal monochromators (CCMs) with narrow channel width, we newly prepared small rotation electrode and treated inner-walls of CCM with channel width of 8 mm.

**XOPTp9-19**

**Development of Fabrication Method of Speckle-free Channel-cut Crystal X-ray Monochromators with Sub-mm Channel Width**

Takashi Hirano[1], Yuki Morioka[1], Yasuhisa Sano[1], Taito Osaka[1,2], Satoshi Matsuyama[1], Makina Yabashi[2], Kazuto Yamauchi[1]
*[1]Osaka University, Japan, [2]RIKEN SPring-8 Center, Japan*

A speckle-free channel-cut crystal monochromators with a sub-mm channel width is highly demanded for self-seeded XFELs. Its fabrication method based on the local etching technique using atmospheric-pressure plasma was proposed and discussed.

**XOPTp9-20**

**Interface engineering of periodic multilayer EUV and x-ray mirrors**

JiaoLing Zhao, Meiping Zhu, Kui Yi, Hongji Qi, Hongbo He, Jianda Shao
*Chinese Academy of Sciences, China*

The interface of EUV and X-ray multilayer mirrors are investigated to improve the reflectivity and thermal stability, in which the barrier layer, reactive sputtering and co-sputtering are discussed.

**XOPTp9-21**

**The Commission of Mirror Holder for X-ray Nanoprobe**

BoYi Chen[1], Gung-Chian Yin[1], Chien-Yu Lee[1], Ming-Ying Hsu[1], Bi-Hsuan Lin[2], Shao-Chin Tseng[2], Xiao-Yun Li[2], Huang-Yeh Chen[2], Jian-Xing Wu[2], Shih-Hung Chang[3], Mau-Tsu Tang[2]
*[1]Experimental Technique Group, National Synchrotron Radiation Research Center, Taiwan, [2]X-ray and IR imaging Group, National Synchrotron Radiation Research Center, Taiwan, [3]Beamline Group, National Synchrotron Radiation Research Center, Taiwan*

The commission of X-ray nanoprobe endstation started to test the performance of each components and systems. Both of the focus ability of Montel mirros and the stability are studied.

**XOPTp9-22**

**New figuring model based on surface slope profiles for X-ray optics**

Lin Zhou[1], Hao Hu[1], Ci Song[1], Shanyong Chen[1], Guipeng Tie[1], Mourad Idir[2]
*[1]National University of Defense Technology, China, [2]NSLS II, Brookhaven National Laboratory, USA*

Surface slope profiles are widely used in the metrology of X-ray optics instead of surface height profiles. Nevertheless, the theoretical and experimental model currently used in deterministic optical figuring processes is based on surface heights, not on surface slopes.

**XOPTp9-23**

**Measurement of a spherical mirror with sub-50 pm repeatability by three-dimensional nanoprofiler using normal vector tracing Method**

Yui Toyoshi, Ryo Kizaki, Hiroki Shiraji, Takao Kitayama, Jungmin Kang, Kazuya Yamamura, Katsuyoshi Endo
*Osaka University, Japan*

We developed a non-contact nanoprofiler that measures normal vectors of surface. We introduce a measurement of a spherical mirror with radius of curvature of 1000 mm. The repeatability of it were less than 50 pm.

**XOPTp9-24**

**Development of nanofocusing system for X-ray free electron Laser (Study of nanobeam characterization)**

Takato Inoue[1], Satoshi Matsuyama[1], Shogo Kawai[1], Hirokatsu Yumoto[2], Yuichi Inubushi[2], Takahisa Koyama[2], Kensuke Tono[2], Taito Osaka[3], Haruhiko Ohashi[2], Makina Yabashi[3], Tetsuya Ishikawa[3], Kazuto Yamauchi[1]
*[1]Osaka University, Japan, [2]Japan Synchrotron Radiation Research Institute, Japan, [3]RIKEN SPring-8 Center, Japan*

Ideal focusing can be realized if wavefront information of a focused beam can be measured and improved. We evaluated the single shot beam characterization method using speckle patterns due to the scattering of nanoscale particles.

**XOPTp9-25**

**Development of high-resolution X-ray imaging optical system using multilayer imaging mirrors**

Kentaro Hata[1], Jumpei Yamada[1], Satoshi Matsuyama[1], Yasuhisa Sano[1], Yoshiki Kohmura[2], Makina Yabashi[2], Tetsuya Ishikawa[2], Kazuto Yamauchi[1,3]
*[1]Department of Precision Science and Technology, Graduate School of Engineering, Osaka University, Japan, [2]RIKEN SPring-8 Center, Japan, [3]Center for Ultra-Precision Science and Technology, Graduate School of Engineering, Osaka University, Japan*

We have developed an imaging optics based on Advanced KB mirrors with a graded multilayer film. A high resolution of about 35 nm x 50 nm (H x V) was achieved.

**XOPTp9-26**

**Development of adaptive X-ray focusing system based on a combination of a piezoelectric bimorph mirror and a mechanical mirror bender**

Hiroyuki Yamaguchi[1], Takumi Goto[1], Hiroki Hayashi[1], Satoshi Matsuyama[1], Junki Sonoyama[2], Kazuki Akiyama[2], Hiroki Nakamori[3], Yasuhisa Sano[1], Yoshiki Kohmura[4], Makina Yabashi[4], Tetsuya Ishikawa[4], Kazuto Yamauchi[1]
*[1]Osaka University, Japan, [2]TOYAMA, Japan, [3]JTEC Corporation, Japan, [4]RIKEN SPring-8 Center, Japan*

We developed a hybrid deformable mirror based on a combination of a piezoelectric bimorph mirror and a mechanical mirror bender. We report the result of 2D focusing experiment using the mirrors at SPring-8.

**XOPTp9-27**

**Thermal Analysis for Ion Beam Processing of the Unimorph Deformable Mirror**

Zhanbin Fan[1,2], Chaoliang Guan[1,2], Guipeng Tie[1,2], Shanyong Chen[1,2]
*[1]National University of Defense Technology, China, [2]Hunan Key Laboratory of Ultra-precision Machining Technology, China*

The variation law of temperature and thermal stress of the adhesive layer with different ion beam diameters and scanning times are obtained by simulation and test. The thermal effect of the ion beam is eliminated.

**XOPTp9-28**

**Figure correction of ellipsoidal x-ray mirrors by ion beam sputtering deposition**

Shunya Yokomae, Hiroto Motoyama, Hidekazu Mimura
*The University of Tokyo, Japan*

We developed a figure correction system for ellipsoidal x-ray mirrors employing ion beam sputtering deposition. After the process, figure error of the inner surface of a mirror was decreased from 202 nm to 96 nm.

**XOPTp9-29**

**Development of a high precision processing for master mandrel of soft X-ray ellipsoidal mirror**

Yuusuke Matsuzawa, Shinji Okawa, Hidekazu Mimura
*The University of Tokyo, Japan*

Our research group is development of single nano-meter precision of the master mandrel for fabrication soft X-ray ellipsoidal mirror. We developed a processing method that is combination by small diameter tool and organic particles.

**XOPTp9-30**

**Imaging Quality of HHG Achromatic Microscope Using Wolter Mirrors**

Satoru Egawa[1], Hiroto Motoyama[1], Atsushi Iwasaki[2], Kaoru Yamanouchi[2], Hidekazu Mimura[1]
*[1]Department of Precision Engineering, School of Engineering, the University of Tokyo, Japan, [2]Department of Chemistry, School of Science, the University of Tokyo, Japan*

We demonstrate a HHG (high-harmonic generation) achromatic imaging microscope using Wotler mirrors. Sub-micrometer spatial resolution was achieved. The future plan is to perform time-resolved imaging using polychromatic bright illumination.

# Poster Session <Exhibition Hall A>

## Thursday, 26 April

### XOPTp9 10:30-12:00

**XOPTp9-31**

**Current X-ray mirrors and metrology of JTEC Corporation**

Hiroki Nakamori[1,2], Hiromi Okada[1], Shinya Aono[1], Kazuto Yamauchi[2], Takashi Tsumura[1]
*[1]JTEC Corporation, Japan, [2]Osaka University, Japan*

We fabricate ultraprecise X-ray mirrors for synchrotron radiation facilities. The mirrors are measured and fabricated by special techniques. We will report current metrology and X-ray mirrors.

### ICNN5p 13:00-14:30

**ICNN5p-1**

**Plasmonic Property of Two-Dimensional Transition Metal Nanodot Arrays**

Mi Jung, Sun-Ho Kim, Eudum Kim
*Chung-Ang University, Korea*

Two-dimensional (2D) copper and nickel NDAs with ~ 85 nm diameter were fabricated on ITO substrates using ultra-thin nanoporous alumina mask with through-holes as a shadow mask. Plasmonic properties of 2D Cu and Ni NDAs

**ICNN5p-2**

**Enhanced Emission from Ultrastable CsPbBr3/SiO2 Nanocrystals**

Zhengzheng Liu[1], Zhiping Hu[2], Tongchao Shi[1], Zeyu Zhang[1], Xin Xing[1], Xiaosheng Tang[2], Juan Du[1], Yuxin Leng[1]
*[1]Shanghai Institute of Optics and Fine Mechanics, Chinese Academy of Sciences, China, [2]Chongqing University, China*

Enhanced amplified spontaneous emission has been obtained from perovskite CsPbBr3 quantum dots embedded in waterless silica spheres. In addition, the moisture resistance and photostability of quantum dots are effectively improved.

**ICNN5p-3**

**Enhanced Light-Coupling in Laser-Crystallised Silicon Thin-Film Solar Cells on Glass by Moth-Eye Anti-Reflection Foil**

Mohd Zamir Pakhuruddin
*School of Photovoltaic and Renewable Energy Engineering, University of New South Wales, Australia*

Enhanced Light-Coupling in Laser-Crystallised Silicon Thin-Film Solar Cells on Glass by Moth-Eye Anti-Reflection Foil

**ICNN5p-4**

**UV Enhanced Non-Enzymatic Glucose Biosensor of Zno Nanosheets**

Zi-Hao Wang[1,2], Shi-Wei Luo[2,3], Wei-Sheng Yeh[1,2], Cheng-You Tai[1,2], Chih-Chiang Yang[2], Chien-Sheng Huang[3], Yan-Kuin Su[1,2]
*[1]National Cheng Kung University, Taiwan, [2]Kun Shan University, Taiwan, [3]National Yunlin University of Science and Technology, Taiwan*

ZnO nanosheets were synthesized on glass substrates. Moreover, UV illumination increases the sensitivity by about 50%. In addition, these enhanced UV illumination are due to the localized surface plasmon resonance effect.

**ICNN5p-5**

**Supercell-Based High-Efficiency Reflector-Arrays Metasurface Based on Bridged Plasmonic Nanoparticles**

Enliang Wang[1,2], Liang Yonghao[1,2], Xie Changqing[1]
*[1]Key Laboratory of Microelectronic Devices and Integrated Technology, Institute of Microelectronics, Chinese Academy of Sciences, China, [2]School of Microelectronics, University of Chinese Academy of Sciences, China*

We provide a reflector-arrays metasurface consisting of Au nanowire-bridged dimer associated with an Au reflector substrate.

**ICNN5p-6**

**Polarization-Insensitive and Wide-Incident-Angle Optical Absorber with Periodically Patterned Graphene-Dielectric Arrays**

Xiu juan Zou, Gaige Zheng
*NUIST, China*

A polarization-insensitive and angle-independent graphene absorber (GA) with periodically patterned grating is demonstrated.

**ICNN5p-7**

**Design of An Ultra-Broadband Near-Infrared Cut Filter Based on Hydrogenated Amorphous Carbon**

Yusuke Kondo
*Osaka research institute of science and technology (ORIST), Japan*

Hydrogenated amorphous carbon (a-C:H) is a promising candidate for the fabrication of near-infrared (NIR) optical filters. We succeeded in precisely controlling the refractive index and designed a multilayer system for ultra-broadband NIR cut filter.

**ICNN5p-8**

**Novel CQDs@Ni(OH)2 Fluorescent Hybrid Materials for the H2 Production via Photocatalytic Water Splitting**

Seshadri Reddy Ankireddy, Roopkumar Sangubotla, Kyusik Yun
*Gachon University, Korea*

We are presenting hydrothermal preparation of CQDs@Ni(OH)2 fluorescent hybrid materials for the H2 Production via Photocatalytic Water Splitting. By the immobilization of Ni(OH)2 on the surface of CQDs, more amount of H2 was produced

**ICNN5p-9**

**Near-Unity Absorption of Graphene Monolayer with A Triple-Layer Waveguide Coupled Grating**

Haojing Zhang, Gaige Zheng
*NUIST, China*

A design of absorber inspired by contact coupled gratings with an absentee layer is demonstrated.

**ICNN5p-10**

**1*2 Hybrid Plasmonic Multimode Interference Power Splitter with Arbitrary Ratio**

Wencheng Yu, Wei Luo, Yuxiang Sheng, Peng Zhou, Hongye Zhou, Ye Tian
*Hunan City University, China*

The power-splitting-ratio (PSR) of the 1*2 multimode interference (MMI) device based on hybrid plasmonic waveguide are studied theoretically. An arbitrary PSR is achieved.

**ICNN5p-11**

**Observation of Whispering Gallery Mode At An Unbalanced Mach-Zehnder Interferometer by Plasmonic Waveguides**

Shun Kamada, Toshihiro Okamoto, Masanobu Haraguchi
*Tokushima University, Japan*

We proposed an unbalanced Mach-Zehnder interferometer (MZI) by using Metal/Insulator/Metal type plasmonic waveguides for optical modulation or sensor devises. In this study, transmission properties of the unbalanced MZIs are evaluated both experimentally and numerically.

**ICNN5p-12**

**Generation of Surface Plasmon Polaritons in Graphene-Semiconductor Structure with Distributed Feedback**

Sergey Moiseev, Yuliya Dadoenkova, Aleksei Kadochkin, Igor Zolotovskii
*Ulyanovsk State Univ, Russia*

The possibility of surface plasmon polariton generation in a waveguiding system containing semiconductor film and graphene single-layer is shown.

**ICNN5p-13**

**Synthesis of Carbon Quantum Dots from Aspartic Acid**

Yeji Kim, Roopkumar Sangubotla, Jongsung Kim
*Gachon university, Korea*

Synthesis of Carbon Quantum Dots from Aspartic Acid. Aspartic acid is simple, and inexpensive. And change the functional group to thiol group detect lead by L-cysteine.

**ICNN5p-14**

**One-Step Green Synthesis of Carbon Dots from Indian Kino Via Hydrothermal Process**

Roopkumar Sangubotla, Yeji Kim
*Gachon University, Korea*

Green synthesis of carbon dots from natural source via hydrothermal process and potentially applied for the epinephrine sensing in biological samples.

**ICNN5p-15**

**Microwave Synthesis of Highly Fluorescent N-doped Carbon Dots from Pamam Dendrimer**

Moniruzzaman Md, Seshadri Reddy Ankireddy
*Gachon University, Korea*

Herein we report a simple microwave method for the synthesis of highly fluorescent N-Doped carbon dots (CQDs) and linked with DHLA for the ultra level sensing of Hg2+ ions

**ICNN5p-16**

**Improving the Characteristics of Au/ZnO Schottky-Photodiodes by Inserting an Intrinsic NiO Layer**

Jun-Dar Hwang, H.Y. Chen
*Electrophysics, National Chiayi University, Taiwan*

Conventionally, the Schottky-photodiodes (SPDs) of Au/ZnO presented an ohmic behavior. In this work, the intrinsic NiO (i-NiO) layer was inserted between Au/ZnO interface, i.e., Au/NiO/ZnO, to improve the characteristics of Au/ZnO SPDs.

**ICNN5p-17**

**Normally-Off HEMT with Simply Solution-Processed p-NiO As Gate Oxide Layer**

Liang Rong Shi
*Institute of Microelectronics, Taiwan*

A p-NiO gate oxide layer with nanoscale thickness formed on AlGaN barrier layer can lift up the potential at the channel and achieved the normally-off device with high channel mobility.

# Poster Session <Exhibition Hall A>

## Thursday, 26 April

### ICNN5p 13:00-14:30

**ICNN5p-18**

**The Luminance Improvement of MAPbBr3 Light Emitting Diodes by Boiled NiOx Solution for Hole Transport Layer**

Hui Yu He
*Institute of Microelectronics, Taiwan*

We demonstrate efficient pure greenlight emitting diodes based on methylammonium lead bromide (MAPbBr3) hybrid perovskite with p-type NiO by boiled solution as the hole transporting layer (HTL). The LED exhibits a current efficiency and luminance of 5.7 cd/A and 116,295 cd/m2, respectively.

**ICNN5p-19**

**Indium-Gallium-Oxide Solar-Blind Photodetectors under Different Oxygen Concentrations**

Chih-Chiang Yang, Kuan-Yu Chen, Hsin-Chieh Yu, Zi-Hao Wang, Ching-Chien Hsu, Yan-Kun Su
*Kun Shan University, Taiwan*

Ultraviolet (UV) photodetectors (PDs) have been well-known research topics in the past decade and have been applied in many fields, such as flame detection, space-to-space communications, agricultural development, and medical science. Therefore, effectively and accurately

**ICNN5p-20**

**Numerical Investigation on the Non-uniform Optical Phased Array for Wide Angle Beam steering**

Dong-Ju Seo, Han-Youl Ryu
*Inha University, Korea*

The optical phased array based on the silicon photonics technology was investigated numerically. Wide-angle beam steering with low-noise can be achieved by optimizing the antenna arrangement of a nonuniform aperiodic phased array structure.

**ICNN5p-21**

**Selective Emitter for Micro-Combustion Based Thermophotovoltaic System**

Bo young Park, Keum Hwan Park, Young seock Kim
*Korea Electronics Technology Institute, Korea*

We made Thermophotovoltaic emitter for micro-combustion based TPV system.

**ICNN5p-22**

**Temperature Optimization of P-doping Layer in Quantum Dot Laser Diodes Grown on GaAs for Si Photonics Application**

Guen-Hwan Ryu[1,2], Jae-Hoon Han[2], Han-Youl Ryu[1]
*[1]Inha University, Korea, [2]Korea Institute of Science and Technology, Korea*

Laser diode structures with InAs/GaAs QDs were grown on GaAs substrates by MBE. It was found that the growth temperature of the p-doping layer plays a critical role in the LD performance.

### LEDIAp2 13:00-14:30

**LEDIAp2-1**

**Algan-Based Deep UV Flip-Chip Light Emitting Diode with AlN/Al Reflector**

Tae Hoon Park, Tae Ho Lee, Tae Geun Kim
*Korea University, Korea*

AlGaN-based deep ultraviolet flip-chip light-emitting diodes using AlN/Al electrodes were studied, which shows the outstanding Ohmic behavior for both n- and p-AlGaN layers and high reflectance.

**LEDIAp2-2**

**The Effect of the Metallic Nano-Grating for 365nm Polarized UV-LED**

Eun-Kyung Chu[1], Nam-Woo Kang[1], Beom-Rae Noh[1], Hee-Jung Choi[1], Kwon Yung-Ju[2], Kyoung-Kook Kim[1]
*[1]Dept. of Advanced Convergence Technology, Korea, [2]Dept. of Nano Optical Engineering, Korea*

The aluminum based metal nano-grating with a period of 100nm is fabricated on the sapphire substrate of the flip-chip by e-beam evaporator and inductively coupled plasma etching for 365nm polarized UV-LED.

**LEDIAp2-3**

**Wide Band Gap Transparent Conductive Oxides of Oxide/Metal/Oxide Triple-Layer Structure based on Fluorine Tin Oxide**

Si-Won Kim[1], Gyu-Jae Yohn[1], Soae Jeong[1], Beom-Rae Noh[1], So-Yeon Park[2], Suyeon Son[2], Kyoung-Kook Kim[1]
*[1]Convergence Technology, Korea Polytechnic University, Korea, [2]Dept. of Nano Optical Engineering, Korea Polytechnic University, Korea*

For wide bandgap TCOs, we fabricated OMO structure using FTO and Ag nano-layer. This TCO shows the lower resistivity of 6.43 x 10-4 Ω·cm and the average optical transmittance of about 84% in deep UV

**LEDIAp2-4**

**Efficient Blue Micro-Light-Emitting Diodes Using SiOx-Based Glass Electrode**

Kyung Rock Son, Byeong Ryong Lee, Tae Ho Lee, Sang Hoon Oh
*School of electrical Engineering, Korea University, Korea*

The SiOx-based glass electrode that has a high transmittance and even a current path was applied as a transparent conducting electrode (TCE) of micro-light-emitting diodes to overcome their saturated efficiency, instead of conventional TCE material,

**LEDIAp2-5**

**Self-Standing ZnO Nanotube/SiO2 Core-Shell Arrays for High Photon Extraction Efficiency in III-Nitride Emitter**

Hee-Jung Choi[1], Semi Oh[2], Soo-Hyun Kang[1], Kab Ha[1], Eun-Kyung Chu[1], Won-Seok Lee[3], Soon-Hwan Kwon[3], Kyoung-Kook Kim[1]
*[1]Dept. of Advanced convergence Technology, Korea, [2]Dept. of Materials Science & Technology (GIST), Korea, [3]Dept. of Nano Optical Engineering, Korea*

Self-standing ZnO nanotubes arrays were fabricated on the surface of a GaN-based emitter with an indium tin oxide (ITO) transparent layer using a hydrothermal method and temperature cooling down process.

**LEDIAp2-6**

**Improved Light Extraction Efficiency of GaN-Based Near Ultraviolet Light-Emitting Diodes Using TiO2/HfO2 DBR Electrode with Conductive Filaments**

Sanghoon Oh, Kyung Rock Son, Tae Geun Kim
*School of Electrical Engineering, Korea University, Korea*

We have reported a distributed Bragg reflector, having high reflectance, based p-type electrodes to reflect light absorbed by p-electrodes made of metal from ultraviolet micro-light emitting diodes emitting at 385 nm to improve light extraction.

**LEDIAp2-7**

**Thermal Annealing Effect of Ti Buffer Layer for the Growth of GAN Film**

Tzu-Ting Lin, Shih-Hao Chan, Shao-Ze Tseng, Sheng-Hui Chen
*National Central University, Taiwan*

Ti buffer layers were fabricated and annealed with various temperatures to achieve good crystalline properties in (002) on Si wafer. Then GaN thin films can be deposited on the Ti buffer layer with good crystallization.

**LEDIAp2-8**

**Characterizations and Growth of ZnO: B Films Grown by Low-Pressure Chemical Vapor Deposition on Glass Substrates**

Wei-Ming Lee[1], Ying-Hsiang Wang[1], Chin-Yi Tsai[1], Shih-Wei Feng[1], Chien-Hsun Chen[2], Hsiang-Chen Wang[3], Li-Wei Tu[4]
*[1]Department of Applied Physics, National University of Kaohsiung, Taiwan, [2]Green Energy and Environment Research Labs, Industrial Technology Research Institute, Taiwan, [3]Graduate Institute of Opto-Mechatronics, National Chung Cheng University, Taiwan, [4]Department of Physics and Center for Nanoscience and Nanotechnology, National Sun Yat-Sen University, Taiwan*

The results of this work provide information for the LPCVD growth of ZnO films grown on glass substrates that could be potentially utilized for high-performance and low-cost transparent conductive oxides and their associated applications.

**LEDIAp2-9**

**A study on p-type Conductivity of Phosphorus-doped ZnO Thin Film using RF Sputtering and Annealing**

So-Yeon Park[1], Si-Won Kim[2], Gyu-Jae Yohn[2], Hee-Jung Choi[2], Yebin Im[1], Kyoung-Kook Kim[2]
*[1]Dept. of Nano Optical Engineering, Korea, [2]Dept. of Advanced convergence Technology, Korea*

we have tried to grow phosphorus dopes ZnO using RF sputtering and to use annealing. The p-type ZnO grown on sapphire substrate shows the electrical properties of concentration of 10^17/cm3 with mobility of 1.2 cm2/Vs.

**LEDIAp2-10**

**Photoluminescence Investigation of Near White Light-Emitting Zinc Stannate-Based Phosphors**

Mu-Tsun Tsai, Chih-Chuan Chan, Chien-Hung Lin
*National Formosa University, Taiwan*

We experimentally investigate the near white light emission of Zn2Sn04 (ZT0)-based powders via a sol-gel process. The photoluminescence (PL) mechanism was discussed. Significant enhancement in PL intensity was demonstrated for the ZnO-rich ZTO phosphors.

**LEDIAp2-11**

**Highly Efficient Photonic Conversion Mediums Based on Polymer Complexes for Applications in Light Emitting Devices**

Petronela Horlescu, Corneliu S. Stan, Simona E. Bacaita
*"Gheorghe Asachi" Technical University of Iasi/ Faculty of Chemical Engineering and Environmental Protection, Romania*

New polymer complexes with impressive luminescent properties were prepared and investigated. Their facile preparation path both in bulk and thin films recommend them as photonic conversion mediums in light emitting devices.

**LEDIAp2-12**

**Numerical and Experimental Investigations for Deposited Nanosilver Tracks on Polyimide Films with Heterostructures**

Chia-Yen Chan[1], TBD[1], Kuan-Cheng Shih[2], Yu-Hsin Lin[1]
*[1]Instrument Technology Research Center, National Applied Research Laboratories, Taiwan, [2]Kingley Rubber Industrial Co., Ltd., Taiwan*

Numerical computations and experimental measurements have been complimentarily performed to study the nanosilver solution ejected from a drop-on-demand piezoelectric inkjet printhead and the characteristics of the deposited nanosilver tracks on the Polyimide substrates with heterostructures.

**LEDIAp2-13**

**Effect of the Oxygen Concentration on Electrical Properties of GaN Crystals Grown with the Na-flux Point Seed Method**

K. Endo, T. Yamada, H. Kubo, K. Murakami, M. Imanishi, M. Yoshimura, Y. Mori
*Osaka University, Japan*

We investigated electrical properties of a GaN crystal grown with {10"1" $\bar{1}$} plane in the Na-flux point seed method. The resistivity was 8.9×10-4 Ω cm, which was much lower than that of crystals with (0001) plane.

**LEDIAp2-14**

**The Effect Of Nitrogen Pressure On Threading Dislocation Density During The Na-flux GaN Growth Using Point Seed Technique**

Yuki Sawada, Takumi Yamada, Kosuke Murakami, Keisuke Kakinouchi, Kosuke Nakamura, Kanako Okumura, Tomoko Kitamura, Yasuhiro Unoki, Masayuki Imanishi, Masashi Yoshimura, Yusuke Mori
*Osaka University, Japan*

We investigated the relationship between dislocation density and nitrogen pressure. Dislocation density reduced with reduction of nitrogen pressure, reaching the order of 104 /cm2 with 3.0-MPa pressure due to c-plane shrinking during growth.

# Poster Session <Exhibition Hall A>

## Thursday, 26 April

### LEDIAp2 13:00-14:30

#### LEDIAp2-15

**Reduction of Li Impurity in the Freestanding Gan Substrate Fabricated Using the Sapphire Dissolution Technique in the Na-Flux Growth**

Takumi Yamada, Masayuki Imanishi, Kosuke Murakami, Kosuke Nakamura, Mamoru Imade, Masashi Yoshimura, Yusuke Mori
*Osaka University, Japan*

In Na-flux sapphire dissolution technique for fabricating freestanding GaN substrates, incorporation of Li impurity in crystals can't be avoided. For reduction of Li impurity, GaN crystals were regrown on GaN substrates obtained by the technique.

#### LEDIAp2-16

**Sol-Gel-Derived Hole-Transporting NiOx Films for Perovskite CsPbBr3 Green Light-Emitting Diodes**

Chun-Yuan Huang[1], Shyh-Jer Huang[2], Yi-Hsiu Hsieh[1]
*[1]Nation Taitung University, Taiwan, [2]National Cheng Kung University, Taiwan*

A novel perovskite light-emitting diodes (PeLED) with nickel oxide for efficient hole transport. Via adequately adjusting the thickness of NiOx, low turn-on voltage of 3.4 V and high luminance of 1200 cd/m2 can be achieved.

#### LEDIAp2-17

**Optically Readable GaN-based Micro-LEDs Using NiO-based ReRAM as an N-Type Contact Layer for Micro-LED Display**

Byeong Ryong Lee, Ju Hyun Park, Hyun Tae Kim, Kyung Rock Son, Tae Geun Kim
*Korea University, Korea*

New driving technology of micro-light-emitting-diodes (μLEDs) display by combining resistive random access memory (RRAM) with lateral LED have been developed. Excellent unipolar RRAM behavior and superior μLED performance were shown.

#### LEDIAp2-18

**Optical and Device Characteristics of InGaN/GaN Light Emitting Diodes with Multilayer Graphene as Transparent and Current Spreading Electrodes**

Ying-Hsiang Wang[1], Wei-Ming Lee[1], Shih-Wei Feng[1], Hsiang-Chen Wang[2]
*[1]Department of Applied Physics, National University of Kaohsiung, Taiwan, [2]Graduate Institute of Opto-Mechatronics, National Chung Cheng University, Taiwan*

We demonstrated InGaN-based LEDs with graphene transparent conductive electrodes. The shorter response, rise, delay, and recombination times of the InGaN-based LEDs with graphene transparent conductive electrodes provide more efficient carrier injection, transport, relaxation, and recombination.

### LSCp6 13:15-13:45

#### LSCp6-1

**Gamma-Ray Irradiation-Induced Absorption and Refractive Index Change in BK7 Glass**

Youwei Lai[1], J. Gabayno[1,2], T. Ishimoto[1], Yuki Iwasa[1], K. Yamanoi[1], T. Shimizu[1], N. Sarukura[1]
*[1]Institute of Laser Engineering, Osaka University, Japan, [2]Mapua University, Philippines*

In this study, we investigate the effects of gamma-ray irradiation on the transmission and refractive index of BK7 glass as a means to assess the optical performance of glass to mitigate radiation induced damage.

#### LSCp6-2

**Structural and Optical Properties of ZnO-PVP Composites for Potential Phosphor-Based Applications**

Verdad Agulto[1], Melvin John F. Empizo[1], Keisuke Kawano[1], Yuki Minami[1], Kohei Yamanoi[1], Nobuhiko Sarukura[1], Allan Christopher C. Yago[2], Roland V. Sarmago[3]
*[1]Institute of Laser Engineering, Osaka University, Japan, [2]Institute of Chemistry, University of the Philippines Diliman, Philippines, [3]National Institute of Physics, University of the Philippines Diliman, Philippines*

Using spectroscopy and other techniques, we investigate the structural and optical properties of composites made of zinc oxide (ZnO) microrods and polyvinylpyrrolidone (PVP) polymer. The ZnO-PVP composites exhibit properties that have potential for phosphor-based applications.

#### LSCp6-3

**Improved Luminescence Lifetime Observed in Pr3+/Ce3+-codoped APLF Glass**

Yuki Minami[1], J. F. Gabayno[1,4], M. J. F. Empizo[1], M. Cadatal-Raduban[2], K. Yamanoi[1], T. Shimizu[1], N. Sarukura[1], T. Murata[3]
*[1]Institute of Laser Engineering, Osaka University, Japan, [2]Institute of Natural and Mathematical Sciences, Massey University, New Zealand, [3]Faculty of Education, Kumamoto University, Japan, [4]Department of Physics, Mapua University, Philippines*

We report the observed effects of co-doping APLF glass with Pr and Ce ions on the luminescence lifetime. Less than 10ns lifetime is achieved, shorter than previously obtained with either Pr or Ce-doped APLF.

### ALPSp 13:00-14:30

#### ALPSp-1

**Vertically-oriented Graphene for Field-Effect Transistor Photodetector**

Jiawei Yang, Baolu Guan
*Key Laboratory of Optoelectronics Technology, Ministry of Education, Faculty of Information Technology, Beijing University of Technology, China*

In this paper, a field-effect transistor (FET) photodetector is demonstrated using vertically-oriented graphene sheets grown on the glass substrate, and the corresponding responsivity can reach 0.47A/W.

#### ALPSp-2

**Structure of non-temperable low-E glass determined by synchrotron radiation**

Sang Joon Park[1], Hyung Wook Choi[2], Samgmo Kim[2], Chung Wung Bark[2]
*[1]Dept. Chemical and Biological Engineering, Gachon University, Korea, [2]Dept. Electrical Engineering, Gachon University, Korea*

By using laser annealing, we found the enhancement of low-E properties and the reduction of unit cell volume was obverted rather than the reduction of FWHM of Ag(111) on the metal layer.

#### ALPSp-3

**SERS on Antirabbit IgG: Preliminary results**

Juan Carlos Martínez-Espinosa[1], Teodoro Córdova-Fraga[2], Gustavo Basurto-Islas[2], Octavio Jimenez-Gonzalez[2], Jacqueline Torres-Ramirez[1], Ana Pamela Andrade-Pérez[1], Jesús Bernal-Alvarado[2], Angélica Hernández-Rayas[2], Mauricio Sánchez-Barajas[3]
*[1]Instituto Politécnico Nacional-UPIIG, México, [2]Departamento de Ingeniería Física – DCI, Universidad de Guanajuato campus León, México, [3]Hospital General de Zona con Medicina Familiar No 21 León Sur, Universidad de Guanajuato campus León., México*

In this work we present preliminary results about the Surface enhanced Raman spectroscopy of theGoat IgG antirabbit antigen. We suggest continuing with this protocol by using others antigens forcancer study.

#### ALPSp-4

**High gain single crystal fiber amplifier for hybrid femtosecond laser system**

Elena Sall, Sergey Chizhov, Byunghak Lee, Bosu Jeong, Jun Wan Kim, Duchang Heo, Chur Kim, Seol Won Park, Guang-Hoon Kim
*Korea Electrotechnology Research Institute, Korea*

We report a comparative study of femtosecond pulses amplification in hybrid laser system with different single crystal fiber (SCF) amplifier modules. Two SCF modules from Fibercryst and Shasta Crystals were tested in double-pass scheme. High gain 71 and 62 respectively were achieved.

#### ALPSp-5

**Longitudinally Excited $CO_2$ Laser Driven by Fast-High Voltage Solid State Switch**

Noor Shahira binti Masroon[1], Shigeyasu Ohashi[1], Masaya Tei[1], Miyu Tanaka[1], Kazuyuki Uno[2], Hitoshi Nakano[1]
*[1]Kindai University, Japan, [2]University of Yamanashi, Japan*

Longitudinally excited $CO_2$ laser driven by fast-high voltage solid state switch has been developed, which consists of avalanche transistor circuit and series-connected of IGBTs. Simple, compact and affordable gas laser has been realized.

#### ALPSp-6

**Development of Nanosecond Pump Source for Optically Synchronized OPCPA**

Yasuhiro Miyasaka, Hiromitsu Kiriyama, Maki Kishimoto, Michiaki Mori, Masaki Kando, Kiminori Kondo
*Kansai Photon Science Institute (KPSI), National Institutes for Quantum and Radiological Science and Technology (QST), Japan*

We are developing a nanosecond green laser from Ti:sapphire oscillator pulses for reducing timing jitter of OPCPA. 1064nm pulses are generated by spectrum extension and amplified to 15mJ in LD-pumped regenerative amplifier at 10Hz.

#### ALPSp-7

**Reducing amplified spontaneous emission of a cryogenic disk amplifier through geometrical optimization of the gain medium**

Reza Amani[1], Jan Cvrček[1,2], Jitka Černohorská[1,2], Martin Smrž[1], Akira Endo[1], Tomáš Mocek[1]
*[1]HiLASE Centre, Institute of Physics, Czech Academy of Sciences, Czech Republic, [2]Czech Technical University in Prague, Czech Republic*

We report geometrical optimization of a cryogenic Yb:YAG disk towards reducing amplified spontaneous emission (ASE) in a 100 mJ, 1 kHz chirped pulse amplification chain with potential scalability to a pulse energy beyond 1 J.

#### ALPSp-8

**Temperature Dependence Evaluation of Absorption in YAG Cladding Materials for High Power Solid-State Lasers**

Koichi Hamamoto[1,2], Shigeki Tokita[1], Hidetsugu Yoshida[1], Noriaki Miyanaga[1], Junji Kawanaka[1]
*[1]Institute of Laser Engineering, Osaka University, Japan, [2]Mitsubishi Heavy Industries, Ltd., Japan*

To suppress parasitic oscillation or amplified spontaneous emission in high power lasers, gain material with cladding is used. We evaluated temperature dependence of absorption properties of some YAG ceramics cladding materials.

# Poster Session <Exhibition Hall A>

## Thursday, 26 April

### ALPSp 13:00-14:30

**ALPSp-9**

**Research of Diamond Transmission Gratings Used for of High Power Laser Pulse Compression**

Shuwei Fan, Tianfei Zhu, Hongxing Wang
*Institute of Wide Band Gap Semiconductors, School of Electronics and Information Engineering, Xi'an Jiaotong University, China*

The diamond transmission grating is designed based on rigorous coupled-wave theory. The simulation results demonstrate that the highest diffraction efficiency was over 99% at wavelength 800nm. Studies show the design has a larger process tolerance.

**ALPSp-10**

**Sub-100-fs Pulse Generation from a Tm,Ho:CALYO Laser Mode-Locked by SWCNTs**

Yongguang Zhao[1,2], Yicheng Wang[1], Zhongben Pan[1,3], Ji Eun Bae[4], Sun Young Choi[4], Fabian Rotermund[4], Wei Zhou[2], Xiaodong Xu[2], Deyuan Shen[2], Jun Xu[5], Xavier Mateos[1,6], Pavel Loiko[7], Uwe Griebner[1], Valentin Petrov[1]
*[1]Max Born Institute for Nonlinear Optics and Short Pulse Spectroscopy, Germany, [2]Jiangsu Key Laboratory of Advanced Laser Materials and Devices, Jiangsu Normal University, China, [3]Institute of Chemical Materials, China Academy of Engineering Physics, China, [4]Department of Physics, Korea Advanced Institute of Science and Technology (KAIST), Korea, [5]School of Physics Science and Engineering, Institute for Advanced Study, Tongji University, China, [6]Física i Cristal·lografia de Materials i Nanomaterials (FiCMA-FiCNA)-EMaS, Dept. Química Física i Inòrganica, Universitat Rovira i Virgili (URV), Spain, [7]ITMO University, Russia*

We report on a mode-locked Tm,Ho:CALYO laser employing SWCNTs as a saturable absorber. Transform-limited 96-fs pulses are generated at ~2077 nm for a repetition rate of ~82.5 MHz corresponding to an average output power of 54 mW.

**ALPSp-11**

**177 fs Pulses From Kerr-Lens Mode-Locked Yb:$Lu_2O_3$ Ceramic Thin-Disk Laser**

Shotaro Kitajima[1], Akira Shirakawa[1], Hideki Yagi[2], Takagimi Yanagitani[2]
*[1]Institute for Laser Science, University of Electro-Communications, Japan, [2]Takuma Works, Konoshima Chemical Co., Ltd., Japan*

The first Kerr-lens mode-locked Yb:$Lu_2O_3$ ceramic thin-disk laser was demonstrated. The shortest pulse duration was 177 fs with 3.2 W output power. The output power of 17 W with 588 fs pulses was also demonstrated.

**ALPSp-12**

**Measurement of Carrier Dynamics of the Graphite by Time-Resolved ARPES**

Kento Toume[1,2], Katsuya Oguri[1], Hiroki Mashiko[1], Keiko Kato[1], Yoshiaki Sekine[1], Hiroki Hibino[3,1], Akira Suda[2], Hideki Gotoh[1]
*[1]NTT Basic Research Laboratories, Japan, [2]Tokyo University of Science, Japan, [3]Kwansei Gakuin University, Japan*

We demonstrate the Tr-ARPES based on the high-order harmonic source with sub-10 fs pulse duration. We measured the Tr-ARPES spectra at the Dirac point of the graphite at various time delays.

**ALPSp-13**

**Electron Temperature of High-Pressure Argon Plasma by Focusing Femtosecond Laser**

Kohsuke Tsuchida, Norio Tsuda, Jun Yamada
*Aichi Insitute of Technology, Japan*

The electron temperature of high-pressure argon plasma generated by the femtosecond laser is obtained from the plasma emission by two methods. The measurement result and the theoretical calculation result are compared.

**ALPSp-14**

**Patterning Oxidation of Copper Substrate by Femtosecond Laser Irradiation**

Xi Yu[1], Masaaki Sudo[2], Fumihiro Itoigawa[1], Shingo Ono[1]
*[1]Nagoya Institute of Technology, Japan, [2]IMRA America Inc., Japan*

Patterning oxidation of copper substrate was performed by irradiating femtosecond laser pulses to surface of copper substrate. Shape transformation was observed by SEM, CLSM. Formation of copper oxide was confirmed by Raman, EDX, and XRD.

**ALPSp-15**

**Optical Properties of Saturable Absorber for Temporal Contrast Improvement of Ultra-High Intensity Laser**

Koichi Ogura, Yasuhiro Miyasaka, Yuji Fukuda, Akito Sagisaka, Alexander S. Pirozhkov, Hiromitsu Kiriyama
*Kansai Photo Science Institute, National Institutes for Quantum and Radiological Science and Technology, Japan*

We report on evaluation of optical properties of saturable absorber, including damage threshold, transmittance efficiency, transmission spectral bandwidth, beam profile and long-term operation for temporal contrast improvement using saturable absorber after compressor.

**ALPSp-16**

**Polarization and Laser Properties of Resonators with Corner-Cube and Axicon Retro-Reflectors**

Haik Chosrowjan[1], Seiji Taniguchi[1], Hidetsugu Yoshida[2], Noriaki Miyanaga[2]
*[1]Institute for Laser Technology, c/o Technical Research Center, Kansai Electric Power Company, Japan, [2]Institute of Laser Engineering, Osaka University, Japan*

Polarization properties from CCR and AL retro-reflected beams have been studied. Cryogenic Yb:YAG laser output characteristics when a flat mirror, CCR or AL is used as a high-reflection element in a resonator, have been elucidated.

**ALPSp-17**

**Amplification Property of Ce/Cr/Nd:YAG Ceramic Laser Using White-light Pump Source**

Taku Saiki[1], T. Nakamachi[1], T. Hayashi[1], R. Matsushita[1], T. Ichiuji[1], H. Furuse[2], S. Motokoshi[4], Y. Fujimoto[3], M. Nakatsuka[3,4]
*[1]Department of Electrical and Electronic Engineering, Faculty of Engineering Science, Kansai University, Japan, [2]Kitami Institute of Technology, Japan, [3]Institute of Laser Engineering, Osaka University, Japan, [4]Institute for Laser Technology, Japan*

Effective fluorescence lifetime of Nd ion for $Ce^{3+}/Cr^{3+}$/Nd:YAG ceramic was prolonged by increasing the temperature of the ceramic laser material owing to cross-relaxation effect. The ceramic laser material has worked as a CW laser amplifier.

**ALPSp-18**

**White-Light Whispering-Gallery-Mode Lasing from Lanthanide-Doped Upconversion $NaYF_4$ Hexagonal Microrods**

Ting Wang[1], Huan Yu[2], Chun kit Siu[1], Jianbei Qiu[2], Xuhui Xu[1,2], Siu Fung Yu[1]
*[1]Department of Applied Physics, The Hong Kong Polytechnic University, China, [2]College of Materials Science and Engineering, Kunming University of Science and Technology, China*

Through the proper tuning of sensitizer ($Yb^{3+}$) and activators ($Er^{3+}$, $Tm^{3+}$) concentration in the host matrix, we realize white-light lasing from a $Yb^{3+}$-$Er^{3+}$-$Tm^{3+}$ tri-doped hexagonal β-$NaYF_4$ microrod under near-infrared excitation at room temperature.

**ALPSp-19**

**Assessment on Power-scaling of Ti:sapphire Lasers Pumped by Blue-diode Lasers**

Naoto Sugiyama, Hiroki Tanaka, Fumihiko Kannari
*Department of Electronics and Electrical Engineering, Keio University, Japan*

Kerr-lens mode-locking of direct-diode-pumped Ti:sapphire laser is demonstrated using 478- and 520-nm LDs. The influence of the blue-pump-induced loss on Ti:sapphire lasers is measured.

**ALPSp-20**

**Power scaling of a passively Q-switched diode-pumped $Pr^{3+}$:YLF laser**

Shogo Fujita, Hiroki Tanaka, Naoto Sugiyama, Fumihiko Kannari
*Department of Electronics and Electrical Engineering, Keio University, Japan*

We demonstrate a $Pr^{3+}$:YLF laser with to 6.7- and 3.7-W output power at 640 and 607 nm, respectively. Passive Q-switching is also obtained using $Cr^{4+}$:YAG and $Co^{2+}$:$MgAl_2O_4$ saturable absorbers.

**ALPSp-21**

**Development of compact and high efficient UV laser system**

Y. Fujimoto[1], M. Nakahara[2], P. Binun[2], S. Motokoshi[3], O. Ishii[4], M. Watanabe[4], M. Yamazaki[5], T. Shinozaki[2], T. Sato[2], H. Yanomori[2]
*[1]Chiba Institute of Technology, Department of Electrical and Electronic Engineering, Japan, [2]Kimmon Koha co., Ltd., Japan, [3]Institute of Laser Technology, Japan, [4]Production Engineering Section, Optical Glass Production Department, Sumita Optical Glass, Inc., Japan, [5]Glass Research Division, R&D Department, Sumita Optical Glass, Inc., Japan*

This paper presents that we are developing a compact and high efficient continuous-wave UV laser system with a Pr-doped double-clad structured waterproof fluoro-aluminate glass fiber laser as a fundamental laser beam.

**ALPSp-22**

**Compact pulsed Yb-doped fiber laser and intra-cavity cascaded Raman spectrum generation**

Yanrong Song, Zikai Dong, Runqin Xu, Jinrong Tian
*College of Applied Sciences, Beijing University of Technology, China*

A compact mode locked Yb-doped fiber laser is demonstrated withnonlinear polarization rotation technique.There are no physical filter and polarization controller. A broadband continuum spectrum is generated by intra-cavity cascaded Raman scattering effect.

**ALPSp-23**

**Off-peak Raman fiber laser at the wavelength of 1629 nm**

Anna Suzuki, Eisuke Fujita, Masaki Tokurakawa
*Institute for Laser Science, University of Electro-Communications, Japan*

We report Raman fiber laser at 1629 nm with the maximum output power of 2W and spectral bandwidth of 2 nm. The operation was very stable with output power fluctuation of less than 1%.

**ALPSp-24**

**Research on Ohmic contact of VCSEL based on Cr/ Au alloy of non-magnetic materials**

Yanling Guo, Baolu Guan
*Key Laboratory of Optoelectronics Technology, Ministry of Education, Faculty of Information Technology, Beijing University of Technology, China*

In this paper, the VCSEL based on the non-magnetic Cr/Au alloy eliminates the effect the magnetic sensitivity of the magnetic, and it has low ohmic contact resistivity of $2.5\times10^{-6}$ ohmic $cm^2$ and high reliability.

# Poster Session <Exhibition Hall A>

## Thursday, 26 April

### ALPSp 13:00-14:30

**ALPSp-25**

**Clean pump generation for in-line phase sensitive amplification using carrier phase recovery and injection locking**

Masato Kato[1], Takeshi Umeki[2], Koji Enbutsu[2], Masaki Asobe[1]
*[1]Tokai University, Japan, [2]NTT Device Technology Laboratories, NTT Corporation, Japan*

Carrier phase of a QPSK signal was extracted by using multi-stage frequency mixing in a multiple QPM $LiNbO_3$ waveguide. We demonstrate residual intensity modulation can be suppressed by using injection locking.

**ALPSp-26**

**Terahertz Time Domain Spectroscopy for Radiative Eigenmodes in Metallic Slit Array**

Thanh Nhat Khoa Phan[1], Dazhi Li[2], Kosaku Kato[1], Masahiko Tani[3], Masashi Yoshimura[1], Masaki Hashida[4], Yanyu Wei[5], Makoto Nakajima[1]
*[1]Institute of Laser Engineering, Osaka University, Japan, [2]Institute for Laser Technology, Japan, [3]University of Fukui, Japan, [4]Advanced Research Center for Beam Science, ICR, Kyoto University, Japan, [5]School of Physical Electronics, University of Electronics Science and Technology of China, China*

We studied the interaction between terahertz wave and the metallic slit array. Through calculation and experiment, we found various eigenmodes, which can help in improving the efficiency of Free Electron Laser based on Smith-Purcell effect.

**ALPSp-27**

**Programmable Optical Linear Circuit using Wavelength-Division-Multiplexed Quantum States**

Akihito Omi, Aruto Hosaka, Masaya Tomita, Shintaro Niimura, Fumihiko Kannari
*Department of Electronics and Electrical Engineering, Keio University, Japan*

We propose a novel scheme of multistage quantum pulse gate realizing universal linear optical circuits. Arbitral mode mixing can be realized by 4-f optical loop system and sum frequency generation.

**ALPSp-28**

**Modal Analysis and Characterization of Photon-Number Statistics of Supercontinuum laser Pulses**

Shintaro Niimura, Aruto Hosaka, Masaya Tomita, Akihito Omi, Fumihiko Kannari
*Department of Electronics and Electrical Engineering, Keio University, Japan*

We experimentally characterize second-order photon-number statistics in a supercontinuum pulse. By modal analysis of photon-number covariance matrix, we reveal mode structure of a supercontinuum pulse and find photon-number squeezed states from the noisy supercontinuum pulse.

**ALPSp-29**

**Maker Fringe Measurements of Ultra-Precisely Processed N-Benzyl-2-Methyl-4-Nitroaniline Organic Crystal**

Takashi Notake[1], Masahiro Takeda[2,3], Takuya Hosobata[2], Yutaka Yamagata[2,3], Hiroaki Minamide[1]
*[1]Teraphotonics Team, RIKEN, Japan, [2]Ultrahigh Precision Optics Technology Team, RIKEN, Japan, [3]Adavanced Manufacturing Support Team, RIKEN, Japan*

An ultra-high-precision lathe is applied to process fragile organic BNA crystals precisely. Nonlinear optical coefficients and the associated dispersions of BNA can be measured accurately by using the precisely processed thin BNA slab samples.

**ALPSp-30**

**Fabrication of 1 & 4 inch size transparent Nd:YAG ceramics and Laser Oscillation**

Yoshiki Yamazaki[1], Makoto Mikami[1], Yuichi Kozawa[2], Shunichi Sato[2]
*[1]JX Nippon Mining & Metals Corporation Isohara Works, Japan, [2]Institute of Multidisciplinary Research for Advanced Matirials, Tohoku University, Japan*

We fabricated Nd:YAG ceramics with 1 and 4 inch diameters. The YAG ceramics were highly transparent with the transmittance of 84% including surface reflection. Laser oscillation of the Nd:YAG ceramics was achieved.

**ALPSp-31**

**High-efficiency ring beam converter with axicon mirrors**

Yuya Shimoji, Godai Miyaji
*Department of Applied Physics, Tokyo University of Agriculture and Technology, Japan*

We have designed and fabricated a new beam converter from a Gaussian beam to a ring beam, which can efficiently generate a nondiffracting beam.

**ALPSp-32**

**High aspect ratio nanometer size channel machining with phase corrected femtosecond Bessel beams.**

Kosuke Iida, Yurina Michine, Hitoki Yoneda
*Institute for Laser Science, University of Electro-Communications, Japan*

High aspect channel formations with diameter in submicron range are obtained with ultra-short-pulse Bessel (UB) beam and phase controlled UB machining system.

**ALPSp-33**

**Absorption Enhancement in Solar Cells with Metamaterial Perfect Absorbers**

Tomihisa Isegawa[1], Takayuki Okamoto[2], Wakana Kubo[1]
*[1]Tokyo University of Agriculture and Technology, Japan, [2]RIKEN, Japan*

Organic thin-film solar cells with metamaterial perfect absorbers are investigated. Metamaterial perfect absorbers confine incident light into the photoelectric conversion layer, resulting in an increase of absorption by a factor of 18%.

**ALPSp-34**

**Selective coherent anti-Stokes Raman scattering microscopy employing dual-wavelength nanofocused ultrafast plasmon pulses**

Keita Tomita, Yasuhiro Kojima, Fumihiko Kannari
*Department of Electronics and Electrical Engineering, Keio University, Japan*

We demonstrate selective CARS measurements of graphene and multi-walled carbon nanotubes with nanofocused SPP pulses at 800 and 400 nm using an aluminum tapered tip.

**ALPSp-35**

**Optical gain of multi stacked InGaAs quantum dots using VSL method**

Keishiro Goshima[1], Norio Tsuda[1], Keisuke Inukai[1], Takeru Amano[2], Takeyoshi Sugaya[2]
*[1]Electronics Engineering, Aichi Institute of Technology, Japan, [2]National Institute of Advanced Industrial Science and Technology (AIST), Japan*

A Quantum dot laser (QD laser) is expected to have a low threshold current density, high thermal stability, and high modal gain. In our study we carried out the optical gain of multi-stacked QDs different thin barrier layers using a variable stripe length (VSL) method. Optical gain increased with decreasing barrier layer due to quantum mechanical coupling.

**ALPSp-36**

**Single-shot Ultrafast Imaging with Burst Pulses of 100-ps Interval**

Hirofumi Nemoto, Takakazu Suzuki, Yuki Yamaguchi, Ryohei Hida, Fumihiko Kannari
*Department of Electronics and Electrical Engineering, Keio University, Japan*

We generate frequency chirped 100-ps-interval pulse trains for ultrafast burst imaging. Employing those pulses to sequentially timed all-optical mapping photography utilizing spectral filtering (SF-STAMP), we realize single-shot burst imaging with sub-nanosecond time window.

**ALPSp-37**

**Development of rigid-endoscope optical coherence tomography system using two-dimensional KTN optical scanner**

Masato Ohmi[1], Eunjoo Choi[1], Takayuki Komatsu[2], Shogo Yagi[2]
*[1]Course of Allied Health Science, Graduate School of Medicine, Osaka University, Japan, [2]NTT Advance Technology Corporation, Japan*

We developed novel rigid-endoscope OCT with KTN optical probe for a diagnosis in the orthopedic fields. System demonstrates that biological image was measured by using KTN scanner for having degree of freedom in sample arm.

**ALPSp-38**

**Multifocal spectral-domain optical coherence tomography based on Bessel beam for Biological Imaging**

Luying Yi, Liqun Sun
*State Key Laboratory of Precision Measurement Technology & Instruments, Department of Precission Instruments, Tsinghua University, China*

The multifocal spectral-domain optical coherence tomography based on Bessel beam is proved not only to increase the depth of the imaging, but also to reduce the demand for high spectral resolution of spectrometer.

**ALPSp-39**

**Velocity and Distance Simultaneous Measurement by Digital Processing of Self-Coupling Signal**

Keiichi Shibata, Noriio Tsuda, Jun Yamada
*Aichi Institute of Technology, Japan*

The simultaneous measurement sensor of distance and velocity by using self-coupling effect of the semiconductor laser has been studied. The velocity and distance can have been simultaneously measured by digital signal processing of self-coupling signal.

**ALPSp-40**

**A Simplified Heterodyne Surface Plasmon Resonance Sensor**

Michihiro Uchiumi[1], Fumiya Kai[1], Ozora Ushijima[1], Kohei Shimogama[1], Kazuyoshi Koga[1], Kyouichi Deki[2], Nobuaki Tominaga[2]
*[1]Inf. Syst. Crs, Div. of Hum. and Welfare Eng., Dept. Creative Eng., Natl Inst. Of Technol. Ariake Coll., Japan, [2]Environ. Sci. Crs, Div. of Environ. and Energy Eng., Dept. Creative Eng., Natl Inst. Of Technol. Ariake Coll., Japan*

We developed a simplified surface plasmon sensor using a stabilized transverse Zeeman He-Ne laser. It is shown that the surface plasmon sensor with a simple configuration is sensitive.

**ALPSp-41** *Canceled*

**ALPSp-42**

**Bidirectional Mode-locked Er:fiber Laser with Two Semiconductor Saturable Absorber Mirrors**

Yuya Hata[1], Yoshiaki Nakajima[1,2], Kaoru Minoshima[1,2]
*[1]The University of Electro-Communications (UEC), Japan, [2]Japan Science and Technology Agency (JST), ERATO MINOSHIMA Intelligent Optical Synthesizer (IOS) Project, Japan*

We developed a bidirectional mode-locked Er:fiber laser with two semiconductor saturable absorber mirrors and nonlinear polarization rotation. A symmetrical cavity configuration performed remarkable broad optical spectra in both directions with high relative stability.

## Poster Session <Exhibition Hall A>

## Thursday, 26 April

### ALPSp 13:00-14:30

**ALPSp-43**

**High-accuracy corrections of large and fast air refractive index fluctuations using two-color interferometry with optical frequency combs**

Yoshihisa Ikisawa[1], Tomohiro Makino[1,2], Yoshiaki Nakajima[1,2], Guanhao Wu[3], Kaoru Minoshima[1,2]
*[1]The University of Electro-Communications (UEC), Japan, [2]Japan Science and Technology Agency (JST), ERATO MINOSHIMA Intelligent Optical Synthesizer (IOS) Project, Japan, [3]Tsinghua University, China*

We significantly extended the applicable range of corrections of environmental air refractive index variations using two-color interferometry with optical frequency combs. The developed technique will enhance the practical applicability of high-accuracy optical distance measurements.

**ALPSp-44**

**10W amplification of 750-MHz Yb:fiber laser frequency comb for sub-100 fs pulse duration**

Hirotaka Ishii[1], Bo Xu[1,2], Yuxuan Ma[1,3], Isao Matsushima[1,2], Yoshiaki Nakajima[1,2], Thomas Schibli[4], Zhigang Zhang[3], Kaoru Minoshima[1,2]
*[1]Department of Engineering Science, Graduate School of Informatics, The University of Electro-Communications (UEC), Japan, [2]Japan Science and Technology Agency (JST), ERATO MINOSHIMA Intelligent Optical Synthesizer (IOS) Project, Japan, [3]State Key Laboratory of Advanced Optical Communication System and Networks, Peking University, China, [4]Dep. of Physics, University of Colorado at Boulder, USA*

We developed a polarization-maintaining high power fiber amplifier based on a 750-MHz self-referenced Yb:fiber frequency comb. An average output power of 10 W was achieved.

**ALPSp-45**

**Dual-Comb Interferometry Based on Synthetic-Wavelength for High-Speed and High-Precision Distance Measurement**

Zebin Zhu[1], Kai Ni[2], Qian Zhou[2], Guanhao Wu[1,2]
*[1]State Key Laboratory of Precision Measurement Technology and Instruments, Department of Precission Instruments, Tsinghua University, China, [2]Division of Advanced Manufacturing, Graduate School at Shenzhen, Tsinghua University, China*

We propose a dual-comb ranging system based on synthetic-wavelength interferometry. It can realize absolute distance measurement with ~2.7m ambiguity range, ~3nm precision within ~10ms averaging time.

**ALPSp-46**

**Tunable single-frequency continuous-wave optical parametric oscillator in the near-IR and mid-IR**

Sophie Kröger[1], Edlef Büttner[2], Andreas Steiger[3], Ralf Müller[3]
*[1]Hochschule für Technik und Wirtschaft, Germany, [2]APE Angewandte Physik & Elektronik GmbH, Germany, [3]Physikalisch-Technische Bundesanstalt, Germany*

A high power single-frequency continuous-wave optical parametric oscillator is presented; special compact resonator with new tuning concept.

**ALPSp-47**

**Broadband achromatic metalens in the visible**

Mu Ku Chen[1,2], Pin Chieh Wu[1,2], Vin-Cent Su[4], Hui-Hsin Hsiao[3], Yi-Chieh Lai[1,2], Hsin Yu Kuo[1,2], Bo Han Chen[1,2], Yu Han Chen[1,2], Din Ping Tsai[1,2]
*[1]Research Center for Applied Sciences, Academia Sinica, Taiwan, [2]Department of Physics, National Taiwan University, Taiwan, [3]Institute of Biomedical Optomechatronics Taipei Medical University, Taiwan, [4]Department of Electrical Engineering, National United University, Taiwan*

We demonstrated a high efficiency GaN based achromatic metalens working in transmission type. The working wavelength is from 400 to 660 nm. For optical imaging, we show the full-colour images taken by our achromatic metalens.

**ALPSp-48**

**Dependence of temporal Contrast on Optics Surface Roughness in the Stretcher and Compressor**

Hiromitsu Kiriyama[1], Yuji, Mashiba[1,2], Yasuhiro Miyasaka[1], Makoto R. Asakawa[2]
*[1]Kansai Photon Science Institute (KPSI), National Institutes for Quantum and Radiological Science and Technology (QST), Japan, [2]Faculity of Science and Engineering, Kansai University, Japan*

Surface roughness of tens of nanometers on stretcher and compressor optics causes random spectral phase noise, which reduces the temporal coherence of the main pulse and generates a noisy structure around the main pulse.

**ALPSp-49**

**Surface Cleaning and Modification of Thin Target Films by CW laser for Laser-driven Heavy Ion Acceleration**

Kotaro Kondo[1], Mamiko Nishiuchi[1], Hironao Sakaki[1], Nicholas P. Dover[1], Hiromitsu Kiriyama[1], Masahiko Ishino[1], Takumi Miyahara[1,2], Yukinobu Watanabe[2], Masaki Hashida[3], Mitsuhiro Kusaba[4], Masaki Kando[1], Kiminori Kondo[1]
*[1]Kansai Photon Science Institute, National Institutes for Quantum and Radiological Science and Technology (QST), Japan, [2]Interdisciplinary Graduate School of Engineering Science, Kyushu University, Japan, [3]Institute for Chemical Research, Kyoto University, Japan, [4]Department of Electronics, Information and Communication Engineering, Osaka Sangyo University, Japan*

A test bench has been developed for surface cleaning and modification of thin film targets by CW laser irradiation. QMS detects gas emissions during the irradiation and polyimide films are carbonized by irradiation in vacuum.

# Poster Session <Exhibition Hall A>

## Friday, 27 April

### IoT6p 10:30-12:00

**IoT6p-1**

**Internet of Things Implemented by Visible Light Communication (VLC)**

Jhao-Ting Wu[1], Chi-Wai Chow[1], Chien-Hung Yeh[2]
*[1]National Chiao Tung University, Taiwan, [2]Feng Chia University, Taiwan*

Due to the shortage of traditional radio-frequency (RF) spectrum, using visible-light-communication (VLC) for Internet-of-Thing (IoT) is promising. We demonstrate pre-distortion 4-level-pulse-amplitude-modulation (PAM-4) to enhance the performance of the solar-cell receiver based VLC.

**IoT6p-2**

**High-speed low-coherence interferometry for real-time monitoring of laser processing and smart factory**

Katsuhiro Ishii, Masaharu Hoshikawa
*The Graduate School for the Creation of New Photonics Industries, Japan*

We propose a real-time and high-temporal-resolution low-coherence interferometer using a chirped pulse laser and TD-DFT technique and show preliminary experimental results.

**IoT6p-3**

**High Accuracy Optical Arbitrary Angle Control with MEMS Mirror Using 8 kHz Visual Feedback**

Yoshinori Matsui[1], Yukinobu Sugiyama[2], Kazuhiro Nakamura[1], Munenori Takumi[1], Kazutaka Suzuki[1], Haruyoshi Toyoda[1]
*[1]Central Research Laboratory, Hamamatsu Photinics K.K., Japan, [2]Solid State Division, Hamamatsu Photinics K.K., Japan*

We proposed 2-D optical angle control module with MEMS mirror using 8kHz visual feedback control. We have achieved the convergence time to the target angle about 1.5 msec, and the temporal stability about 0.001 deg.

**IoT6p-4**

**Parasitic intensity modulation effect within PGC demodulation using arctangent algorithm: analysis and elimination**

Qiong Yao, Fuyin Wang, Shuidong Xiong, Qingkai Hou, Hong Luo, Xun Liang
*National University of Defense Technology, China*

We analyze the influence of the parasitic intensity modulation within PGC-atan demodulation algorithm, and the corresponding measure was raised to greatly improve the output stability and fidelity.

**IoT6p-5**

**Elimination of the Low-frequency Noise for Optical Fiber Extrinsic Fabry-Perot Interferometric Sensors**

Fuyin Wang, Qiong Yao, Zhengliang Hu, Shuidong Xiong, Hong Luo, Lina Ma, Yongming Hu
*National University of Defense Technology, China*

We report a robust low-frequency noise elimination scheme for miniature fiber EFPI sensors with promising low phase noise of -97.2 dB. The noise spectrum is uniformly flat nearly down to DC.

**IoT6p-6**

**A Study on Space Recognition Method by Using Optical Sensor Information Using Neural Network**

Kenji Ishihara, Ryohei Hanayama, Katsuhiro Ishii, Yoshihiro Takiguchi
*The Graduate School for the Creation of New Photonics Industries, Japan*

Neural Network, Robot, Environment Recognition, Sensing, Photonics, and Computing.

### LDCp9 10:30-12:00

**LDCp9-1**

**Fiber-Coupled High-Power RGB Laser Module for Underwater Optical Wireless Communication**

Ryosuke Nishi[1], Koji Tojo[1], Naoki Nishimura[1], Takao Sawa[2]
*[1]Shimadzu Corp., Japan, [2]JAMSTEC, Japan*

We developed fiber-coupled high-power RGB laser module for underwater optical wireless communication. The RGB laser module provides over 3.5-W laser output for each wavelength range of red, green, and blue.

**LDCp9-2**

**Experiment on Colour Mixing Using Tunable Red-Green-Blue Light-Emitting Diode Against Flux Luminous and Chromaticity Coordinates Values**

Revantino[1,2], Rizki Armanto Mangkuto[1], Abdul Rachman Sanjaya[1], Jaka Kelana Putra[1], F.X. Nugroho Soelami[1]
*[1]Institut Teknologi Bandung, Indonesia, [2]Ministry of Industry of Republic of Indonesia, Indonesia*

Experiment was conducted using light-emitting diode with tunability in red-green-blue components. Light intensity of each component was set by microcontroller within variation steps. Results showed variation of green component affected flux luminous and chromaticity values.

**LDCp9-3**

**Optically Tunable Liquid Crystal Broadband Linear-Polarization Rotator**

Ko-Ting Cheng[1], Cheng-Kai Liu[1], Chian-Yu Chiu[1], Stephen M. Morris[2], Min-Cheng Tsai[1], Chii-Chang Chen[1]
*[1]National Central University, Taiwan, [2]University of Oxford, UK*

A linear-polarization rotator based on the optically tunable pitch of chiral-azobenzene-doped liquid crystals has been investigated. The rotation angle is dependent on the pitch and the number of turns of the cholesteric LC helix.

**LDCp9-4**

**Proposal of Protective Filter Adjustment for RGB Lasers**

Yoshihisa Ishiba, Shinya Kajiri
*Yamamoto kogaku co., ltd., Japan*

We have reported on the details of protection filter which can adjust optical axis for RGB laser.

**LDCp9-5**

**Portable Camera Based 3D Imaging with Structured Light**

Ting-Yi Huang[1], Wei Min Cheng[1], Fan Tim[2], J. Andrew Yeh[1], Yuan Luo[2]
*[1]National Tsing Hua University, Taiwan, [2]National Taiwan University, Taiwan*

Three-dimensional (3D) image reconstruction has been developed for various applications. Here, we proposed a smart phone combined with structured light source to experimentally demonstrate 3D reconstructed images.

**LDCp9-6**

**Utilization of Nanocellulose from Bagasse as Carbon Source on Bcno Synthesis / SiO2 for White Led Lamp**

I Putu Darma Ruswara, Dafi Adinegoro, Bambang Sunendar, Ahmad Nuruddin
*Institut Teknologi Bandung, Indonesia*

White LED can be made by transmitting UV light source through phosphor material. Phosphor BCNO Silica is made of nanocellulose from bagasse using sol-gel method and calcination at 600° C and used for LED film.

**LDCp9-7**

**Effect of Luminance and Contrast on Psycho-physiological Response of Dentist in General Examination Room of a Dental Hospital**

Damarwulan Eka Agustina, Fariza A Alifah, Rizki A. Mangkuto, Suprijanto
*Institut Teknologi Bandung, Indonesia*

Three variables yield significant effect on subjective error percentage: maximum face luminance, maximum ambient luminance, and contrast of oral-mannequin. The following values are suggested: $L_{f,max} \leq 3.42$ cd/m$^2$, $L_{a,max} \geq 2.24$ cd/m$^2$, $C_{m\text{-}f} \leq 9.66$.

**LDCp9-8**

**Parametric Design for Optimising Dimensions and Specularity of Light Shelves**

Rialdi Eka Putra, Fathurrahman Feradi, Rizki Armanto Mangkuto, R. Triyogo Atmodipoero
*Institut Teknologi Bandung, Indonesia*

This study aims to optimise the design parameters of light shelves in an open-plan space, to maximise daylight availability and minimise glare risk, using parametric design with genetic algorithm optimisation.

**LDCp9-9**

**Secure Transmission and analysis of Optical Scanned Holographic Images for Efficient Communication**

Meril Cyriac, Kanjana G, Anusree L, Leena Thomas, Nelwin Raj N.R, Roshan Varghese
*SCT College of Engineering, India*

A new approach for the secure transmission of optical scanning holographic image is proposed. The optically scanned holographic image is scrambled using different chaotic maps. This image is converted to a quick response code.

**LDCp9-10**

**Development of Portable Light Therapy Apparatus using LED for Improvement of Sleep and Wakefulness**

Tomonori Yuasa[1], Jun Miura[2], Yasumori Sugai[3], Yousuke Ito[3], Yoshihisa Aizu[1]
*[1]Muroran Institute of Technology, Japan, [2]Hokkaido Pharmaceutical Univ.ersity, Japan, [3]DENSEI COMMUNICATION Inc., Japan*

We have developed a portable light therapy apparatus for improvement of sleep quality and wakefulness and performed some preliminary experiments. The experimental results demonstrate usefulness of developed portable light therapy apparatus.

# Poster Session <Exhibition Hall A>

## Friday, 27 April

### LDCp9 10:30-12:00

#### LDCp9-11

**Understanding the Exposure-time Effect on Speckle Contrast Measurement for Laser Projection with Rotating Diffuser**

Koji Suzuki, Shigeo Kubota
*Oxide Corporation, Japan*

We measured speckle contrast for laser projection with a rotating diffuser. The exposure-time effect was observed at slow surface velocity. The exposure time won't affect speckle contrast of laser displays if temporally-averaging speed is fast.

#### LDCp9-12

**Improvement of Image Blurring for Aerial Image formed by Dihedral Corner Reflector Array using Optimization Processing**

Daisuke Miyazaki, Shinji Onoda
*Osaka City University, Japan*

A method to improve blurring in an aerial image formed by a micro mirror array imaging element is proposed. A displayed image is optimized to minimize image blur using simulated annealing algorithm.

#### LDCp9-13

**Forming a Thermal Aerial Image with AIRR**

Kengo Fujii[1], Erina Abe[1], Ryosuke Kujime[1,2], Hirotsugu Yamamoto[1,2]
*[1]Utsunomiya University, Japan, [2]JST ACCEL, Japan*

This paper shows the possibility of forming a thermal aerial image with aerial imaging by retro-reflection (AIRR). Although far-infrared rays are absorbed by polymers, near-infrared lights can be retro-reflected and transmit through a beam splitter.

#### LDCp9-14

**Aerial Imaging in a Cylindrical Water Tank with Omnidirectional**

Erina Abe[1], Sho Onose[1], Hirotsugu Yamamoto[1,2]
*[1]Utsunomiya University, Japan, [2]JST ACCEL, Japan*

This paper utilizes aerial imaging by retro-reflection (AIRR) for an omnidirectional aerial display. The omnidirectional aerial screen is formed inside a cylindrical water tank, which is aimed for experiments on fish by showing images.

#### LDCp9-PDP1

**The Advantage of Centroid Wavelengths for Precise Evaluation of Laser Displays**

Keisuke Hieda, T. Maruyama, F. Narusawa
*HIOKI E.E. CORPORATION, Japan*

The accuracy of a measurement method for the chromaticity and photometric quantity of laser displays using centroid wavelengths was experimentally verified.

### PLD8p 10:30-12:00

#### PLD8p-1

**A real-time laser conditioning technique coupled with photothermal lens probe on 1064-nm mirror**

Yi Zheng[1], Z. Liu[2], P. Ma[2], F. Pan[2], F. Geng[2], J. Wang[2], Q. Xu[2]
*[1]Chengdu Novaphoton Co. Ltd., China, [2]Chengdu Fine Optical Engineering Research Ctr, China*

We have presented a novel adaptive laser conditioning (ALC) concept on 1064nm mirror that uses photo-thermal lens probe (PTLP) to detect defects in-situ and then carries out adaptive control of exposure fluence.

#### PLD8p-2

**Study on the properties of thin films used in laser system**

Cui Yun[1], Fei Liang[2], Yuan\'an Zhao[1], Meiping Zhu[1], Kui Yi[1], Jianda Shao[1]
*[1]Shanghai Institute of Optics and Fine Mechanics, China, [2]Shanghai Univ., China*

Hafnia-silica (Hf02-Si02) mixed coatings with a wide range of compositions were deposited on fused silica substrates by electron beam co-evaporation.

#### PLD8p-3

**High-efficiency and low-damage lapping process optimization based on effective damage removal rate**

Ci Song, Y. Lin, H. Hu, S. Chen, L. Zhou, G. Tie
*National Univ. of Defense Technology, China*

The low-damage optics are applied widely in modern laser system, and its fabrication is always the popular issue. As one of the key points in the manufacturing process, the optimization of efficiency and damage challenges the lapping process.

#### PLD8p-4

**Research on a new combined polishing technology and damage threshold improvement of KDP crystals**

Hao Hu, G. Tie, C. Song, L. Zhou, S. Chen
*National Univ. of Defense Technology, China*

Potassium Dihydrogen Phosphate(KDP) crystal is an excellent nonlinear optical material and is also the unique material used for high energy laser system.

#### PLD8p-5

**Characterization of multiwavelength laser-induced damage in DKDP crystals**

Jinming Wu[1,2], Y. Zhao[2], L. Wang[1], X. Peng[2], L. Yang[2]
*[1]Shanghai Univ., China, [2]Shanghai Institute of Optics and Fine Mechanics, China*

Nanosecond laser-induced damage (LID) in potassium dihydrogen phosphate (KH2P04) remains an issue for light- frequency converters in large-scale lasers system such as NIF (National Ignition Facility, in USA) and LMJ (Laser MegaJoule, in France).

#### PLD8p-6

**Nonlinear optical characteristics of ADP crystals**

Yafei Lian, X. Sun, M. Xu, L. Zhang
*Shandong Univ., China*

A picosecond Nd:YAG laser (30 ps, 10-Hz pulse repetition rate) was used in the experiments. Nonlinear optical characteristics of crystals were investigated at λ= 532nm, 355nm and 266nm.

#### PLD8p-7

**Third-harmonic-generation nonlinear absorption coefficient of 70% deuterated DKDP crystal**

Dongting Cai[1], X. Ju[2], B. Liu[2]
*[1]Shandong Univ., China, [2]Univ. of Science and Technology Beijing, China*

The nonlinear optical absorption (NLA) of 70% deuterated DKDP crystals that were cut along different directions and annealed under different temperatures were measured at the third-harmonic-generation (THG) wavelength (355 nm) of a nanosecond Nd:YAG laser (pulse duration of 5.4 ns and repetition rate of 10 Hz) by using the Z-scan method.

#### PLD8p-8

**Wide-bandgap nonlinear crystal with high damage resistance for femtosecond mid-infrared spectrometer using chirped-pulse upconversion**

Yusuke Funamoto[1], Y. Inagaki[1,2], H. Hata[1,2], T. Kamimura[1], N. Umemura[3], N. Hamada[2], R. Nakamura[2]
*[1]Osaka institute of technology, Japan, [2]Osaka University, Japan, [3]Chitose Institute of Science and Technology, Japan*

For biochemical processes such as photoisomerization, bond formation and dissociation, and protein folding, femtosecond time-resolved mid-infrared (MIR) spectroscopy has been a powerful tool for gaining insight.

#### PLD8p-9

**XANES investigation on surface electronic structure of KDP crystals irradiated with different fluences and retired components**

Xiangcao Li, X. Ju, B. Liu
*Univ. of Science and Technology Beijing, China*

The electronic structure of phosphorus is essential for understand the laser-induced damage since P atom is the body-centered atom and it is fundamental to the structure of KDP crystal.

#### PLD8p-10

**Crystal growth and UV laser-induced damage resistance of a strontium tetraborate**

Yasunori Tanaka[1], K. Shikata[1], Y. Takahashi[1], R. Murai[1], M. Imanishi[1], Y. Mori[1,2], M. Yoshimura[1,2]
*[1]Osaka University, Japan, [2]SOSHO CHOKO Inc., Japan*

One of borate materials, strontium tetraborate SrB407 (SBO), was reported as a nonlinear optical crystal with high nonlinear coefficients and wide transparency range [1].

#### PLD8p-11

**Research of diamond transmission gratings used for high-power laser pulse compression**

Shuwei Fan, T. Zhu, H. Wang
*Xi'an Jiaotong Univ., China*

As a milestone in the development of laser technique, chirp pulse amplification (CPA) technique is widely applied to produce ultrahigh power laser.

#### PLD8p-12

**Carrier dynamics in dispersion compensation element induced by femtosecond laser**

Xin Xing[1], W. Yuan[1], T. Kobayashi[2], B. Xue[2], J. Du[1], Y. Leng[1], Y. Zhao[1], J. Shao[1]
*[1]Shanghai Institute of Optics and Fine Mechanics, China, [2]University of Electro-Communications, Japan*

With the wildely application of high power femtosecond laser, optical thin film components are being one of the most critical components in the laser system.

#### PLD8p-13

**Non-invasive and in situ measurement of a refractive index gradient profile of one-dimensional GRIN materials**

Humbat Nasibov
*TÜBITAK UME, Turkey*

Refractive index (RI) distribution plays a crucial role in the propagation of light trough any transparent medium except a vacuum.

#### PLD8p-14

**Q-switched composite gold nanorod and Nd:YAG ceramic planar waveguide laser**

Wenda Cui, K. Han, C. Zhang, G. Lin, J. Li, W. Hua, H. Wang, Y. Pan, X. Xu
*National Univ. of Defense Technology, China*

The planar waveguide laser is a crucial device for high power solid state lasers and integrated optics. The RE-doped ceramics has been widely investigated because of its flexibility and easier manufacture of large homogeneous gain volume.

#### PLD8p-15

**Experimental study on the processing effect of DUV laser radiation to CFRP**

Xingliang Song[1,2], P. Sha[1], H. Shi[3,4], B. Liu[1,2], Z. Feng[1,2], J. Rui[1], Y. Zhou[1], S. Yuan[3,4], J. Yang[1], G. Xiong[1], Y. Wang[1]
*[1]Academy of Opto-Electronics, CAS, China, [2]Univ. of Chinese Academy of Sciences, China, [3]Beijing Engineering Technological Research Ctr. for High-Efficient and Green CNC Machining Process, China, [4]Beihang Univ., China*

Carbon Fiber Reinforced Polymer(CFRP) is widely used in the industries of aerospace, automobile and sport. Due to its complex material component and structure, it is hard to assemble CFRP parts to others without damage.

#### PLD8p-16

**Dynamical behavior of laser-produced copper plasma in uniform external magnetic field**

Narayan Behera, R. K. Singh, A. Kumar
*Institute for Plasma Research, HBNI, Gandhinagar, India*

An Nd:YAG laser (λ =1064 nm, 8 ns pulse width) of 150 mJ pulse energy is used to ablate copper target in the presence of 0 - 0.50 T transverse magnetic field.

#### PLD8p-17

**The post-processing process and mechanism of coating based on laser shock wave**

Wenwen Liu, H. Yang, J. Zhang, D. Zhu
*Wenzhou Univ., China*

High power laser coatings are facing a series of more serious challenges including running on higher laser induced damage threshold (LIDT), higher repetitive frequency and higher stability.

# Poster Session <Exhibition Hall A>

## Friday, 27 April

### PLD8p 10:30-12:00

**PLD8p-18**

**Photostability study of CdTe quantum dots using laser induced fluorescence Author Preference**

Ahmed El-Hussein Mohamed Kamel ElNewishy, S. Elfeky
*National Institute of Laser Enhanced Sciences, Egypt*

Semiconductor quantum dots (QDs) having high quantum yields and unique photostability. This research studies the optical properties of the synthesized CdTe QDs with two different sizes using Laser induced fluorescence for investigating their photostability.

**PLD8p-19**

**Laser decoating of TiN from TiN-coated 316L stainless steel substrates: Effects of laser parameters on the decoating**

Jingxuan Wang, Y. Ye
*China Academy of Engineering Physics, China*

Current environmental challenges require sustainable and extended use and re-use of materials. For example, the service life of engineering tooling can be extended by using thin film coatings such as titanium nitride (TiN).

**PLD8p-20**

**Laser-induced damage of indium tin oxide films and polyimide films at 1064nm**

Liping Peng[1,2], X. Liu[1,2], Y. Zhao[1], Y. Liu[3,2], Z. Cao[3,2], M. Zhu[1,2], J. Shao[1,2]
*[1]Shanghai Institute of Optics and Fine Mechanics, China, [2]Univ. of Chinese Academy of Sciences, China, [3]Changchun Institute of Optics, Fine Mechanics and Physics, Chinese Academy of Sciences, China*

Laser damage performance of indium tin oxide (ITO) films and polyimide (PI) thin films were investigated. The ITO films with 25nm thickness were deposited on glass substrates by magnetic sputtering, and then PI film samples with thickness of 80nm were spin coated on the ITO.

**PLD8p-21**

**Study on the micro-etched morphology and electromagnetic properties of grain-oriented silicon steel by laser processing**

Zhang Jian
*WenZhou University, China*

In order to effectively reduce the iron loss of grain-oriented silicon steel. In order to optimize the electromagnetic properties of grain-oriented silicon steel.

**PLD8p-22**

**Thermo-mechanical behavior of photovoltaic cell under laser irradiation**

Chen-Wu Wu
*Institute of Mechanics, China*

The multiple physical responses of photovoltaic cell to laser irradiation are of fundamental meaning for developing laser power beaming technology as well as evaluating reliability of the solar panel subjected to unexpected laser exposure.

**PLD8p-23**

**Mechanism of laser resist removal phenomenon without causing laser damage**

Yuji Umeda[1], K. Nuno[1], T. Yamashiro[1], Y. Hunamoto[1], A. Nishiura[1], D. Sima[1], H. Tsukamoto[1], N. Nishioka[1], H. Kuramae[2], T. Nishiyama[3], H. Horibe[3], R. Nakamura[4], T. Kamikura[1]
*[1]Osaka Institute of Technology, Japan, [2]Department of Robotics, Osaka Institute of Technology, Japan, [3]Department of Applied Chemistry and Bioengineering, Graduate School of Engineering, Japan, [4]Science & Technology Entrepreneurship Laboratory, Osaka University, Japan*

Resist removal using the laser irradiation has attracted a great deal of attention as one of the new removal technologies. Usually, when a laser beam is irradiated to the resist in the normal atmosphere, laser damage occurs to the Si wafer surface.

### OMCp 13:00-14:00

**OMCp-1**

**Polarization Control Based on Graphene Hyperbolic Metamaterials**

Tao Wang, L. Cheng
*Huazhong Univ of Science and Technology, China*

Polarization manipulation of the electromagnetic wave is essential for numerous and extensive applications such as biological imaging, sensing, communication and microscopy.

**OMCp-2**

**Theoretical and Experimental Investigations of Photonic Jet Array From Rectangle Phase Diffraction Grating**

Cheng-Yang Liu[1], T. Yen[1], O. V. Minin[2], I. V. Minin[2]
*[1]Tamkang Univ, Taiwan, [2]Siberian State University of Geosystem and Technologies, Russia*

The generations of photonic jet array using rectangle phase diffraction grating at visible light region are demonstrated numerically and experimentally for the first time.

**OMCp-3**

**Dispersion of Quantum Dots into Gases Toward Their Optical Manipulation**

Mitsutaka Kumakura, A. Kinan, T. Moriyasu
*Univ of Fukui, Japan*

To realize optical manipulation and measurement for isolated quantum dots (QDs) in gaseous phase, we are developing experimental apparatus for dispersing QDs into a gas by using droplets of organic solvents.

**OMCp-4**

**Multiplexed Volume Holographic Gratings for Simultaneous Generation of Airy and Dual Airy Beams**

Sunil Vyas, Y. Chia, Y. Luo
*National Taiwan Univ, Taiwan*

Most of the generation techniques of structured light are inherently wavelength dependent. Holography has always played an important role in generating structured light. Volume holograms have ability to Bragg diffract only a narrow band of wavelengths.

**OMCp-5**

**Thermal Analysis for Ion Beam Processing of the Unimorph Deformable Mirror**

Zhanbin Fan, C. Guan, G. Tie, S. Chen
*National University of Defense Technology, China*

The unimorph deformable mirror (DM) is favored in the field of synchrotron radiation due to its simple structure, dynamic surface figure and adaptive adjustment. The request of mirror surface accuracy on the synchrotron radiation beam focus can be up to sub-nanometer RMS.

**OMCp-6**

**Thermal Analysis for Ion Beam Processing of the Unimorph Deformable Mirror**

Fan Zhanbin, C. Guan, G. Tie, S. Chen
*National University of Defense Technology, China*

The unimorph deformable mirror (DM) is favored in the field of synchrotron radiation due to its simple structure, dynamic surface figure and adaptive adjustment. The request of mirror surface accuracy on the synchrotron radiation beam focus can be up to sub-nanometer RMS.

**OMCp-7**

**Preparation of Low-Toxic Zn-Ag-In-Te Quantum Dots with Tunable Near-IR Emission Toward Optical Applications**

Tatsuya Kameyama[1], K. Sugiura[1], Y. Ishigami[1], T. Yamamoto[1], S. Kuwabata[2], T. Okuhata[3], N. Tamai[3], T. Torimoto[1]
*[1]Nagoya Univ., Japan, [2]Osaka Univ., Japan, [3]Kwansei Gakuin University, Japan*

Semiconductor quantum dots (QDs) composed of ZnTe-AgInTe2 solid solution ((AgIn)xZn2(1-x)Te2, ZAITe) were synthesized by a thermal reaction of corresponding metal acetates and a Te precursor in 1-dodecanethiol.

**OMCp-8**

**Trapping and Manipulation of Individual Cells in the Crowd**

Qian Zhao
*The University of Science and Technology of China, China*

Manipulating single cell with optical tweezers in vitro or in vivo plays an important role in biological research, whereas the manipulation of individual cells might be affected by the neighbor cells especially in the crowd environment.

**OMCp-9**

**Dynamic Shaping of Orbital-Angular-Momentum Beams with An Optimized Lee Method**

Xinyao Hu
*The University of Science and Technology of China, China*

Shaping complex fields with a digital micromirror device (DMD) has attracted much attention recently due to its potential application in optical communication and microscopy.

**OMCp-10**

**Proposed Selective Optical Transport of Nanoparticles using Counter-Propagating Beams**

Takudo Wada, H. Ishihara
*Osaka Prefecture University, Japan*

Optical manipulation is a technique for mechanically manipulating minute substances by using radiation force from laser beams.

# Poster Session <Exhibition Hall A>

## Friday, 27 April

### OMCp 13:00-14:00

#### OMCp-11

**Optical Forces on A Nonlinear Optical Rayleigh Particle Induced by Highrepetition-Rate Femtosecond Laser Pulses**

Bing Gu[1], L. Gong[1], G. Rui[1], Y. Cui[1], Z. Zhu[2], Q. Zhan[3]
*[1]Southeast Univ, China, [2]Nanjing Normal University, China, [3]University of Dayton, USA*

The principle of optical trapping is conventionally based on the interaction of optical fields with linear-induced polarizations.

#### OMCp-12

**Metalens for Structure Light**

Mu Ku Chen[1], Cheng Hung Chu[2], Hsin Yu Kuo[1], Yu Han Chen[1], Ren Jie Lin[1], Jia-Wern Chen[1], Din Ping K. Tsai[1,2]
*[1]Department of Physics, National Taiwan University, Taiwan, [2]Research Center for Applied Sciences, Academia Sinica, Taiwan*

Metalens have great ability in light focusing and can be tailored to exhibit varied functionalities in ultrathin optical applications.

#### OMCp-13

**Active Polarization Control of Optical Fields Localized on Gold Nano-Rectangles**

S. Hashiyada, T. Narushima, H. Okamoto
*Institute for Molecular Science, Japan*

We demonstrate here that control of local optical field near a single non-chiral gold nano-rectangle irradiated with linearly polarized light is possible from linearly polarized to nearly pure left- or right-handed circular polarization, by adjusting the angle of the incident polarization relative to the rectangle.

#### OMCp-14

**Optical Manipulation of Nonlinear Vibration of Graphene Mechanical Resonator**

Taichi Inoue, Y. Anno, Y. Imakita, K. Takei, T. Arie, S. Akita
*Osaka Prefecture University, Japan*

Graphene mechanical resonator (G-MR) has possibilities of high sensitive sensor because of excellent mechanical properties. In many cases, G-MR has been actuated in linear resume.

#### OMCp-15

**Optical Manipulation of Vibration Amplitude of Electrostatically Actuated Cantilevered MoS2**

Daiki Yoshikawa, Y. Miyamoto, K. Takei, T. Arie, S. Akita
*Osaka Prefecture University, Japan*

Transition metal dichalcogenide such as MoS2 is expected as high performance nano-electro-mechanical devices due to their unique electrical, optical and mechanical properties.

#### OMCp-16

**Hyper-Entanglement Preservation in Quantum Optical Circuits**

Vladimir Nikulin
*Binghamton Univ, USA*

Secure optical data links can be implemented using quantum communication (QC) protocols that offer physical-layer encryption without the mathematical complexity of traditional cryptography.

#### OMCp-17

**Novel Non-plasmonic Optical Trapping; Nano-Structured Semiconductor Assisted (NASSCA) Optical Tweezers**

Yuki Uenobo[1], Tatsuya Shoji[1], Ayaka Mototsuji[1], S. Komoto[1], T. Nagai[1], Yasuyuki Tsuboi[1], J. Saulius[2], L. Denver[2], Swinburne[2]
*[1]Osaka City University, Japan, [2]University of Technology, Australia*

We have studied plasmonic optical tweezers (POT) for nanomaterials such as DNA and polymers. These nanomaterials would be efficiently trapped by a plasmon-enhanced optical force.

#### OMCp-18

**Raman Microspectroscopic Study on an Optically Formed Poly(N-isopropylacrylamide) Rich Microparticle: Molecular Weight Dependence of a Polymer Concentration in the Particle**

Kayo Fujiwara, T. Shoji, M. Matsumoto, T. Asoh, T. Nishiyama, H. Horibe, Y. Tsuboi
*Osaka City University, Japan*

Poly(N-isopropylacrylamide) solution, which is a representative thermoresponsive polymer, exhibits a phase separation with a formation of polymer-rich microparticles due to dehydration and aggregation of the polymer chains above a lower critical solution temperature (LCST).

#### OMCp-19

**Temperature at the Focal Point of Optical Trapping Beam: Evaluation Using Fluorescence Correlation Spectroscopy**

Kenji Setoura, S. Ito, K. Fujita, H. Miyasaka
*Osaka Univ, Japan*

Fluorescence correlation spectroscopy was applied to the evaluation of the local heating at the focal spot of nearinfrared laser for optical trapping.

#### OMCp-20

**Optofluidics Driven by Photothermal Effects of Single Gold Nanoparticles**

Kenji Setoura, S. Ito, H. Miyasaka
*Osaka University, Japan*

Gold nanoparticles (Au NPs) exhibit strong light absorption due to localized surface plasmon resonance (LSPR), and efficiently convert light energy into heat under illumination.

#### OMCp-21

**In-Situ Observation of Molecules in the Strong Coupling States**

Kei Murakoshi, F. Kato, H. Minamimoto
*Hokkaido Univ, Japan*

We have attempted to control molecular behavior of a small number of molecules which are strongly coupled with the localized light energy in the vicinity of the metal nano structures.

#### OMCp-22

**In-situ SERS Observation of Selective Molecule Optical Trapping**

Kei Murakoshi, N. Oyamada, H. Minamimoto
*Hokkaido Univ, Japan*

It is predicted by various theoretical studies that nanometer size molecules could be trapped in the strong electromagnetic field due to its steep spatial gradient of the filed intensity.

#### OMCp-23

**Optical control of orientation of nanosheet in colloidal state**

Yasutaka Suzuki[1], Toshiaki Iwai[2]
*[1]Yamaguchi University, Japan, [2]Tokyo University of Agriculture and Technology, Japan*

TBD

### BISCp6 13:00-14:30

#### BISCp6-1

**Non-invasive glucose monitoring based on optical coherent tomography**

Tseng-Lin Chen[1], Yu-Lung Lo[1,2], Quoc-Hung Phan[1]
*[1]Department of Mechanical Engineering, National Cheng Kung University, Taiwan, [2]Advanced Optoelectronic Technology Center, National Cheng Kung University, Taiwan*

A novel technique based on optical coherence tomography (OCT) for noninvasive glucose monitoring is proposed. The feasibility of the proposed technique is demonstrated by detecting the glucose concentration of aqueous solution ranging from 0~4000 mg/dL with 0.02% lipofundin.

#### BISCp6-2

**Monitoring protein-related degeneration of Drosophila eyes with optical coherence tomography**

Chia-Heng Wu[1], Meng-Tsan Tsai[2]
*[1]Chang Gung Univ, Taiwan, [2]Department of Electrical Engineering, Chang Gung University, Taiwan*

In this study, we propose to use optical coherence tomography (OCT) for the study of protein-related degeneration of Drosophila eyes. With OCT, the bristles of Drosophila eye can be identified and different mutant Drosophila were scanned with OCT for investigation of progress of protein-related degeneration.

#### BISCp6-3

**Parallel phase-shifting radial shearing interferometry and its numerical verification**

Syogo Mochida[1], Takahito Fukuda[1], Yasuhiro Awatsuji[2], Kenzo Nishio[3], Osamu Matoba[4]
*[1]Department of Electronics, Graduate School of Science and Technology, Kyoto Institute of Technology, Japan, [2]Faculty of Electrical and Electronics, Kyoto Institute of Technology, Japan, [3]Advanced Technology Center, Kyoto Institute of Technology, Japan, [4]Department of Systems Science, Graduate School of System Informatics, Kobe University, Japan*

We propose parallel phase-shifting radial shearing interferometry for single-shot measurement of wavefront from an object. We numerically simulated and demonstrated the wavefront measurement of two particles assumed as object wave by using the proposed technique.

#### BISCp6-4

**Motion-picture phase imaging by an integrated optical system of a parallel phase-shifting digital holographic microscope**

Kazuki Shimizu[1], Takahito Fukuda[1], Peng Xia[2], Yasuhiro Awatsuji[3], Kenzo Nishio[4], Osamu Matoba[5]
*[1]Department of Electronics, Graduate School of Science and Technology, Kyoto Institute of Technology, Japan, [2]National Institute of Advanced Industrial Science and Technology, Japan, [3]Kyoto Institute of Technology, Faculty of Electrical Engineering and Electronics, Japan, [4]Advanced Technology Center, Kyoto Institute of Technology, Japan, [5]Department of Systems Science, Graduate School of System Informatics, Kobe University, Japan*

The authors have designed and constructed an integrated optical system of parallel phase-shifting digital holographic microscope. Motion-picture phase imaging of a dynamic minute transparent specimen at 1,000 fps has been demonstrated by the microscope.

# Poster Session <Exhibition Hall A>

## Friday, 27 April

### BISCp6 13:00-14:30

**BISCp6-5**

**Digital holographic microscopy using speckle illuminations and two-wavelength method**

Hideki Funamizu[1], Jun Uozumi[2], Yoshihisa Aizu[3]
*[1]Yusei Onodera, Muroran Institute of Technology, Japan, [2]Faculty of Engineering, Hokkai-Gakuen University, Japan, [3]Muroran Institute of Technology, Japan*

It has been known that spatial resolution of digital holographic microscopy (DHM) can be enhanced using speckle illuminations. In this study, we report the application of the two-wavelength method to DHM using speckle illuminations.

**BISCp6-6**

**Tomographic phase imaging of RBCs in blood coagulation structures using digital holographic microscopy**

Hideki Funamizu, Ryoji Goto, Yoshihisa Aizu
*Muroran Institute of Technology, Japan*

Blood coagulation is an important role in hemostasis. In this study, to observe the degree of blood coagulation, we demonstrate a tomographic phase imaging of aggregation structures of RBCs using digital holographic microscopy.

**BISCp6-7**

**Reconstruction of complex amplitude by lensless phase-shift digital holography through an opaque glass plate**

Akinori Igarashi, Wataru Watanabe
*Ritsumeikan University, Japan*

Optical imaging through diffusive or scattering media has attracted much attention. Digital holographic microscopy provides quantitative phase imaging thorough diffusive media. We experimentally reconstruct intensity and phase images of an object through an opaque ground glass screen by means of digital holography.

**BISCp6-8**

**Digital holographic size measurement of Daphnia pulex**

Kota Sunayama[1], Hitoshi Miyakawa[2], Yoshio Hayasak[2]
*[1]Center for Optical Research and Education (CORE), Utsunomiya University, Japan, [2]Center for Bioscience Research and Education (CBRE), Utsunomiya University, Japan*

Toxicity of chemical substances should be determined for protecting biological environment. A Daphnia pulex is one of the indicator organisms for searching the toxicity, because the shape is changed depending on the toxicity. Conventional method for its observation has been performed under suppression of its movement in a small thin room with an ordinary optical microscope.

**BISCp6-9**

**Incoherent holographic imaging of subsurface structures with volume holographic gratings**

Yu-Hsin Chia[1], Hung-Chun Wang[2], Yuan Luo[3]
*[1]Institute of Medical Device and Imaging, National Taiwan University, Taiwan, [2]Department of Power Mechanical Engineering, National Tsing Hua University, Taiwan, [3]Institute of Medical Device and Imaging, National Taiwan University, Taiwan*

Under broadband illumination, a multiplane microscopy incorporating volume holographic gratings (VHGs) to observe three-dimensional structures of biological samples is presented. Here, we experimentally demonstrate this microscopic imaging capability to obtain multiple depth-resolved images of fine structures from eight depths in one shot.

**BISCp6-10**

**In vivo time-series monitoring of dermal collagen fiber during skin burn healing using second-harmonic-generation microscopy**

Eiji Hase[1,2], Ryosuke Tanaka[3], Shu-ichiro Fukushima[3], Takeshi Yasui[1,3]
*[1]Tokushima University, Japan, [2]JASRI/SPring-8, Japan, [3]Osaka University, Japan*

We applied second-harmonic-generation microscopy for in vivo imaging of healing process in animal skin burn and visualized decomposition, production, and growth of renewal collagen fibers as a series of time-lapse images in the same subject.

**BISCp6-11**

**In vivo visualization of dermal collagen fibers in human skin using a photonic-crystal-fiber-coupled, hand-held second-harmonic-generation microscope**

Yuki Ogura, Kosuke Atsuta, Eiji Hase, Takeo Minamikawa, Takeshi Yasui
*Tokushima Univ., Japan*

We constructed a hand-held second-harmonic-generation microscope for in vivo monitoring of collagen fibers in human skin by fiber delivery of ultrashort pulse light in a large-mode-area photonic-crystal-fiber and a compact microscopy setup.

**BISCp6-12**

**Analysis of collagen fiber orientation in biological tissues using polarization-resolved second-harmonic-generation microscopy**

Takuya Sakaue[1], Eiji Hase[2], Takeo Minamikawa[3]
*[1]Tokushima Univ, Japan, [2]Tokushima Univ, Japan, SPring-8(JASRI), Japan, [3]Takeshi Yasui, Tokushima Univ, Japan*

We constructed continuously-polarization-resolved SHG microscopy based on rapid polarization rotation every 15 degrees with electric-optic Pockells cell, and applied it for the quantitative analysis of collagen fiber orientation in biological tissues.

**BISCp6-13**

**In situ monitoring of incised wound healing in animal model using second-harmonic-generation and third-harmonic-generation microscopy**

Shu-ichiro Fukushima[1], Yuji Tanaka[1], Eiji Hase[2,3], Kazuma Takeichi[2], Takeshi Yasui[1,2]
*[1]Osaka University, Japan, [2]Tokushima University, Japan, [3]JASRI/SPring-8, Japan*

We apply the combination of second-harmonic-generation microscopy with third-harmonic-generation microscopy for incised wound animal model, and visualize collagen dynamics during the wound healing process in time series in situ.

**BISCp6-14**

**Resonance Raman and fluorescence spectroscopy to evaluate increased brain kynurenine pathway activity in samples from patients with Alzheimer's**

Laura A. Sordillo, Lin Zhang, Lingyan Shi, Peter Sordillo, Robert Alfano
*City College of New York, USA*

Resonance Raman and fluorescence spectroscopy were used to assess increased kynurenine pathway activity in brain samples from Alzheimer's patients and age-matched controls. Increased activity was seen in areas of the brain involved in Alzheimer's disease.

**BISCp6-15**

**Development of dual-wavelength microscopic laser speckle contrast imaging system**

Cheng-Yu Lee[1], Meng-Tsan Tsai[1,2]
*[1]Chang Gung University, Taiwan, [2]Chang Gung Memorial Hospital, Taiwan*

Laser Speckle Contrast Imaging (LSCI), which used coherent light, has fully been used for observing blood flow due to its non-invasive, non-contact acquisition method. Generally, LSCI system uses just a single wavelength for measurement. In this research, first, considering the biological characteristics of different reflection rates and absorption, we use two lasers at 633nm and 855 nm and two CCD cameras to build a microscopic LSCI system.

**BISCp6-16**

**Polarization-resolved second-harmonic-generation imaging of dermal collagen fiber in pre-wrinkled skin of ultraviolet-B-exposed mouse**

Shu-ichiro Fukushima[1], Makoto Yonetsu[1], Eiji Hase[2,3], Takeshi Yasui[1,2]
*[1]Osaka University, Japan, [2]Tokushima University, Japan, [3]JASRI/SPring-8, Japan*

We investigate orientation change of dermal collagen fiber in pre-wrinkled skin of ultraviolet-B-exposed mouse skin using polarization-resolved second-harmonic-generation microscopy, and confirm that change of collagen fiber orientation is a trigger of wrinkling in photo-aged skin.

**BISCp6-17**

**Effects of nitric oxide on cortical hemodynamic responses in the rat brain exposed to a shock wave**

Masaki Inaba[1], Shunichi Sato[2], Izumi Nishidate[3]
*[1]Tokyo University of Agriculture and Technology, Japan, [2]National Defense Medical College Research Institute, Japan, [3]Tokyo University of Agriculture and Technology, Japan*

We examied how the nitric oxide synthesis inhibition altered hemodynamic responses to a laser-induced shock wave(LISW) by diffuse reflectance spectroscopy. The results suggested that hemodynamic abnormalities, or transient hyperemia/hyperoxemia followed by persistent oligemia/hypoxemia, caused by an LISW in the rat cortex was associated with an increased nitric oxide production and its vasodilatory/vasoconstrictory effects.

**BISCp6-18**

**Partial optical path length in the scalp in subject-specific head models for multi-distance probe configuration of near infrared spectroscopy**

Taku Yanagisawa[1], Hiroshi Kawaguchi[2], Eiji Okada[3]
*[1]Department of Electronics and Electrical Engineering,Keio University, Japan, [2]National Institute of Advanced Industrial Science and Technology, Japan, [3]Department of Electronics and Electrical Engineering,Keio University, Japan*

Light propagation in 45 subject specific head models was calculated to predict the spatial variability of the partial optical path length in the scalp and the weighting factor for the multi-distance probe configuration of NIRS.

**BISCp6-19**

**Measurement of head phantom by functional near infrared imaging using multi-distance probe configuration**

Koki Hayabusa, Eiji Okada
*Department of Electronics and Electrical Engineering, Keio University, Japan*

The topographic image of the head phantom including the local absorption change in gray matter and global absorption change in the scalp was measured by functional near infrared imaging system using multi-distance probe configuration.

**BISCp6-20**

**Diffuse light reflectometry for measuring scattering and absorption coefficients of a biological tissue**

Daiki Maeda, Toshiaki Iwai
*Tokyo University of Agriculture and Technology, Japan*

The optical properties, a scattering and an absorption coefficients, of biological tissues will be used to estimate quantitatively change in bioactivity. Diffuse light reflectometry has been investigated to measure the optical properties of biological tissues from the viewpoints of applicability and practicality.

**BISCp6-21**

**Adjoint based Hessian evaluation for SPN modeled optical tomography**

Nishigandha Patil, Naren Naik
*Indian Institute of Technology Kanpur, India*

We present for the first time an adjoint based evaluation of the Hessian matrix for the SPN-approximation modeled forward operator in optical tomography. The Hessians so calculated are numerically validated with respect to finite difference calculations.

# Poster Session <Exhibition Hall A>

## Friday, 27 April

### BISCp6 13:00-14:30

**BISCp6-22**

**Three-dimensional beam focusing control for lensless vascular endoscopes using local wavefront control**

Masaki Hisaka
*Osaka Electro-Communication Univ, Japan*

The focusing beam generated by an optical fiber bundle having locally optical delay has been investigated to simplify the structure of vascular endoscopes. We have demonstrated the beam focusing and scanning using a liquid lens.

**BISCp6-23**

**Application of scan-less two-dimensional confocal microscopy achieved by a combination of confocal slit with wavelength/space conversion**

Eiji Hase[1,2], Takeo Minamikawa[1,2], Yasuhiro Mizutani[2,3], Tetsuo Iwata[2,4], Hirotsugu Yamamoto[2,5], Takeshi Yasui[2,6]
*[1]Tokushima Univ., Japan, [2]JST, ERATO MINOSHIMA Intelligent Optical Synthesizer (IOS), Japan, [3]Osaka Univ., Japan, [4]Tokushima Univ., Japan, [5]Utsunomiya Univ., Japan, [6]Tokushima Univ., Japan*

Scan-less confocal laser microscope is achieved by a combination of confocal slit with wavelength/space conversion and is applied it to several imaging to demonstrate its high potential.

**BISCp6-24**

**Multi-focal imaging system by using a programmable spatial light modulator**

Chen Yen Lin, Yuan Luo
*National Taiwan Univ, Taiwan*

We have demonstrated that the multiplexed gratings pattern displayed on the digital micro-mirror device (DMD) orLC-SLM at the Fourier plane can separate the diffraction light coming from different depths into different angular directions being recorded by different portions of the single image plane.

**BISCp6-25**

**Underwater image enhancement algorithm based on granular computing**

Yingjuan Xie, Xinnan Fan, Haiyan Xu, Zhuo Zhang, Junfeng Chen
*Hohai University, China*

We proposed an image enhancement algorithm based on granular computing to enhance underwater optical image in this paper. The simulation and experiment results verify the effectiveness of the algorithm.

**BISCp6-26**

**An edge detection method based artificial bee colony for underwater dam crack image**

Zhang Zhuo, Fan Xinnan, Xie Yingjuan, Xu Haiyan
*Hohai University, China*

In the proposed model, lateral inhibitory network is firstly presented to enhance edge contrast in complex underwater environment.Then, artificial bee colony is improved to optimize target edge. Experimental results show it is efficient and effective.

**BISCp6-27**

**Practical image quality evaluation for whole slide imaging scanner**

Md Shakhawat Hossain, Toyama Nakamura, Masahiro Yamaguchi
*Tokyo Institute of Technology, Japan*

We propose a method for evaluation of image quality for whole slide imaging system by eliminating false detection due to tissue artefacts. The method enables more efficient and reliable detection of slides to rescan or to score scanned image.

**BISCp6-28**

**Speckle reconstruction based on oversampling smoothness algorithm**

Hui Chen, Yesheng Gao, Xingzhao Liu
*Shanghai Jiao Tong University, China*

Target object image would deteriorate into unrecognizable speckle pattern when encountering with scattering media. In this paper, a method combining correlation method and oversampling smoothness is proposed. It is used for target object reconstruction from scattered speckle pattern.

**BISCp6-29**

**Speckle reconstruction method based on machine learning**

Hui Chen, Yesheng Gao, Xingzhao Liu
*Shanghai Jiao Tong University, China*

Scattering media would deteriorate an object image into unrecognizable speckle pattern. Support vector classification and support vector regression is utilized to reconstruct the object image from speckle pattern.

**BISCp6-30**

**Fractality of biospeckle pattern observed in blood coagulation process**

Naomichi Yokoi[1], Yoshihisa Aizu[2], Jun Uozumi[3]
*[1]National Institute of Technology, Asahikawa College, Japan, [2]Muroran Institute of Technology, Japan, [3]Hokkai-Gakuen University, Japan*

It has been known that speckle images observed for living bodies illuminated by laser light sometimes show fractal appearances. In this study, we investigate fractality of biospeckle pattern observed in coagulation process of horse blood.

**BISCp6-31**

**Computational ghost imaging by using complementary illumination patterns**

Jung-Ping Liu
*Feng Chia University, Taiwan*

We proposed to use complementary illumination patterns to perform CGI. In addition, we applied Gerchberg-Saxton-like algorithm to optimize the reconstructed image. By this way, the signal-to-noise ratio (SNR) can be significantly reduced.

**BISCp6-32**

**Preliminary study on X-ray phase-contrast imaging with tilted-grid**

Myung-Joon Kwack, Sooyeul Lee, Seung-hoon Chae
*ETRI, Korea*

We present preliminary experimental results of X-ray phase-contrast imaging with tilted-grid. Two-dimensional phase gradient information of a PMMA phantom is successfully defined by employing the tilted-grid in a conventional X-ray imaging setup.

**BISCp6-33** ***Withdraw***

**BISCp6-34**

**Implementation of a Raspberry-Pi-based LED array microscope for multi-contrast images**

Hidenobu Arimoto[1], Wataru Watanabe[2]
*[1]AIST, Japan, [2]Ritsumeikan University, Japan*

The light emitting diode (LED) array microscope enables various multi-contrast imaging such as bright-field, dark-field and differential phase-contrast by various illumination patterns without any expensive optical components.

**BISCp6-35**

**Image acquisition with smartphone-based LED array microscope**

Kazuko Koda[1], Shu Uenoyama[1], Ryo Sugimoto[1], Ryoji Maruyama[1], Hidenobu Arimoto[2], Wataru Watanabe[1]
*[1]Ritsumeikan University, Japan, [2]AIST, Japan*

The light emitting diode (LED) array microscope enables various multi-contrast imaging such as bright-field, dark-field and differential phase-contrast (DPC) by various illumination patterns without any expensive optical components.

**BISCp6-36**

**Scan-less, line-filed, confocal phase imaging with dual-comb microscopy**

Eiji Hase[1,2], Takeo Minamikawa[1,2], Yasuhiro Mizutani[2,3], Tetsuo Iwata[2,4], Hirotsugu Yamamoto[2,5], Takeshi Yasui[2,4]
*[1]Tokushima Univ., Japan, [2]JST, ERATO MINOSHIMA Intelligent Optical Synthesizer (IOS), Japan, [3]Osaka Univ., Japan, [4]Tokushima Univ., Japan, [5]Utsunomiya Univ., Japan*

We constructed the scan-less, line-filed, confocal microscopy with the phase-contrast modality by a combination of wavelength-to-space-conversion optical frequency comb with dual-comb spectroscopy, and then demonstrate the proof-of-principle experiment of the scan-less confocal phase line-imaging.

**BISCp6-37**

**Visual search efficiency depending on spatial layout of stimuli in volumetric image**

T. Pladere, V. Konosonoka, K. Panke, G. Krumina
*University of Latvia, Latvia*

The spatial layout of stimuli in horizontal and vertical dimension had a bigger impact on visual search performance comparing to the third dimension on a volumetric multi-planar display, also reflected in the subjective difficulty evaluation.

**BISCp6-38**

**Real-time detection of 192Ir gamma-ray source positon using organic scintillator array sensor in HDR brachytherapy**

Young Beom Song, Bongsoo Lee, Sang Hun Shin
*Chung-Ang University, Korea*

In this study, we fabricated an organic scintillator array sensor (OSAS) based the array of organic scintillators. The scintillator array of OSAS for detecting positions of 192Ir gamma-ray source was fabricated using four types of organic scintillators, which emit the scintillating lights of different wavelength, respectively.

**BISCp6-39**

**Electron beam addressable potentiometric sensor for ion distribution imaging with high resolution**

Wataru Inami, Yoshimasa Kawata
*Shizuoka Univ, Japan*

We have developed an electron beam addressable potentiometric sensor to improve the spatial resolution. Ion sensors are widely used in the fields of medical and life science, food and material development, environmental protection and so on. However, the spatial resolution of the ion distribution imaging sensor is limited by the diffraction limit of light or microfabrication technology.

**BISCp6-40**

**Design of add-on optics for optimization of cot endoscope camera for epiduroscopic surgery**

Khanh Phuong Tran
*Intelligent Systems Research Institute, Korea*

This paper presents a method for designing an add-on lens assembly to optimize the performance of Chip-on-the-Tip (COT) endoscope. In particular, an add-on lens assembly is designed here attributes to a commercially available COT camera, NanEye, in such that provides a FOV of 110º and DOF of 1.5 mm to 8 mm under the refractive index of water.

**BISCp6-41**

**Disturbance location algorithm of the single-core fiber optic sensor based on frequency domain**

Haiyan Xu, Yingjuan Xie
*Hohai Univ, China*

A novel distributed fiber-optic sensor based on Wavelength Division Multiplex (WDM) for determining the position of disturbances is presented. Theory analysis and experiment results show that the proposed algorithm can realize the detection and location of the multipoint disturb signals rapidly and effectively.

**BISCp6-42**

**Design optimization of a single-mode microring resonator for label-free detection of biomarkers within a tunable spectral range of 2 nm**

Prabodh Panindre[1], N. S. Susan Mousavi[2], Sunil Kumar[1,3]
*[1]New York University, USA, [2]Institute for Research in Fundamental Sciences, Iran, [3]New York University Abu Dhabi, UAE*

The electromagnetic frequency domain parametric analysis using finite element numerical technique quantifies the effect of geometrical design parameters of microring resonator on its optical characteristics to optimize its performance for label-free detection of nano-biomarkers.

# Poster Session <Exhibition Hall A>

## Friday, 27 April

### BISCp6 13:00-14:30

**BISCp6-43**

**Low dose of narrow-band ultraviolet B lamp for improving vitamin D synthesis with minimum skin damage**

Lin Yu-Hsuan[1], Yi-Wen Chiu[2,3], Ming-Yen Lin[2,3], Siao-Ping Tsai[2], Feng-Xuan Jian[3], Shang-Jyh Hwang[2,3], Kuo-Cheng Huang[1]
*[1]National Applied Research Laboratories, Taiwan, [2]Kaohsiung Medical University Hospital, Taiwan, [3]Kaohsiung Medical University, Taiwan*

This study proposes that the UV irradiation with a wavelength of 310-320 nm can effectively improve the vitamin D synthesis and minimize the skin damage.

**BISCp6-44**

**Photostability study of CdTe quantum dots using laser induced fluorescence**

Souad A. Elfeky, A.El-Hussein
*The National Institute of Laser Enhanced Science, Cairo University, Egypt*

Semiconductor quantum dots (QDs) having high quantum yields and unique photostability. This research studies the optical properties of the synthesized CdTe QDs with two different sizes using Laser-induced fluorescence (LIF) for investigating their photostability.

**BISCp6-45**

**Edge contrast enhancement at multiple planes using Forked Shaped defocus grating**

Sunil Vyas, Chen Yen Lin, Yuan Luo
*National Taiwan Univ, Taiwan*

We report on the implementation of spiral phase contrast imaging at multiple planes using forked-shaped defocus grating. The dual function of grating helps in simultaneous generation of multiple edge enhanced images corresponding to different depths.

**BISCp6-46**

**Orthogonal functional system for finite Fresnel transform**

Tomohiro Aoyagi, Kouichi Ohtsubo, Nobuo Aoyagi
*Toyo University, Japan*

The Fresnel transform has been studied mathematically and revealed the topological properties in Hilbert space. Main aim is to reveal the property of band-limited function. We seek the function that its total power is maximized in finite Fresnel transform plane, on condition that an input signal is zero outside the bounded region.

**BISCp6-47**

**Nanoscale three-dimensional imaging of biological tissue with X-ray holographic tomography**

Alexandra Pacureanu, Julio Caesar da Silva, Yang Yang, Sylvain Bohic, Peter Cloetens
*European Synchrotron Radiation Facility, France*

Enabling exploration of biological tissue in three-dimensions at sub-cellular scale is instrumental for advancing our understanding of biological systems and for finding better ways to cope with diseases.

### LICp6 13:30-14:30

**LICp6-1**

**A high-peak power passively Q-switched Nd:YAG/Cr4+:YAG compact laser with multiple-beam output**

Nicolaie Pavel, Oana Valeria Grigore, Gabriela Croitoru, Mihai Dinca
*National Institute for Laser, Plasma and Radiation Physics - INFLPR, Romania*

A diode-pumped, passively Q-switched, compact and monolithic Nd:YAG/Cr4+:YAG ceramic laser with four-beam output is presented. The energy of each laser pulse could be increased up to 5.9 mJ at pulse duration around 1 ns.

**LICp6-2**

**Development of high-brightness high-energy micro-MOPA**

Vincent Yahia, Takunori Taira
*Institute for Molecular Science, Japan*

Ultra-compact MOPA for high-energy laser pulses is developed. Gain aperture is used for production of near-gaussian pulses, with brightness of 18 PW/sr/cm2. We propose the end-pumped DFC medium as an alternative to side-pumped rod-type amplifier.

**LICp6-3**

**Study on laser threshold of CuO/Al nanowires composite**

Yao Wang[1], Qiubo Fu[1], Ruiqi Shen[2]
*[1]Institute of chemical materials, CAEP, China, [2]Nanjing university of science and technology, China*

In this paper, the CuO nanowires cores were served as templates for the deposition of Al shells by subsequent magnetron sputtering to get the CuO/Al. The thershold laser igniton energy was performed of CuO/Al nanowires

**LICp6-4**

**Laser ignition in compact engines: two-stroke and Wankel**

Egor Y. Loktionov, Nikita A. Pasechnikov, Victor D. Telekh
*Bauman Moscow State Technical University, Russia*

We have investigated possible benefits of laser ignition in two-stroke and Wankel 1 hp scale model engines using different kinds of fuel mixtures: hydrogen, methane, propane, butane, gasoline and ethanol based.

**LICp6-5**

**Effect of discharge lengths on combustion characteristics in laser breakdown-assisted long-distance discharge ignition**

Shun Sakamoto[1], Takaki Ikemoto[1], Kazuya Iwata[1], Osamu Imamura[1], Yasunori Ohkuma[1], Hiroshi Yamasaki[1], Kazuhiro Akihama[1], Hirohide Furutani[2], Eiichi Takahashi[3]
*[1]Graduate School of Industrial Technology, Nihon University, Japan, [2]Renewable Energy Research Center, AIST, Japan, [3]Research Institute for Energy Conservation, AIST, Japan*

Pressure histories of LBALDI with various electrode gaps were acquired for methane/air mixture in a vessel with constant volume. Faster combustion was observed for a longer electrode distance in the lean mixture.

**LICp6-6**

**Ultrafast shock evolution phenomena generated by laser ablation of Al-based metal films**

Yuan Gao, Wenzhi Qin, Zhihao Wang, Xiangbo Ji, Duo Tang, Yong Li, Liang Wang
*Institute of Chemical Materials, CAEP, China*

We investigate the ultrafast phenomena of Nd:YAG laser ablation of Al films with and without Ti layer by a time-resolved nanosecond-shadowgraph technique.

**LICp6-7**

**Q-switched laser oscillation in polycrystalline Yb:FAP anisotropic laser ceramics**

Yoichi Sato, Jun Akiyama, Takunori Taira
*Institute for Molecular Science, Japan*

Using polycrystalline Yb3+-doped fluoroapatite (Yb:FAP), we investigated the process control with quantum mechanics for anisotropic laser ceramics. Kilowatt-level sub-ns laser pulses were generated from orientation-controlled microdomains with the extraction density of 0.34 J/cm3.

**LICp6-8**

**Theoretical study on the mechanism of sub-ns giant-pulse laser induced air-breakdown due to cascade ionization**

Hwan Hong Lim, Takunori Taira
*Institute for Molecular Science, Japan*

We proposed a rate equation of free electron density induced by laser due to cascade ionization. The simulation results were used to analyze the pulse-width scaling law of air-breakdown threshold intensity for laser ignition application.

**LICp6-9**

**Optimization of CW operation in distributed face cooling**

Arvydas Kausas, Lihe Zheng , Takunori Taira
*Institute for Molecular Science, Japan*

A Distributed Face Cooling chip which consist or periodic Sapphire and Nd3+:YAG crystals is introduced. The chip is made of 11 crystals by surface activated bonding technology at room temperature. CW operation was compared to conventional Nd3+:YAG rod laser with same gain length. Twice the output power was obtained in DFC chip.

**LICp6-10**

**Single-crystal intermediate laser coating (SILC) for high-field polycrystalline ceramics laser**

Lihe Zheng, Takunori Taira
*Institute for Molecular Science, Japan*

LiDT fluence of new coating solution named single-crystal intermediate laser coating (SILC) on single crystal got one order higher enhancement compared with that on polycrystalline ceramics, opening new research field for high-field polycrystalline ceramics laser.

**LICp6-11**

**Development of Cr:YAG/Nd:YAG ceramics pulse laser chip**

Y. Yamazaki[1], M. Mikami[1], M. Goto[2], H. Tanaka[2]
*[1]JX Nippon Mining & Metals Corporation Isohara Works, Japan, [2]JXTG Nippon Oil & Energy Corporation High Performance Materials Company, Japan*

Ceramics laser medium was promising for a light source of new applications. We developed a transparent YAG ceramics. And mm3-size Cr:YAG/Nd:YAG composite were fabricated. A composite with mirror at both sides was excited by 808 nm Laser-Diode and Q-switched laser oscillation was confirmed.

**LICp6-12**

**Analysis of the amplifier for PW/sr/cm2 class Micro-MOPA**

Taisuke Kawasaki, Vincent Yahia, Takunori Taira
*Institute for Molecular Science, Japan*

Thermal lens problem of PW/sr/cm2-class Micro-MOPA was discussed. In order to realize 100 Hz operation, we evaluated thermal lens effect in highly excited Nd:YAG-rod of 200mJ Micro-MOPA.

# What's Happening in the Exhibition Hall?

***OPIC attendees are welcome to join the exhibition and seminars, free of charge. (OPIC badges required)***

## Highlights

25 April 11:00-11:45 at Stage A
**Overview and prospective on China's optoelectronic industry**
**Mr. Eric Yang,** Secretary General of CIOE

25 April 10:40-11:20 at Stage B
**Global photonics market size, trends, and hot topics in 2018**
**Peter F. Hallett,** Director of Marketing and Industry Relations, SPIE

25 April 13:00-13:30 at Stage A
**Optics Market Overview & Future Opportunities**
**Beth Harrington,** Senior Director, Industry Relations, The Optical Society (OSA)

26 April 13:00-16:30 at Stage B
**Fraunhofer Photonic Research Cooperation Workshop**
**Photonics Solutions from HHI**
**Martin Schell** (HHI, Berlin)

**Terahertz Communications: Photonics vs. Electronics**
**Tadao Nagatsuma** (Osaka University, Japan)
**Optoelectronic Terahertz Systems Solutions from HHI**
**Bjoern Globisch** (HHI, Berlin)
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**Moritz Kleinert** (HHI, Berlin)
**Polymer Optical Waveguides**
**Takaaki Ishigure** (Keio University, Japan)
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**New Applications for Optical Wireless Communication**
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**Yasukazu Sengoku** (Sangikyo Corporation, Japan)
**Optical Wireless - Test and Measurement Solutions from HHI**
**Dominic Schulz** (HHI, Berlin)

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Japan Intense Light Field Science Society
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*(Sangikyo Corporation, Japan)*

### Test and Measurement Solutions from HHI

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# CALL FOR PAPERS

11th International Conference on Optics-photonics Design & Fabrication
**"ODF '18, Hiroshima"**
November 28th-30th, 2018
International Conference Center Hiroshima

## INTRODUCTION

ODF'18 will be held at International Conference Center Hiroshima on 28th -30th / Nov / 2018. Optics-photonics design and fabrication will continue to play a significantly important role in the future, achieving harmony between technology and the environment and building bridges for real international cooperation worldwide. ODF'18 provides an international forum for original paper presentations and discussions of optics-photonics design and fabrication-related technological and scientific topics, including theory, design, fabrication, testing, applications and others.

## SCOPE OF THE CONFERENCE

ODF'18 is an international forum for the engineers and scientists in the field of Optics-photonics Design and Fabrication to exchange their ideas and achievements with the goal of future mutual progress. The conference covers the following major topical categories;

### Category 1. Optical Design / Simulation

Lens Design, Illumination Simulation, Non-imaging Optics, Lens Design Theory, Fabrication and Testing, Simulation Software, Freeform Optics

### Category 2. Optical Components / Devices

Diffractive Optics and Holography, Thin Films, Fiber Optics, Integrated Optoelectronics, Optical Waveguide, Active Optical Components, Optical MEMS, Illumination Optical Components, Polarization Optics, Photonic Crystals, Lasers and Laser Optics, LEDs, Detectors

### Category 3. Optical Systems

Illumination Optics, Information Optics, Optical Data Storage, Optical Lithography, Microscopy, Displays, Computational Imaging and Sensing, Automotive Optics, Bio-Medical Optics, Optofluidics, Measurement and Sensing, Cameras

### Category 4. New Technologies

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## PREPARATION OF ABSTRACTS AND MANUSCRIPTS

A limited number of original contributed papers covering unpublished work will be accepted for presentation. Authors are required to submit papers including 35-word abstracts and 2-page manuscripts in the prescribed form. The form can be downloaded from the conference website. Papers must be submitted online. Please see the ODF'18 website for details of the submission procedure. Authors are required to agree to copyright transfer by including a completed form when submitting papers.

### 35-word Abstracts

35-word abstracts in an ASCII text file are strictly required and the program committee may automatically modify the abstract that contains over 50 words. Please confirm the number of words using a word counting tool. Also, please avoid the use of scientific and engineering symbols in the abstract. If your paper is accepted, the abstract will appear in the Advanced Program.

### 2-page Manuscripts

2-page camera-ready manuscripts including text, figures, tables and references must be typed single-spaced on A4 or letter size pages with the title followed by the author's name, affiliation, and address. Accepted papers will be published in the Technical Digest of the conference. For the layout of the manuscript, please see the guidelines on the ODF'18 website.

**Abstracts&Manuscripts will be accepted: February 1st-June 30th, 2018 (Extended)**

For inquiries, please contact:

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The presentation schedule will be determined after the program committee has reviewed the papers. Authors will be notified by August, 2018 whether their papers have been accepted. Notification will be sent to the author listed first by e-mail or letter. Note that it will be the author's responsibility to obtain any necessary and appropriate clearances from his/her affiliated organization.

ADDITIONAL INFORMATION

Post-Deadline Papers
Detailed information will be announced in the Final Call for Papers.

ODF'18 Special Issue of OPTICAL REVIEW
The presented papers can be resubmitted and published in the ODF'18 special issue of OPTICAL REVIEW after peer review. It is the English-language journal of the Optical Society of Japan (OSJ). Application forms for the special issue will be presented on the website.

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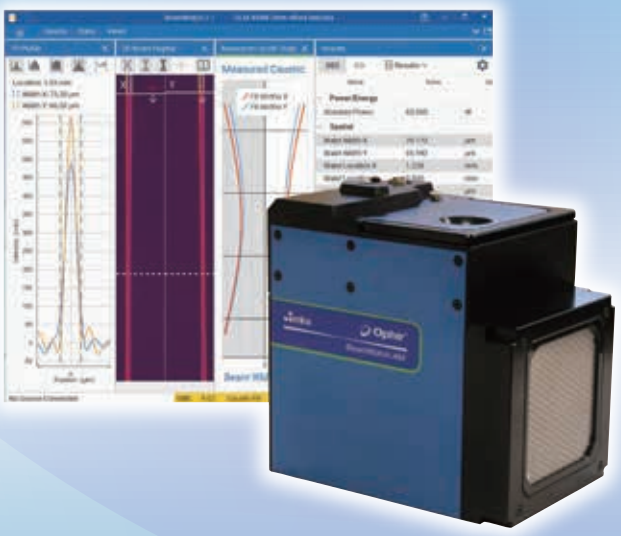

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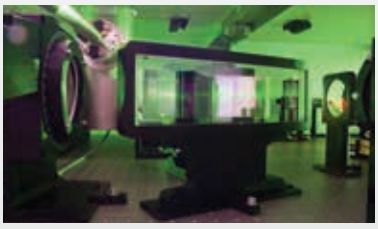

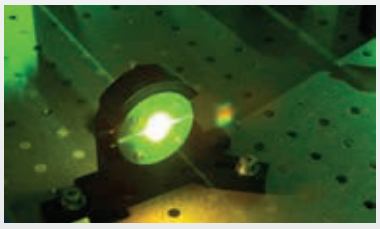

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