Friday, April 27

9:00-10:30 LSSE7 Room 316

Adaptive Optics

Chair: Norihito Saito, *RIKEN, Japan*

LSSE7-1 9:00-9:30 INVITED

Adaptive optics applications from cells to the universe

Yutaka Hayano[1,2], Y. Tamada[3,4], M. Hattori[1], H. Takami[1,2], T. Murata[3,4], N. Miura[5], S. Oya[1,2], A. Matsuda[6], Y. Kamei[3,4], C. Clergeon[7], T. Hattori[7], Y. Minowa[7], M. Akiyama[8], Y. Ono[7], M. Hasebe[3,4]

[1] *National Astronomical Observatory of Japan, Japan*
[2] *SOKENDAI (The Graduate University for Advanced Studies), Japan*
[3] *National Institutes of Natural Sciences, Japan*
[4] *SOKENDAI (The Graduate University for Advanced Studies), Japan*
[5] *Kitami Institute of Technology, Japan*
[6] *National Institute of Information and Communications Technology, Japan.*
[7] *Subaru Telescope, National Astronomical Observatory of Japan, USA*
[8] *Tohoku University, 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 9:30-10:00 INVITED

Adaptive Optics for high power laser beam correction in the atmosphere

Alexis Kudryashov[1,2], Vadim Samarkin[1], Alexey Rukosuev[1], Julia Sheldakova[1]

[1] *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.

LSSE7-3 10:00-10:30 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)

11:00-15:00 LSSE8 Room 316

Agri-Photonics

Chair: Satoshi Wada, *RIKEN, Japan*

LSSE8-1 11:00-11:45 INVITED KEYNOTE

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.

LSSE8-2 11:45-12:30 INVITED KEYNOTE

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 13:30-14:00 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.

LSSE8-4 14:00-14:30 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 14:30-15:00 INVITED

Application of Optical Technology for Smart Agriculture

Taro Fukuyama, Norihito Saito, Takayo Ogawa, Tomoki Matsuyama, Masaki Yumoto, Satoshi Wada

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.

LSSE8-6 15:00-15:30 INVITED

Open Innovation for Agriculture between WUR and NARO -Research topics around Agriphotonics and Horticulture-

Kazuhisa Goto[1], Arjo Rothuis[2], Tadahisa Higashide[3]

[1] *NARO Headquarter, Japan*
[2] *Wageningen University and Research, Netherlands*
[3] *NARO Institute of Vegetables and Floriculture Science, Japan*

Japanese agriculture is facing serious issues. But researchers try to find solutions by using ICT, sensor, light technologies. WUR and NARO research together around horticulture and Agri photonics. We provide some research results.

15:30-15:45 Closing Room 316

15:30-15:45 Closing Remarks

T. Ebisuzaki, Conference Chair of LSSE2018

RIKEN, Japan

REGISTRATION

Registration Fees		On/Before April 5, 2018	After April 6, 2018
General	Member	55,000 JPY	60,000 JPY
	Non-member	65,000 JPY	70,000 JPY
Student, Retiree	Member	18,000 JPY	21,000 JPY
	Non-member	21,000 JPY	23,000 JPY

OPTICS&PHOTONICS International Congress 2018 (OPIC2018) *http://opicon.jp/*

Fourteen international conferences will be held simultaneously. By registering for this conference, you can participate in all international conferences.

- ALPS2018: The 7th Advanced Lasers and Photon Sources
- BISC2018: The 4th Biomedical Imaging and Sensing Conference
- HEDS2018: International Conference on High Energy Density Science 2018
- ICNN2018: International Conference on Nano-photonics and Nano-optoelectronics 2018
- IoT-SNAP2018: IoT Enabling Sensing/Network/AI and Photonics Conference
- LDC2018: Laser Display and Lighting Conference 2018
- LEDIA2018: The 6th International Conference on Light-Emitting Devices and Their Industrial Applications
- LIC2018: The 6th Laser Ignition Conference 2018
- LSC2018: Conference on Laser and Synchrotron Radiation Combination Experiment 2018
- LSSE2018: Laser Solutions for Space and the Earth 2018
- OMC2018: The 5th Optical Manipulation Conference
- PLD2018: Pacific Rim Laser Damage 2018
- SLPC2018: The 3rd Smart Laser Processing Conference 2018
- XOPT2018: International Conference on X-ray Optics and Applications 2018

Exhibition

OPTICS & PHOTONICS International Exhibition, OPIE'18 will be held simultaneously on April 25-27 at Pacifico Yokohama.

CONFERENCE CHAIR

Toshikazu Ebisuzaki, *RIKEN*

INTERNATIONAL ADVISORY BOARD

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M. Vasile, *University of Strathclyde, UK*
S. Wada, *RIKEN, Japan*
T. Yanagisawa, *JAXA, Japan*
Y. Shimada, *Institute for Laser Technology, Japan*
A. Nishimura, *Japan Atomic Energy Agency, Japan*
S. Shibusawa, *Tokyo University of Agriculture and Technology, Japan*
A. Shinjo, *Keio University, Japan*
T. Ogawa, *RIKEN, Japan*

OFFICIAL LANGUAGE

The official language of LSSE2018 is English.

LOCATION OF CONFERENCE SITE

The LSSE2018 will take place at Pacifico Yokohama, Yokohama city, Kanagawa prefecture, JAPAN. Yokohama city, the center of Kanagawa prefecture is located south of Tokyo. Pacifico Yokohama is conveniently located about 40 min. by Limousine Bus from Haneda Airport and 90 min. from Narita Airport.

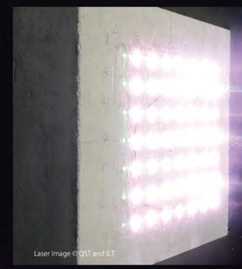
Pacifico Yokohama
1-1-1 Minato Mirai, Nishi-ku, Yokohama 220-0012, Japan
http://www.pacifico.co.jp/english/
Transportation Guide: TEL +81-45-221-2166
Information: TEL +81-45-221-2155
FAX +81-45-221-2136

OPTICS & PHOTONICS International Congress 2018

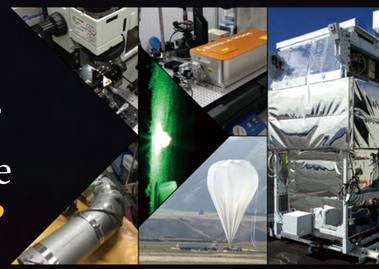
LSSE2018

April 24-27, 2018
at Pacifico Yokohama, Japan

The aim of "Laser Solutions 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 consider "Agri-Photonics", "Infrastructure (Nondestructive Testing and 3-D Imaging)" and "Energy Production and Transmission" as the featured topics of the year 2018.



Laser Solutions for Space and the Earth *2018*



KEYNOTE SPEECH

10:30-11:30 April 24, 2018

Hiroki Takesue
NTT Corporation
*Awarded Nishina Memorial Prize 2017
A coherent Ising machine for solving combinatorial optimization problems

11:00-11:45 April 27, 2018

Sakae Shibusawa
Tokyo University of Agriculture and Technology
Context Changes with Advanced Precision Agriculture and Agro-medical Foods in Japan

11:45-12:30 April 27, 2018

Naoshi Kondo
Kyoto University
*Awarded Japan Prize of Agricultural Science 2017
Agri-photonics and Agri-robotics for Food Production toward Global Population 9 Billion time

TOPICS

- Laser-Induced Breakdown Spectroscopy in Space
- Laser-Induced Breakdown Spectroscopy on the Earth
- Remote Sensing
- Agri-Photonics
- Adaptive Optics
- Infrastructure (Nondestructive Testing)
- Infrastructure (3-D Imaging)
- Energy Production and Transmission
- Atomic Energy
- Space Debris
- Others

The speakers and the latest information of the conference will be presented on the web site.
http://lsse.opicon.jp/

Tuesday, April 24

10:15-10:30 Opening Room 316

10:15-10:30 Opening Remarks
Toshikazu Ebisuzaki, Conference Chair of LSSE2018
RIKEN, Japan

10:30-11:30 LSSE1 Room 316

Nishina Award Memorial Lecture

Chair: Toshikazu Ebisuzaki, *RIKEN, Japan*

LSSE1-1 10:30-11:30 INVITED KEYNOTE
A coherent Ising machine for solving combinatorial optimization problems

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

Lunch (11:30-13:15)

13:15-16:45 NSTP Room 302

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

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

13:15-13:30 Opening Remarks
Ken-ichi Kitayama
The Graduate School for the Creation of New Photonics Industries, Japan

NSTP-1 13:30-14:00 INVITED
Toward highly advanced social infrastructure by utilizing 3D laser measurement and IoT

Nobuyoshi Yabuki
Osaka University, 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 14:00-14:30 INVITED
Application of microwave-photonics technologies to high-frequency Radio Astronomy
Hitoshi Kiuchi[1], Richard Hills[2], Nicholas D.Whyborn[3], Masumi Yamada[1]
[1] *National Astronomical Observatory of Japan, Japan*
[2] *University 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.

NSTP-3 14:30-15:00 INVITED
Nondestructive testing of aging phenomena by using electromagnetic waves
Kaori Fukunaga
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.

Break (15:00-15:30)

NSTP-4 15:30-16:00 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 Kaburagi, Kuniaki Kawabata, Tatsuo 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.

NSTP-5 16:00-16:30 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, focusing on elderly care and education.

16:30-16:45 Closing Remarks
Toshikazu Ebisuzaki
RIKEN, Japan

Wednesday, April 25

9:00-12:30 OPIC Plenary Session

Lunch (12:30-13:30)

13:30-16:30 LSSE3 Room 316

Social Infrastructure

Chair: Yoshinori Shimada, *Institute for Laser Technology, Japan*

LSSE3-1 13:30-14:00 INVITED
Demonstration of High-speed Defect Inspection Technique for Simulated Tunnnel using Laser Hammering Method

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 14:00-14:30 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 14:30-15:00 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], Takeshi Watari[4], Yoshio Mizuta[4], Yuki Kabeya[4]
[1] *ILE, Osaka University, Japan*
[2] *National Institute of Advanced Industrial Science and Technology, 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.

Break (15:00-15:30)

LSSE3-4 15:30-16:00 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 16:00-16:30 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 16:30-17:00 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.

Thursday, April 26

10:30-12:00 LSSEp4 Exhibition Hall A

Poster Session

LSSEp4-1
Development of Polarization Imaging Camera by Femtosecond Laser Microfabrication
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
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, 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
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[2], Kazuo Yoshida[3]
[1] *Japan Atomic Energy Agency, Japan*
[2] *IML-Tokyo Sokki Kenkyuja, Japan*
[3] *The Institute of 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
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, 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
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
Estimation of the second-order spatial correlation properties of a one-dimensional rough surface from polarization sensitive bistatic measurements
Jonathan Alejandro Franco-Ortega, Oscar G. Rodríguez-Herrera
Universidad Nacional Autónoma de México, 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
Broadening and Shift of Emission Lines in Femtosecond Laser Induced Plasma Filament
Alexey Ilyin[1,2], Sergey 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
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], Alexey Ilyin[1,2], D. Yu. Proschenko[1,2], A. Yu. Mayor[1,2], Yu. S. Tolstonogova[1,2], M. Yu. Babuiy[1], A. V. Borovsky[1], T. M. Agapova[1], V. V. Lisitsa, Yu. N. Kulchin[1,2], O. A. Bukin[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.

Lunch (12:00-13:30)

13:30-15:00 LSSE5 Room 316

Energy Production and Transmission

Chair: Akihiko Nishimura, *Japan Atomic Energy Agency, Japan*

LSSE5-2 13:30-14:00 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[1], M. Nomura[2], T. Yamaki[3], T. Tsuru[4], M. Machida[5], T. Ishihara[6], H. Abekawa[7], H. Hosono[8], M. Inomata[9], K. Miyajima[10], S. Kubo[1], Y. Inagaki[1], N. Sakaba[1]
[1] *Japan Atomic Energy Agency, Japan*
[2] *Shibaura Institute Technology, Japan*
[3] *Takasaki Advanced Radiation Research Institute, Japan*
[4] *Hiroshima University, Japan*
[5] *Kumamoto University, Japan*
[6] *Kyushu University, Japan*
[7] *Sumitomo Chemical Company Limited, Japan*
[8] *Chiyoda Corporation, Japan*
[9] *JGC Corporation, Japan*
[10] *Research & Development Center, Japan*
This paper summarizes current R&D of key devices of thermochemical water-splitting iodine-sulfur process for hydrogen production, and of process evaluation.

LSSE5-3 14:00-14:30 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 14:30-15:00 INVITED
Solar-thermal energy conversion using solar selective absorbers based on semiconducting β-$FeSi_2$

Yoshiki Okuhara, 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 β-$FeSi_2$ 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)

15:30-17:10 LSSE6 Room 316

Remote Sensing and Laser Induced Breakdown Spectroscopy

Chair: Takashi Fujii, *Central Research Institute of Electric Power Industry, Japan*

LSSE6-1 15:30-16:00 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[6], Satoshi Wada[3]
[1] *Shinshu University, Japan*
[2] *Nagoya University, Japan*
[3] *RIKEN, Japan*
[4] *The University of Electro-Communications, Japan*
[5] *Nagoya University, Japan*
[6] *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 16:00-16:30 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] *JAMSTEC, 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.

LSSE6-3 16:30-16:50
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 16:50-17:10
Mid Infrared (IR) Tunable Optical Parametric Oscillator (OPO) Differential Absorption Lidar (DIAL) for Methane Concentration Measurements
Taieb Gasmi Cherifi
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.