ADVANCE PROGRAM

ISOM'16

IN COOPERATION WITH

The Optical Society (OSA) (under negotiation)

SPIE

The Magnetics Society of Japan (MSJ)

The Institute of Electronics, Information and Communication Engineers (IEICE)

The Chemical Society of Japan

Information Processing Society of Japan

The Institute of Electrical Engineers of Japan

The Institute of Image Electronics Engineers of Japan

The Institute of Image Information and Television Engineers

The Japan Society for Precision Engineering

The Laser Society of Japan

INTERNATIONAL SYMPOSIUM ON OPTICAL MEMORY 2016

Kyoto Research Park, Kyoto, Japan

Oct. 16 - Oct. 20, 2016

SPONSORED BY

- The Optical Society of Japan (OSJ)

COSPONSORED BY

-The Japan Society of Applied Physics (JSAP)

-Optoelectronics Industry and Technology Development Association (OITDA)

FINANCIALLY SUPPORTED BY

-The Takano Eiichi Optical Science Funds

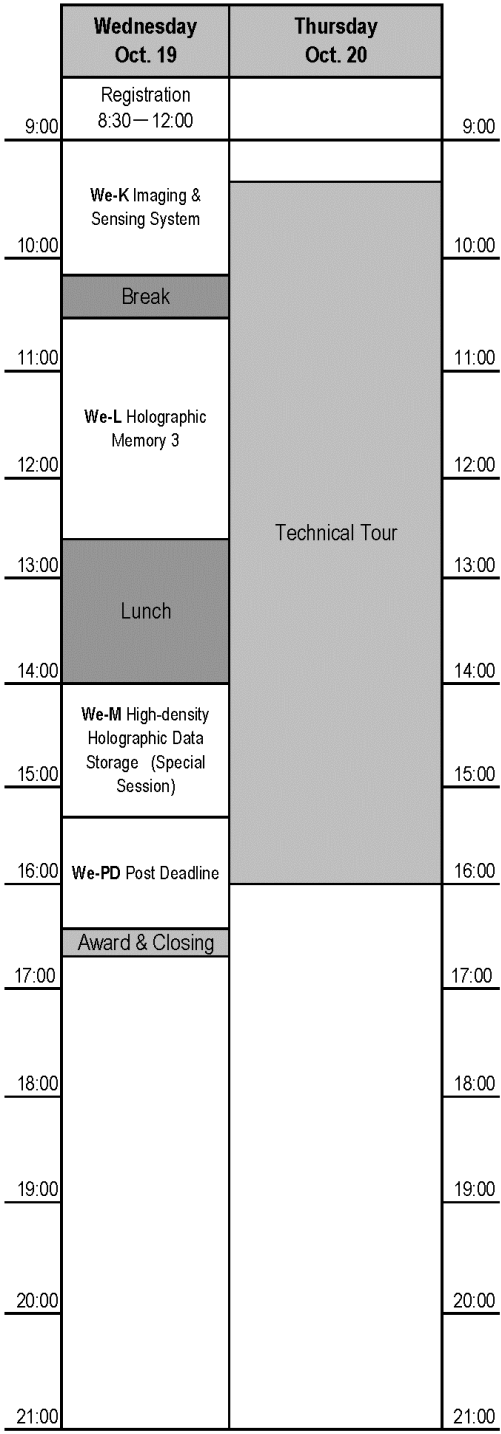
Deadlines

Post Deadline Papers : Aug. 29, 2016
Hotel Reservation: Sep. 16, 2016
Advance Registration : Oct. 2, 2016

http://www.isom.jp/

Symposium Schedule

	Sunday Oct. 16	Monday Oct. 17	Tuesday Oct. 18	
9:00	Registration 15:00 – 17:00	Registration 8:30 – 13:00	Registration 8:30 – 13:00	9:00
10:00		**Mo-A** Opening Remarks & Keynote	**Tu-G** Nano Photonics	10:00
11:00		**Mo-B** Holographic Memory 1	Break	11:00
12:00		Break **Mo-C** Holographic Memory 2	**Tu-H** Computational Imaging & Sensing (Special Session)	12:00
13:00		Lunch	ISOM'17 Announce & Photo Lunch	13:00
14:00		**Mo-D** Special Invited	**Tu-I** Optical Technologies	14:00
15:00		**Mo-E** Adaptive Optics (Special Session)	Break	15:00
16:00		Break	**Tu-J** Poster Session	16:00
17:00		**Mo-F** New Technologies	Break	17:00
18:00	Get Together			18:00
19:00			Banquet	19:00
20:00				20:00
21:00				21:00


Wednesday
Oct. 19
Thursday
Oct. 20
Registration
8:30－12:00
9:00
10:00
11:00
12:00
13:00
14:00
15:00
16:00
17:00
18:00
19:00
20:00
21:00
We-K Imaging & Sensing System
Break
We-L Holographic Memory 3
Lunch
We-M High-density Holographic Data Storage (Special Session)
We-PD Post Deadline
Award & Closing
Technical Tour

WELCOME TO ISOM'16

WELCOME STATEMENT FROM THE ORGANIZING COMMITTEE CHAIRPERSON

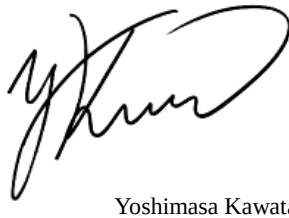
The 26th International Symposium on Optical Memory (ISOM'16) will be held in Kyoto, Japan from Oct. 16 to 20, 2016.

On behalf of the International Symposium on Optical Memory (ISOM) organizing committee, I am delighted to welcome all of you to the ISOM'16 in Japan.

The last ISOM meeting was held in Toyama, Japan. It was very successful to share new developments of high density recording, holographic memories, blue-LED/LD, signal processing, media and material science, digital archival applications, etc. Nano-photonic material and device and image sensing technologies were introduced in the special sessions. ISOM now extends the scope in the new optical fields and new applications. The optical disc and pickup-head technologies can be applied to medical and bio-technologies with the combination of nano-photonic device and image sensing technologies. Optical memory technologies have many potential to produce new applications and to extend current technologies in many applications.

We are very proud of the ISOM activities, because many of technologies leading new developments and new applications have been first presented and discussed in ISOM meeting. Since the first ISOM meeting in 1987, ISOM has led innovation of optical memory and economic growth in optical industry.

I sincerely ask all of ISOM'16 participants to discuss on new technologies of the next generation optical memory and new applications of optical memory technologies in coming ISOM'16.



Yoshimasa Kawata
ISOM'16 Organizing Committee, Chairperson

INTRODUCTION

The 26th International Symposium on Optical Memory (ISOM) will be held from October 16 to October 20, 2016 at Kyoto Research Park, Kyoto, Japan.

The origin of ISOM is SOM (Symposium on Optical Memory), which was held firstly in 1985 in Tokyo as a Japanese domestic symposium. The first ISOM was held in 1987 also in Tokyo. Until 1994, ISOM and SOM were held alternately every other year, and since 1995, ISOM has been held every year. The total number of papers of the past symposiums has reached 3,210, and the total number of participants has reached 10,080.

The purpose of the symposium is to provide a forum for information exchange on a broad range of topics covering science and technology in optical memory and its related fields. However, information explosion in the internet and cloud service is enforcing optical memory to change from that for consumer storage to that for enterprise storage. Many colleagues of us are seeking for new frontiers of optical memory technologies. Considering this situation, we are continuously updating the scopes of ISOM. In 2014, Medical and Bio-Optics and Image Sensing were newly added to the scopes. To highlight them, the scopes have been reorganized this year. Paper submissions related to the new scopes as well as the conventional ones would be strongly encouraged.

In ISOM'16, enhancing this direction, it will be very much expected to discuss the current status of optical memory, image sensing, medical and bio-optics, information system, optical technologies, and emerging technologies and new world. In addition, we are planning to have demonstration poster papers at the symposium as in last year, in which authors will be able to show their vivid and attractive research results.

We are looking forward to your paper submission and seeing you in Kyoto.

SCOPE OF THE SYMPOSIUM

ISOM'16 will discuss the current status of Optical Memory, Image Sensing, Medical and Bio-Optics, Information Systems, Optical Technologies, and Emerging Technologies and New World.

The scope of ISOM'16 is drastically changed to extend the cover of the research fields. Optical memory is still one of the main topics of the symposium, but other fields listed above are also important fields of ISOM. From ISOM'13, the new scope of medical and bio-optics technologies, from ISOM'14, the new scope of image sensing technologies are introduced as extended scopes in the field of emerging optical technologies. ISOM will provide the attractive fields to exchange the latest advances or ideas in above research fields and also provide scientific interaction and collaboration.

Topics to be covered in this symposium include, but are not restricted to:

1. Optical Memory
- Holographic Memory
- Basic Theory and Physical Optics
- Media and Material Science
- Drive Technologies and Signal Processing
- Components and Devices
- Testing Methods
- Optical Memory Systems
- High-Density Recording

2. Image Sensing
- Computational Photography
- Wavefront Coding
- Three-Dimensional Sensing
- Digital Holography

3. Medical and Bio-Optics
- Medical and Bio-Systems
- Bio-Chemical Sensing
- Bio-Lab on a Disc

4. Information System
- Archiving Technology
- Storage Systems
- Holographic Information Processing

5. Optical Technologies
- Components
- Material
- Display
- Equipment
- Optical Sensing
- Optical Interconnects and Switching

6. Emerging Technologies and New World

REGISTRATION

All participants (including speakers) are requested to register, and are encouraged to register in advance (by **October 2, 2016**) in order to receive the early registration discount.

I. Advance Registration

The Symposium registration information and forms can be obtained from ISOM'16 website: (http://www.isom.jp). If you have any questions, please contact ISOM'16 secretariat office.

II. Onsite Registration

The registration desk will be located at the basement 1st floor of the Kyoto Research Park (KRP) from Sunday through Wednesday during the following hours.

Oct. 16: 15:00 - 17:00
Oct. 17: 08:30 - 13:00
Oct. 18: 08:30 - 13:00
Oct. 19: 08:30 - 12:00

Type	Before / On Octorber 2, 2016	On Site
Regular	JPY 50,000	JPY 60,000
Student & Retiree	JPY 10,000	JPY 15,000
Banquet	JPY 5,000	JPY 7,000
Additional Technical Digest	JPY 6,000	JPY 6,000
Technical Tour	JPY 2,000	JPY 2,000

The registration fee for the symposium includes admission to all the technical sessions, a copy of the Technical Digest, and consumption tax. Students are asked for showing their ID cards.

III. Registration and Payment

Those who wish to attend ISOM'16 should register on the web (http://www.isom.jp/) from July, 2016. The deadline for advance registration is **October 2, 2016**. After that, the registration will be processed at the symposium site upon arrival.

Payment should be made in Japanese Yen by bank transfer (inside Japan only), by credit cards (VISA and Master Card) payable to ISOM'16 or by cash onsite. No personal checks will be accepted.

IV. Registration Cancellation Policy

As a rule, no refunds of the registration fee will be made for any reasons whatever. In the event of registrant unable to attend the symposium, a copy of the Technical Digest will be sent after the symposium.

INSTRUCTION FOR SPEAKERS

ORAL PRESENTATION

- Time assigned for

Type	Total	Presentation	Discussion
Keynote	30 min.	30 min.	---
Invited	25 min.	20 min.	5 min.
Contributed	20 min.	15 min.	5 min.

- All speakers are requested to get in touch with their presiders 15 minutes before their sessions start.
- The conference room will contain a projector, a laptop, a podium microphone, a screen and a laser pointer. Speakers may use their own laptop.
- If speakers use their own laptop, they will be requested to confirm its connection with the projector in the conference room during break time or in the morning. We recommend all speakers to have this check the day before their presentations.
- If speakers don't use their own laptop, they are requested to upload their presentation materials in a USB memory at the podium at least one hour prior to their presentations. We recommend the speakers to use PDF files in order to prevent file format or version troubles.
- We recommend all speakers to use more than 16-point font. The audience expects well-prepared presentations with clearly visible figures and captions, as well as good conclusion.

POSTER PRESENTATION

- Your session code will be indicated on the panel board. You will be provided with the material to mount your poster onto the board.
- Each author is provided with a 200 cm high x 90 cm wide poster space on which a summary of the paper is to be displayed.
- All authors are requested to affix their posters on the day of the poster session. Posters are to be removed immediately after the session ends.
- Authors must remain in the vicinity of the poster board at least for the duration of the assigned session (1 hour 30 min.). The absence of authors during the assigned session is treated as "CANCELLED". The session presiders will check all authors during the assigned session time.

Any papers which are not presented during the Oral or Poster session will be regarded as "CANCELLED".

POST-DEADLINE PAPERS

A limited number of papers will be accepted for presentation of significant results obtained after the deadline. A delegated author has to fill in the paper submission form including a 35-word abstract following the instruction for submission at the ISOM website (http://www.isom.jp/), and then a 2-page PDF summary should be submitted through the website.

The ISOM web submission system does not accept any PDF file including 2-byte characters (for example, Japanese, Chinese and Korean characters). The local fonts should be removed from the text body and figures before submission.

Submission website will be open from July to August 29, 2016. The best four post-deadline papers are allowed as oral presentations in the final session. Other post-deadline papers (but limited numbers) will be presented in the poster session. Authors will be notified by the middle of September, 2016 whether their papers are accepted.

Thanks to the Takano Eiichi Optical Science Funds, limited financial support for student presenters in ISOM'16 will be provided.

Applicants must be full-time students living overseas.

Student presenters who are interested in getting this support should submit an application form (announced later) afer receiving the acceptance notice of their submitted paper.

・ Time assigned for:

Type	Total	Presentation	Discussion
Post deadline	15 min.	12 min.	3 min.

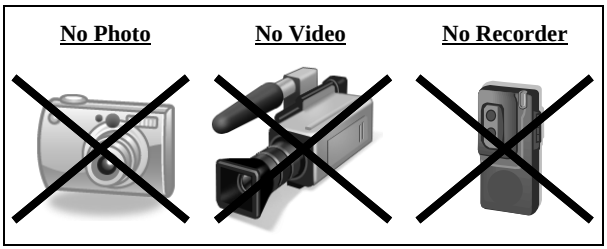
PUBLICATION OF SYMPOSIUM PAPERS

Technical Digest will be available at the symposium including invited papers, accepted contributed papers, and limited numbers of post deadline papers. CD-R including the same contents as Technical Digest will be also available. The conference papers will be published in September 2017 as a special issue of the Japanese Journal of Applied Physics (JJAP), which is the English-language journal of the Japan Society of Applied Physics (JSAP). The authors who will have, by themselves, presented papers at ISOM'16 will be allowed to submit their papers for publication in this special issue.

The instructions for preparation of manuscript and the agreement form for the special issue will appear on the ISOM website after the conference. The deadline for submittion of manuscripts is January 23, 2017. Submitted papers will be reviewed based on the JJAP standard.

ATTENTION

It is not allowed to take photos and videos of any presentation materials in ISOM'16.



SPECIAL PROGRAMS

I. SOCIAL PROGRAM

Get Together Reception

- Date & Time: Sunday, October 16, 17:00-19:00
- Place: Kyoto Research Park Bldg#1 1F, Restaurant PATIO
- Fee: No charge

All attendees including spouses are invited to the Get Together Reception.

Banquet Reception

- Date & Time: Tuesday, October 18, 18:10-20:10
- Place: Kyoto Research Park Bldg#1 1F, Atrium
- Fee: Advance registration 5,000 JPY
  Onsite registration 7,000 JPY

Ticket for the Banquet Recption is not included in the registration fee. Application for Banquet can be made online or onsite.

II. TECHNICAL TOUR

- Date & Time: Thursday, October 20, 9:15-16:00
- Place:

(1) The Kyocera Museum of Fine Ceramics
「京セラファインセラミック館」
Fine Ceramics History, Basic Understanding, Characteristics, and so on will be introduced.

(2) Shimadzu Foundation Memorial Hall
「島津製作所記念館」
The hall is located on the site where Shimadzu was originally founded. It includes various physics and chemistry instruments, medical X-ray systems and industrial equipment.

- Schedule:
  9:15 Get together in front of JR Kyoto station
  9:30 Departure
  10:00 The Kyocera Museum of Fine Ceramics
  (http://www.kyocera.co.jp/company/csr/others/fine_ceramic/index.html)
  11:30 Kiyomizu-dera Temple
  「清水寺」
  (http://www.kiyomizudera.or.jp/)
  13:15 Lunch (KIYOMIZU JUNSEI OKABEYA)
  「清水順正 おかべ家」
  (http://okabeya.com/index.html)
  14:30 Shimadzu Foundation Memorial Hall
  (http://www.shimadzu.co.jp/visionary/memorial-hall/)
  16:00 JR Kyoto Station
  「JR 京都駅」
- Fee: 2,000JPY (40 attendees limited, fee is including transportation, admission to all facilities, lunch, and consumption tax.)
  Application for Technical Tour can be made online or onsite by cash.

ISOM'16 Secretariat

Mitsuhiro Kimura (Secretary)
- Tel: +81-3-5925-2840 / Fax: +81-3-5925-2913
- E-mail: secretary@isom.jp
- Add: c/o Adthree Publishing Co., Ltd.
  27-37, Higashinakano 4-chome,
  Nakano-ku, Tokyo 164-0003, Japan

GENERAL INFORMATION

I. Official Language

The official language of ISOM'16 is English.

II. Message Board

Official Information Board and Message Board will be set near the Registration Desk. Message will be taken during registration hours on Monday through Wednesday and posted on the Message Board. Please check the bulletin board daily to receive your messages. Messages for participants at the meeting should be directed to ISOM'16 Symposium Registration Desk.

III. Lunches

A lunch map in the vicinity of Kyoto Research Park will be provided at the Registration Desk.

IV. Others

To receive further ISOM'16 announcement, please visit ISOM website (http://www.isom.jp/).

DEMO PRESENTATION IN POSTER SESSION

Poster presentations with demonstration will be in the poster session. This is a new approach of poster session in addition to usual poster presentation.

The technical demonstration will be exhibited repeatedly during the session in front of poster boards. Participants can take a close look at the new technologies!

Technical demonstration 1:

Improving the Lighting Efficiency of Holographic Window

Toshihiro Kasezawa[1], Hideyoshi Horimai[1], Hiroshi Tabuchi[2], Tsutomu Shimura[3]

[1]Egarim Co., Ltd., [2]Okamoto Glass Co., Ltd., [3]The University of Tokyo (Japan)

Abstract: We are exhibiting our original photopolymer films, unique light fixtures making advanced use of hologram technology,and as solar power generation units that can lock in sunlight between a window and use it as a source of energy.

Technical demonstration 2:

Wavefront Printing Technique toward High Definition Holographic 3D Image

Koki Wakunami

National Institute of Information and Communications Technology (Japan)

Abstract: We demonstrate the reconstruction of holograms recorded by Wavefront printer. High definition holographic 3D images with over 77 billion pixels of wavefront information can be reconstructed by illumination of white light source.

In addition to above presentations, some presenters will show technical demos in poster session.

TECHNICAL PROGRAM

October 17, 2016 (Monday)

Mo-A: Opening & Keynote

Presider: Osamu Matoba (Kobe University, Japan)

Mo-A-01

09:00 Opening Remarks

Yoshimasa Kawata (Shizuoka University, Japan)

Organizing Committee Chairperson

Ryuichi Katayama (Fukuoka Inst. of Tech., Japan)

Steering Committee Chairperson

Mo-A-02 Keynote

09:15 Virtually Eternal 5D Optical Memory

Peter G. Kazansky, Ausra Cerkauskaite, Jingyu Zhang, Rokas Drevinskas

Optoelectronics Research Centre, University of Southampton (UK)

Polarization-multiplexed optical memory by femtosecond laser nanostructuring of silica glass is demonstrated. The storage allows hundreds of terabytes per disc data capacity, thermal stability up to 1000°C and virtually unlimited lifetime at room temperature.

Mo-B: Holographic Memory 1

Presiders: Norihiko Ishii (NHK, Japan)
Tsutomu Shimura (The University of Tokyo, Japan)

Mo-B-01 Invited

09:45 Optical Memory System Based on Numeric Synthesis, Projection Record and Coherent Reconstruction of Computer Generated Fourier Holograms

Sergey Odinokov[1], Evgeny Zlokazov[1,2], Aleksander Betin[1], Sergey Donchenko[1], Rostislav Starikov[2], Vladimir Bobrinev[1]

[1]Bauman Moscow State Technical University (Russia), [2]National Research Nuclear University MEPhI (Russia)

The details of numeric and experimental

modeling of holographic memory binary data recorder based on computer generated Fourier holograms utilization are discussed in presentation. Also the problem of synthesized holograms multiplexed record is highlighted.

Mo-B-02

10:10 **Error-Free Reconstruction through the Improvement of Collinear Optical System for Magnetic Hologram Memory**

Yuichi Nakamura, Hiroyuki Takagi, Pang Boey Lim, Taichi Goto, Hironaga Uchida, Mitsuteru Inoue

Toyohashi University of Technology (Japan)

Holographic memory is expected to be a high-capacity data storage exceeding 1 TB/disk with fast data transfer rates. We demonstrated that a hologram can be magnetically written by using the thermomagnetic writing and reconstructed from transparent magnetic garnet films using the collinear holographic system. In this work, we improved the optical system for obtaining a clear reconstruction image. Finally, we succeeded in the error-free reconstruction from magnetic hologram with 3:16 modulation using modified collinear optical system for the first time.

Mo-B-03

10:30 **Recording Multilevel Phase Data in a Holographic Data Storage System Based on Digital Holography**

Teruyoshi Nobukawa[1], Takanori Nomura[2]

[1]Graduate School of Systems Engineering, Wakayama University, [2]Faculty of Systems Engineering, Wakayama University (Japan)

Holographic data storage based on digital holography is proposed for recording multilevel phase data in a compact optical setup. In the proposed system, binary amplitude and 4-level phase data are successfully retrieved without error.

Mo-B-04

10:50 **Single-Shot Phase Reconstruction by Iterative Fourier Transform Algorithm in the Holographic Data Storage System**

Xiao Lin[1], Ryushi Fujimura[2], Shinsuke Umegaki[3], Masao Endo[3], Yoshito Tanaka[3], Hajimu Nishimoto[3], Yong Huang[1], Xiaodi Tan[1], Tsutomu Shimura[3]

[1]Beijing Institute of Technology (China), [2]Utsunomiya University, [3]The University of Tokyo (Japan)

We used iterative Fourier transform algorithm (IFTA) as the phase data readout method in the holographic data storage system to retrieve phase information. We optimized IFTA with stronger constraint such as the known pixels, which is fit for the holographic data storage system, to decrease the bit error rate (BER) to 0. Anti-noise performance of IFTA was evaluated in the simulation.

11:10 - 11:30 Coffee Break

Mo-C: Holographic Memory 2

Presiders: Evgeny Zlokazov (Bauman Moscow State Technical University, Russia)
Daisuke Barada (Utsunomiya University, Japan)

Mo-C-01

11:30 **New Compensation for Positioning Error of Hologram for Balancing Large Data Capacity with Fast Transfer Rate**

Kenichi Shimada, Makoto Hosaka, Kazuyoshi Yamazaki, Tatsuro Ide

Hitachi, Ltd. (Japan)

New compensation for the positioning error of hologram is discovered, which precisely controls positioning of a Nyquist aperture instead of the hologram. The method relaxes severe positional tolerance of hologram, consequently contributes to balancing large data capacity with fast readout.

Mo-C-02

11:50 **Relaxation of Tolerance for Holographic Disc Positioning Based on Triaxial Position Control of Nyquist Aperture**

Yukinobu Tanaka, Tatsuro Ide, Jiro Hashizume, Taku Hoshizawa

Hitachi, Ltd. (Japan)

Holographic data storage system (HDSS) is one of promising candidates for future optical data storage system because of its abilities of a high density recording and fast data transfer. To realize HDSS having capacity of TB class and transfer rate of Gbit/s class, precise and fast mechanical control is required. During recording process, hundreds of two-dimensional data pages called a book are angular-multiplexed in the same volume and recorded as a hologram. On the other hand, during reproduction process, each of multiplexed data pages is reproduced by controlling an incident angle of a reference beam so as to maximize signal-to-noise ratio. Therefore, we have developed the high-speed reference beam angle control system to access to a reproduced data page precisely and fast. Additionally, it is necessary to control a relative position between a reproduced hologram and an optical unit of the HDSS. This paper presents a relaxation method of tolerance for disc positioning by triaxial (focus, tangential and radial axial) position control of a Nyquist aperture.

Mo-C-03

12:10 **Spatially Coupled LDPC Error Correction Code for HDS**

Norihiko Ishii, Yutaro Katano, Tetsuhiko Muroi, Nobuhiro Kinoshita

NHK (Japan)

Spatially Coupled (SC) LDPC code was applied to 5:9 differential modulation code in Holographic Data Storage. In the simulation, error correction characteristic showed better than it of irregular LDPC. In experiment, allowance of error correction in SC-LDPC (19500, 6800) was $8x10^{-2}$.

12:30 - 14:00 **Lunch**

Mo-D: Special Invited

Presiders: Yoshimasa Kawata (Shizuoka University, Japan)
Makoto Itonaga (JVC KENWOOD, Japan)

Mo-D-01 **Special Invited**

14:00 **Optical Memory of the Cosmic History**

Masanori Iye

National Astronomical Observatory of Japan (Japan)

Astronomers are deciphering the history of the Universe from images of distant galaxies that show snap shots of distant past. Science objectives, engineering frontier of Subaru Telescope and the Thirty Meter Telescope are reported.

Mo-E: Adaptive Optics (Special Session)

Presiders: Xiaodi Tan (Beijing Institute of Technology, China)
Makoto Itonaga (JVC KENWOOD, Japan)

Mo-E-01 **Invited**

14:30 **Tomographic Wavefront Estimation for Wide-field Adaptive Optics Systems**

Masayuki Akiyama[1], Yoshito Ono[1,2]

[1]Astronomical Institute, Tohoku University (Japan), [2]Laboratoire d'Astrophysique de Marseille (France)

Tomographic wavefront estimation with multiple light sources is a key technology to realize wide-

field adaptive optics systems. We introduce the methodology of the tomography and the expected performance of wide-field astronomical adaptive optics.

Mo-E-02 Invited

14:55 Adaptive Optics Microscopy for High Resolution Imaging of the Stem-Cell Formation in Plants

Yosuke Tamada[1], Masayuki Hattori[2]

[1]Division of Evolutionary Biology, National Institute for Basic Biology, Spectrography and Bioimaging Facility, [2]National Institute for Basic Biology (Japan)

We have tried to develop adaptive optics microscopy to correct the light disturbance caused by structures and organelles in living cells and perform high resolution imaging of the nucleus during the stem-cell formation in plants.

Mo-E-03 Invited

15:20 Phase-only Liquid Crystal on Silicon Spatial Light Modulator for Practical Adaptive Optics Retinal Imaging

Hongxin Huang

Central Research Laboratory, Hamamatsu Photonics K. K. (Japan)

We present our adaptive optics techniques using spatial light modulator and Shack-Hartmann wavefront sensor, and the application for adaptive optics scanning laser ophthalmoscope that achieves cellular-level resolution by dynamic compensation for the aberrations in eyes.

Mo-E-04 Invited

15:45 Wavefront Compensation for Holographic Memory

Tetsuhiko Muroi

Japan Broadcasting Corporation (NHK) (Japan)

Hologram distortion occurs due to shrinkage or expansion in the medium and degrades the reproduced data quality. Wavefront compensation for distortion is effective and can improve the signal-to-noise ratio of the data.

16:10 - 16:30 Coffee Break

Mo-F: New Technologies

Presiders: Minoru Takeda (Kyoto Institute of Technology, Japan)
Tsung Sheng Kao (National Chiao Tung University, Taiwan)

Mo-F-01

16:30 **Design of Polarization Optics for Electrooptic Sensors**

Ai-ichiro Sasaki, Akinori Furuya, Akihiko Hirata, Hiroki Morimura

NTT Device Technology Labs, NTT Corporation (Japan)

We propose a systematic method for designing polarization optics appropriate for electrooptic (EO) sensors. It was found that both the sensitivity and stability of EO sensors can be maximized with fewer components than conventional polarization optics used for the sensors. The sensitivity fluctuation of our fabricated EO sensor is suppressed to less than 0.5 dB. The stable EO sensor will be valid for non-invasive measurements of antenna near-field patterns.

Mo-F-02

16:50 **Analysis of Double-Cylindrical Cloaking Device by Hamiltonian-Based Ray-Tracing Method**

Tatsuo Tanaka, Osamu Matoba

Kobe University (Japan)

We apply the Hamiltonian-based ray-tracing method to a 2D cloaking device with an arbitrary shape. We evaluate the cloaking performance of double-cylindrical cloaking device with various representations of the physical parameters.

Mo-F-03

17:10 **A Novel Approach of Coherence Measurement by Fourier Analysis**

Shih-Hsun Huang, Jie-En Li, Ming-Shu Hsiao, Chung-Hao Tien

Department of Photonics, National Chiao Tung University (Taiwan)

Coherence is one of the most important features in information optics. Recently, plenty of researches reported the influence of partial coherence in many imaging purposes, such as digital in-line holography and phase contrast

imaging. Since the degree of coherence seriously affects the performance of such phasor system, in this study we investigated different approaches for coherence metrology, as well as proposed a novel scheme to improve the order of accuracy base on Fourier analysis.

The degree of coherence can be obtained by analyzing the interference pattern. The most straightforward approach is through the visibility of interference pattern. This approach needs to point out a specific area from the interferogram in advance, thus easily suffers from errors due to translation and rotation misalignment. The misalignment leads to segmentation failure during the stage of interferometric image processing. Meanwhile, an intrinsic limit of diffraction also need to consider since the aperture size is not infinitesimally small. These issues restrict the reliability of measurement, in consequence, the measurement error occurs.

In this work, we introduce a novel approach to measure the optical coherence based on the Fourier analysis. Proposed method is able to overcome aforementioned constrain in interferometer measurement and improve the mean square error (MSE) in several orders.

October 18, 2016 (Tuesday)

Tu-G: Nano Photonics

Presiders: Osamu Matoba (Kobe University, Japan)
Tsutomu Shimura (The University of Tokyo, Japan)

Tu-G-01 **Invited**

09:00 **Metasurface for Optical Disk Storage System**

Cheng Hung Chu[1], Hsiang-Chu Wang[2], Ming Lun Tseng[2], Hui Jun Wu[2], Ting-Yu Chen[2], Pei Ru Wu[2], Pin Chieh Wu[2], Mu-Ku Chen[2], Jia-Wern Chen[2], Wei-Yi Tsai[2], Yao-Wei Huang[2], Din Ping Tsai[1,2]

[1]Research Center for Applied Sciences, Academia Sinica, [2]Department of Physics, National Taiwan University (Taiwan)

Metasurfaces with artificial nano-structures for specific optical functions, such as lens, polarizer, beam splitter, reflector, and hologram, demonstrate the possibility for substituting the traditional optical elements in future optical storage system.

Tu-G-02 **Invited**

09:25 **Selective Near-field Excitation on Hybrid Phase-Change Plasmonic Crystals Array**

Tsung Sheng Kao

Department of Photonics, National Chiao Tung University (Taiwan)

By utilizing the strong induced plasmon coupling between plasmonic meta-molecules and the crystalline phase states of an underlying phase-change thin layer, we show that nanoscale light excitations can be spatially positioned at a step resolution of $\lambda/20$.

Tu-G-03 **Invited**

09:50 **High Resolution Imaging with Electron Beam Excitation**

Yoshimasa Kawata, Masahiro Fukuta, Wataru Inami

Research Institute of Electronics, Shizuoka University (Japan)

We have developed a new optical microscope for the observation of living biological specimens. High resolution imaging of living biological cells is demonstrated with excitation by the focused electron beam.

Tu-G-04

10:15 **Optically Tunable Plasmonic Resonance in Semi-Shell Nanostructures for Plasmonic Optical Memory**

Ryushi Fujimura, Shohei Shibata, Takahiro Oyama, Ryoma Sato

Utsunomiya Univeristy (Japan)

Photothermal deformation in plasmonic semi-shell nanostrucutres were investigated experimentally. The plasmonic resonance in semi-shells can be controlled by the incident light energy density, which can be applied to the optical memory with multivalued signal recording.

Tu-G-05

10:35 **Tunable Optical Response of Phase-Change Metasurface**

Cheng Hung Chu[1], Ming Lun Tseng[2], Hsiang-Chu Wang[2], Ting-Yu Chen[2], Jie Chen[2], Wei-Yi Tsai[2], Din Ping Tsai[1,2]

[1]Research Center for Applied Sciences, Academia Sinica, [2]Department of Physics, National Taiwan

University (Taiwan)

We propose the reconfigurable phase-change metasurfaces, which have different combination of unit cells with various geometries and phase states. The tunable optical resonance and anomalous reflection are achieved.

10:55 - 11:15 Coffee Break

Tu-H: Computational Imaging & Sensing (Special Session)

Presiders: Akinori Furuya (NTT, Japan)
Takanori Nomura (Wakayama University, Japan)

Tu-H-01 Invited

11:15 Computational Holographic Sensing

Ryoichi Horisaki

Osaka University (Japan)

In this talk, we present two of our recent research activities based on computational imaging. The first study is single-shot phase imaging with coded diffraction. The second one is a sensing method through scattering media.

Tu-H-02 Invited

11:40 Illumination Pattern Analysis for Fluorescent Ghost Imaging

Yasuhiro Mizutani, Hiroki Taguchi, Yasuhiro Takaya

Department of Mechanical Engineering, Osaka University (Japan)

We propose a possibility to use for a single-molecule imaging using the ghost imaging, theoretically and experimentally. To improve the sensitivity, we have compared random pattern illumination with Hadamard pattern illumination.

Tu-H-03 Invited

12:05 Interferometric 3D Imaging Spectrometry

Kyu Yoshimori, Masaki Obara

Faculty of Science and Engineering, Iwate University (Japan)

This paper reviews recent progress in interferometric 3D imaging spectrometry. Review includes principle of method, procedure of signal processing and experimental results to obtain a multispectral set of 3D images for spatially incoherent, polychromatic objects.

12:30 - 12:45 ISOM'17 Announce & Photo

12:45 - 14:00 Lunch

Tu-I: Optical Technologies

Presiders: Masayuki Ono (JVC KENWOOD, Japan)
Ryuichi Katayama (Fukuoka Institute of Technology, Japan)

Tu-I-01 Invited

14:00 Precision Alignment of Two or More Pattern Files Recorded on Rotating Master Wafer Using Virtual Image Alignment Technology

Doug Carson

DCA, Inc. (U.S.A.)

A solution to precisely record multiple pattern layers on rotating, remounted wafers is presented. VIATM technology allows Laser Beam Recorders designed for CD, DVD and BD to master semiconductor, bio-science and other multi-depth master patterns.

Tu-I-02

14:25 Wide Free Angular Range Beam Steering Using Liquid Crystal Based Spatial Light Modulator

Mitsumasa Nakajima[1], Keita Yamaguchi[1], Hiroshi Kudo[1], Naru Nemoto[2], Joji Yamaguchi[2], Kenya Suzuki[1], Toshikazu Hashimoto[1]

[1]NTT Device Technology Laboratories, [2]NTT Device Innovation Center (Japan)

We propose a high-order diffraction reduction method. By using the proposed method, the worst intensity of high-order diffraction was decreased from -19.8 dB to -38.6 dB, which elongate the free angular range of an LCOS-SLM.

Tu-I-03

14:45 Effective Mode Demultiplexing Technique Using Angularly Multiplexed Volume Holograms with a Phase Plate

Shimpei Shimizu[1], Atsushi Okamoto[1], Fumiya Mizukawa[1], Taketoshi Takahata[2], Shusaku Noda[2], Naoya Wada[3], Kazuhisa Ogawa[1], Akihisa Tomita[1]

[1]Hokkaido University, [2]OPTOQUEST Co., Ltd., [3]National Institute of Information and Communications Technology (Japan)

We demonstrate an effective mode demultiplexing technique using angularly multiplexed volume holograms with a phase plate for mode division multiplexing. We experimentally show considerable improvement of mode separation characteristics for a specific mode group.

Tu-I-04

15:05 Spatial Mode Separation and Interconversion Using Volume Hologram

Fumiya Mizukawa[1], Atsushi Okamoto[1], Yuta Goto[1], Shimpei Shimizu[1], Satoshi Honma[2], Kazuhisa Ogawa[1], Akihisa Tomita[1]

[1]Hokkaido University, [2]Yamanashi University (Japan)

Toward a next-generation optical network, we propose a spatial mode separation and interconversion method, which enables us to convert and separate spatial modes simultaneously by using angularly multiplexed volume holograms.

15:25 - 15:50 Coffee Break

Tu-J: Poster Session

Presiders: Osamu Matoba (Kobe University, Japan)
Masayuki Ono (JVC KENWOOD, Japan)
Nobuhiro Kinoshita (NHK, Japan)
Takanori Nomura (Wakayama University, Japan)

Tu-J-01 Invited Poster [Demo Presentation]

15:50 Improving the Lighting Efficiency of Holographic Window

Toshihiro Kasezawa[1], Hideyoshi Horimai[1], Hiroshi Tabuchi[2], Tsutomu Shimura[3]

[1]Egarim Co., Ltd., [2]Okamoto Glass Co., Ltd., [3]The University of Tokyo (Japan)

The brand-new photovoltaic generating unit by applying holographic technologies called Holo-Window was proposed. The basic principle and optical configuration for the basic experimental unit was described. Hologram fabrication technology with broadband spectrum of sunlight capturing capability was discussed. Laboratory prototype Holo-Window unit was developed and its performance was evaluated.

Tu-J-02 Invited Poster [Demo Presentation]

15:50 Wavefront Printing Technique toward High Definition Holographic 3D Image

Koki Wakunami

National Institute of Information and Communications Technology (Japan)

We introduce the wavefront printing technique with overlapping approach of sub-holograms to achieve higher quality 3D image reconstruction than the conventional holographic recording technique.

Tu-J-03

15:50 Performance Evaluation of High Speed Full Motion Simulator for Holographic Memory Based on 3D FFT-BPM with GPU Acceleration

Hisatoshi Funakoshi[1], Atsushi Okamoto[2], Satoshi Honma[3]

[1]Gifu University, [2]Hokkaido University, [3]University of Yamanashi (Japan)

We experimentally verify the performance of high speed full motion simulator based on 3D FFT-BPM with GPU acceleration and clarify that our simulator can accurately estimate the system performance of a practical holographic memory.

Tu-J-04

15:50 Improvement of Diffraction Efficiency of Volumetric Magnetic Hologram with Magnetic Assist Recording

Zen Shirakashi, Taichi Goto, Hiroyuki Takagi, Yuichi Nakamura, Pang Boey Lim, Hironaga Uchida, Mitsuteru Inoue

Toyohashi University of Technology (Japan)

Magnetic garnet films (Bi:YIG) are used for rewritable magnetic hologram., To improve the diffraction efficiency, we investigated the effect of magnetic assist recording through numerical simulation and measuring diffraction efficiency of Bi:YIG.

Tu-J-05

15:50 **Inter-Pixel Crosstalk Cancellation on Holographic Memory**

Toshiki Ishii, Ryushi Fujimura

Utsunomiya University (Japan)

We developed inter-pixel crosstalk cancellation technique. We can decrease filter size using checkerboard phase pattern with phase difference of $\pi/2$. When we adopt filter size 1.05, the improvement of SNR is 6.5 dB.

Tu-J-06

15:50 **Characteristics of Multi-Layer and Multi-Level Optical Memory Using Convex-Shaped Recording Mark**

Haruhi Morimoto, Kouichi Nitta, Osamu Matoba

Kobe University (Japan)

The characteristic of multi-valued data in two-layer recording has been analyzed. When NA=0.7, total of 8 bit data is available in two-layer recording, but 6 bit is available in single-layer recording.

Tu-J-07

15:50 **Duplex Phase Code Based on Two-Step Exposure Technique for Holographic Data Storage System**

Satoshi Honma, Mitsuki Takahashi

Yamanashi University (Japan)

We propose a duplex phase code based on the two-step exposure technique for the holographic memory. It is possible to decode the original phase code by estimating the diffraction efficiency of sub-holograms with pilot signals.

Tu-J-08

15:50 **Inter-Page Crosstalk Analyses in 3D Shift Multiplexed Self-Referential Holographic Data Storage**

Taisuke Eto, Masanori Takabayashi, Takashi Okamoto

Department of Systems Design and Informatics, Kyushu Institute of Technology (Japan)

We apply a 3D shift multiplexing technique to self-referential holographic data storage in order to increase the number of multiplexed datapages. To decide the recording layout, 3D shift selectivity is investigated numerically.

Tu-J-09

15:50 **Signal Modulation, Recording, and Detection Error Characteristics in Pseudo-Spatial Quadrature Amplitude Modulation-Based Holographic Data Storage System**

Masanori Takabayashi, Yuya Sakaki, Takashi Okamoto

Kyushu Institute of Technology (Japan)

The error characteristics of modulation, recording, and detection processes in pseudo-spatial quadrature amplitude modulation-based holographic data storage are investigated. The modulation error dependence on quantization bit rate of spatial amplitude modulation (SLM) is particularly discussed.

Tu-J-10

15:50 **Experimental Investigation of Demodulation Accuracy of Spatially Quadrature Amplitude Modulated Signal Beam with Phase-Shift Embedding Method**

Tatsuki Yamamoto[1], Kazutaka Kanno[2], Masatoshi Bunsen[2]

[1]Graduate School of Engineering, Fukuoka University, [2]Department of Electronics Engineering and Computer Science, Fukuoka University (Japan)

The phase-shift embedding method is presented and experimentally investigated for single-shot detection of the intensity- and phase-modulated signal beams in holographic data storage. Characteristics of the proposed method are confirmed by optical experiments.

Tu-J-11

15:50 **Evaluation of Depth Selectivity in Multilayer Recording Coaxial Holographic Memory with Varifocal Kinoform Lens**

Masahiro Karaike[1], Teruyoshi Nobukawa[1], Takanori Nomura[2]

[1]Graduate School of Systems Engineering, Wakayama University, [2]Faculty of Systems Engineering, Wakayama University (Japan)

The effect of a reference beam on the shift selectivity along the optical axis is investigated. Numerical results show that amplitude distribution of the reference beam decides the behavior of the shift selectivity.

Tu-J-12

15:50 **Image Design and Replication for Image-Plane Disk-Type Multiplex Holograms**

Chih-Hung Chen, Yih-Shyang Cheng

Department of Optics and Photonics, National Central University (Taiwan)

In this study, we will describe the methods of image design in image-plane disk-type multiplex holograms. Theoretical model of this kind of hologram is also presented. Optical replication is then introduced by using a stable two-step holographic process.

Tu-J-13

15:50 **Intensity Reduction Using Subtractive Clustering Method by Genetic Algorithm in Holographic Data Storage System**

Jang Hyun Kim

IMRC (Korea)

A holographic data storage system (HDSS) is very important field in the storage system device. Many researchers study the HDSS about image processing algorithm for reduction of image noise. In this paper, we proposed an intelligence algorithm, genetic algorithm and subtractive clustering algorithm, for reduction IPI noise in holographic data storage system. We have to make virtual mask for reduction IPI noise and then, it will be used in our holographic data storage system. The virtual mask is generated using subtractive clustering algorithm by genetic algorithm, it is available to decrease the IPI noise in HDSS.

Tu-J-14

15:50 **Performance of Modulation Code with Low Density Parity Check Code for Holographic Data Storage**

Seongkwon Jeong, Jaejin Lee

Soongsil University (Korea)

Holographic data storage (HDS) is one of a strong candidate for the next generation storage system. HDS has the advantage of short access times and high data storage density. However, two-dimensional inter-symbol interference (2D-ISI) aggravates the performance of HDS, because of adjacent pixels. To solve this problem, 2D non-isolated modulation code is proposed to exclude isolated pixel patterns. But, when using only modulation codes, we cannot get a good performance. In this paper, we propose a modulation coding with low density parity check (LDPC) code for improvement of efficiency.

Tu-J-15

15:50 **9/10 Two-Dimensional Modulation Code for Holographic Data Storage Systems**

Chi D. Nguyen, Jaejin Lee

School of Electronic Engineering, Soongsil University (Korea)

Holographic data storage (HDS) systems are capable of far greater storage densities than traditional optical data storage technologies. However, the system performance is significantly affected by two-dimensional (2D) interference that is usually regarded as the primary cause for degrading the system performance. 2D modulation codes are one approach for mitigating the 2D interference. In this paper, we propose a 9/10 2D modulation code for HDS systems. The proposed modulation code not only maintains a reasonable bit-error-rate (BER), but also provides an improvement of storage capacity.

Tu-J-16

15:50 **Omnidirectional 3D Shape Measurement Using Digital Holographic Shape from Silhouette**

Takumi Mizumura, Nobukazu Yoshikawa

Graduate School of Science and Engineering, Saitama University (Japan)

We develop an omnidirectional 3D shape measurement using Gabor type digital holography. The 3D shape can be retrieved by integrating the object outline estimated using reconstructed images of the digital hologram from all directions.

Tu-J-17

15:50 **Refractive Index Tomography Combined Optical Coherence Tomography and Tomographic Reconstruction Method**

Takahiro Kitazawa[1], Takanori Nomura[2]

[1]Graduate School of Systems Engineering, Wakayama University, [2]Faculty of Systems Engineering, Wakayama University (Japan)

We propose refractive index tomography combined optical coherence tomography and tomographic reconstruction method. Owing to the low-coherency of a light source, the proposed method can remove phase unwrapping error. Numerical simulation confirms the feasibility.

Tu-J-18

15:50 **Accuracy Evaluation of Phase Shifting Digital Holography Using Virtual Interferogram-Generation Algorithm**

Jin Nozawa[1], Atsushi Okamoto[1], Kazuhisa Ogawa[1], Akihisa Tomita[1], Kunihiro Sato[2]

[1]Graduate School of Information Science and Technology, Hokkaido University, [2]Faculty of Engineering, Hokkai-Gakuen University (Japan)

The phase measurement accuracy of the virtual interferogram-generation algorithm is evaluated. The proposed algorithm can achieve highly accurate phase measurement independent to captured intensities by calculating ideal two phase-shifted holograms from two captured interferograms.

Tu-J-19

15:50 **Effect of Coherency in Particles Measurement by Using Low-Coherence In-Line Digital Holography with Phase-Only Correlation**

Keita Fujiwara[1], Takanori Nomura[2]

[1]Graduate School of Systems Engineering, Wakayama University, [2]Faculty of Systems Engineering, Wakayama University (Japan)

A method for particles measurement by the use of low-coherence in-line digital holography with phase-only correlation is proposed. The effect of temporal coherence on the accuracy of the proposed method is numerically investigated.

Tu-J-20

15:50 **Application of Autofocusing to Numerical Propagation-Based Transport of Intensity Phase Imaging for Dynamic Phase Objects**

Koshi Komuro[1], Takanori Nomura[2]

[1]Graduate School of Systems Engineering, Wakayama University, [2]Faculty of Systems Engineering, Wakayama University (Japan)

We proposed autofocusing to the transport of intensity equation-based phase imaging with a numerical propagation for observation of dynamic phase objects. The proposed method is confirmed by a numerical experiment.

Tu-J-21

15:50 **3D-Spatial and Spectral Imaging by Hyperbolic Holography**

Keerayoot Srinuanjan, Saki Ogasawara, Masaki Obara, Kyu Yoshimori

Department of Electrical Engineering and Computer Science, Graduate School of Engineering, Iwate University (Japan)

This paper reports a preliminary experiment of 3D-spatial and spectral imaging for spatially incoherent planar objects based on a new hyperbolic holography. We show that 3D information and continuous spectrum are successfully obtained.

Tu-J-22

15:50 **Numerical Evaluation of Spatial Resolution Characteristics in Wavefront Measurement Using Holographic Shack-Hartmann Wavefront Sensor**

Yusuke Saita, Takanori Nomura

Wakayama University (Japan)

The spatial resolution characteristics in the proposed holographic Shack-Hartmann wavefront sensor which is the wavefront measurement technique with large dynamic range is numerically evaluated. Simulation results confirm that the proposed method requires high spatial resolution.

Tu-J-23

15:50 **Plant-state Evaluation Using Spectral Reflectance Measurements**

Takeshi Hiyama, Takaya Tanabe

National Institute of Technology, Ibaraki College (Japan)

A spectrum reflectance measurement device was developed to detect the plant state. Experimentally obtained results indicate that stress index SI can reveal the plant stress and facilitate stable cultivation light conditions.

Tu-J-24

15:50 **A Two-Dimensional Partial Response Maximum Likelihood Detection Scheme for Misalignment Compensation in Holographic Data Storage Systems**

Gyuyeol Kong, Sooyong Choi

Yonsei University (Korea)

The Two-dimensional Partial Response Maximum Likelihood detection scheme for the misalignment compensation in Holographic Data Storage (HDS) systems proposed in this paper. By estimating and reflecting the misalignment for the detection procedure, we can prevent performance degradation from the effect of misalignment. Simulation result shows that the proposed scheme has more than 3dB gain compared to the conventional scheme when the misalignment is (10%, 10%). Therefore, the proposed scheme could be a good alternative method for high density HDS systems.

Tu-J-25

15:50 **Integrated Meta-Analyzer for Spectropolarimetry**

Jia-Wern Chen[1], Wei-Yi Tsai[1], Wei Ting Chen[1], Chun Yen Liao[1], Pei Ru Wu[1], Greg Sun[2], Peter Török[3], Din Ping Tsai[4]

[1]National Taiwan University (Taiwan), [2]University of Massachusetts Boston (U.S.A.), [3]Imperial College London (U.K.), [4]Academia Sinica (Taiwan)

We propose a multifunctional metasurface to demonstrate the possibility for integrating the optical functionalities of grating, mirror and circular polarization analyzer into a tiny device.

Tu-J-26

15:50 **Resonant Light Scattering of $Ge_2Sb_2Te_5$ Dots Fabricated by Laser-Induced Forward Transfer**

Hsiang-Chu Wang[1], Ming Lun Tseng[1], Mu-Ku Chen[1], Jia-Wern Chen[1], Huijun Wu[2], Cheng Hung Chu[2], Din Ping Tsai[2]

[1]Department of Physics, National Taiwan University, [2]Research Center for Applied Sciences, Academia Sinica (Taiwan)

We report the optical properties of $Ge_2Sb_2Te_5$ dot patterns fabricated by laser-induced forward transfer. The scattering color of $Ge_2Sb_2Te_5$ dot patterns are varied with the laser conditions.

Tu-J-27

15:50 **Multiple Polarization State Generation with Aluminum Metasurface for Optical Storage System**

Wei-Yi Tsai[1], Ting-Yu Chen[1], Wei Ting Chen[1], Ching-Fu Chen[1], Yao-Wei Huang[1], Hui Jun Wu[1], Din Ping Tsai[1,2]

[1]Department of Physics, National Taiwan University, [2]Research Center for Applied Sciences, Academia Sinica (Taiwan)

An aluminum-based polarization generator is presented in visible spectrum region. We numerically and experimentally demonstrated the generation of six kinds of polarizations with rotated antennas under illumination of linear polarized light.

Tu-J-28

15:50 **Non-Zero Padding Algorithm for Expanding Field-of-View in Digital Holography**

Sungbin Jeon, Janghyun Cho, Ji-nan Jin, Jae-Yong Lee, No-Cheol Park

Yonsei University (Korea)

The numerical method for maximizing FOV in digital holography is proposed. By appending non-zero padding during propagation process, unwanted edge diffraction noise could be separated without modifying system configuration.

Tu-J-29

15:50 **Improvement of Focusing Characteristics of a Plasmonic Lens for UV Wavelength**

Akihiro Tsuchiyama[1], Minoru Takeda[1], Tsutomu Inoue[2], Kento Aizawa[2]

[1]Kyoto Institute of Technology, [2]JASCO Corporation (Japan)

We improved the design parameter and the fabrication process of the plasmonic lens (PL) for UV wavelength, and confirmed a tight focal spot with subwavelength size and the prolonged focal length (2.2 μm) were experimentally attained.

Tu-J-30

15:50 **Arbitrary Cell Voltage Generator for Failure Analysis of Organic Photovoltaics**

Yukihiro Ishihara[1], Ryo Saito[1], Masahiro Yada[1], Mitsuru Shinagawa[1], Yoshinori Matsumoto[2], Hiroyuki Sugino[2], Hiroaki Tanaka[2], Jun Katsuyama[2], Hitoshi Hara[2]

[1]Hosei University, [2]Yokogawa Electric Corporation (Japan)

We have developed an organic photovoltaics cell model with a generated arbitrary cell voltage. The experimental results using the cell model agree with the electromagnetic field simulation results.

Tu-J-31

15:50 **Wearable-to-Wearable Device Measurement for Intra-Body Communication Using Electro-Optic Technique**

Daiki Ayuzawa[1], Narumi Sekine[1], Mitsuru Shinagawa[1], Daisuke Saito[2], Takafumi Yamada[2], Kyoji Oohashi[2]

[1]Hosei University, [2]Nippon Signal Company (Japan)

This paper describes a new EO probe using high gain multi-stage amplifier for intra-body communication. The EO probe can be applied to small signal measurement on a body in wearable-to-wearable communication.

Tu-J-32

15:50 **Amplitude Stability of Swept Light Source Using $KTa_{1-x}Nb_xO_3$ for Optical Coherence Tomography**

Kazuma Endo[1], Hiroshi Sunaga[1], Tatsuhiro Akiyama[1], Mitsuru Shinagawa[1], Seiji Toyoda[2], Masahiro Ueno[2], Yuzo Sasaki[2], Tadashi Sakamoto[2]

[1]Hosei University, [2]NTT Corporation (Japan)

We propose a simple method to measure the amplitude stability of a swept light source without the interferometer. The stability of the swept light source is related to the stability of an interference waveform.

17:20 - 18:00 **Break**

18:10 - 20:10 **Banquet at Atrium**

October 19, 2016 (Wednesday)

We-K: Imaging & Sensing Systems

Presiders: Osamu Matoba (Kobe University, Japan)
Kimihiro Saito (Kindai University Technical College, Japan)

We-K-01 **Invited**

09:00 **Holographic Correloscopy for Imaging a 3-D Object Hidden Behind a Diffuser: A Review**

Mitsuo Takeda[1], Alok Kumar Singh[2], Dinesh Narayana Naik[3], Giancarlo Pedrini[2], Wolfgang Osten[2]

[1]Center for Optical Research and Education, Utsunomiya University (Japan), [2]Institut fuer Technische Optik, University of Stuttgart (Germany), [3]School of Physics, University of Hyderabad (India)

Techniques of unconventional holography for imaging 3-D objects through an opaque diffuser or via a scattering wall are reviewed. A particular focus is on Holographic Correloscopy that emerged from the marriage between holography and statistical optics.

We-K-02

09:25 **Three-Dimensional Object Profiling Using FMCW Optical Sensing System**

Koichi Iiyama, Tatsuya Washizuka, Yosuke Kimura

Kanazawa University (Japan)

We have developed and demonstrated three-dimensional object profiling using FMCW optical sensing system. The measurement accuracy of 29μm is achieved, and we can successfully image a coin and a printed circuit board.

We-K-03

09:45 **Image Recovery for Low Inclination Angle of Reference Wave in Single-Shot Digital Holography**

Shinya Hasegawa, Yuki Sato, Takaaki Sunada

Hiroshima Institute of Technology (Japan)

We propose an image recovery method for a low inclination angle of the reference wave in single-shot phase-shifting holography. By performing a simulation, we verify that the method is effective and produces a high-contrast image.

10:05 - 10:25 Coffee Break

We-L: Holographic Memory 3

Presiders: Xiaodi Tan (Beijing Institute of Technology, China)
Nobuhiro Kinoshita (NHK, Japan)

We-L-01

10:25 **Coherent Scattering Noise Reduction Method with Wavelength Diversity Detection for Holographic Data Storage System**

Yusuke Nakamura[1], Yuzuru Takashima[2]

[1]Hitachi, Ltd. (Japan), [2]University of Arizona (U.S.A.)

A new method, wavelength diversity detection, improves SNR is proposed and its effectiveness is numerically confirmed. This method proposes a pathway for a future holographic data storage system having higher recording density than the conventional system.

We-L-02

10:45 **Modeling of Scheduling Free Photopolymers for Holographic Data Storage**

Yuki Takeda[1], Tsutomu Shimura[1], Shinsuke Umegaki[1], Masao Endo[1], Ryushi Fujimura[2]

[1]The University of Tokyo, [2]Utsunomiya University (Japan)

We made a reaction model for the scheduling free photopolymer recording materials for the holographic data storage. We made a set of reaction rate equations and the numerical results well agreed with the experimental results. These results support the validity of our model and it will be effective to prospect the recording properties when we change the properties and densities of the constituent molecules.

We-L-03

11:05 **Multiplexing Technique Using Virtual Phase Conjugation for High-Density Holographic Data Storage Systems**

Yuta Goto[1], Atsushi Okamoto[1], Masanori Takabayashi[2], Akihisa Tomita[1]

[1]Hokkaido University, [2]Kyushu Institute of Technology (Japan)

We propose a new technique for volume holographic multiplexing using virtual phase conjugation (VPC). This technique realizes a high-density holographic data storage system by reducing the consumption of the medium dynamic range.

We-L-04

11:25 **A Novel Coding Method for Holographic Optical Correlator Using Convolutional Neural Network**

Kanami Ikeda, Hidenori Suzuki, Eriko Watanabe

University of Electro-Communications (Japan)

We propose a data coding method using a convolutional neural network to enable the optical correlator to be applied to various data formats. An application of the sketch-based three-dimensional object recognition is also described.

We-L-05

11:45 **Enhanced 2/3 Four-Ary Modulation Code Using Soft-Decision Viterbi Decoding for Four-Level Holographic Data Storage Systems**

Gyuyeol Kong, Sooyong Choi

Yonsei University (Korea)

An enhanced 2/3 modulation code using the soft-decision Viterbi decoding for four-level Holographic Data Storage (HDS) systems is proposed in this paper. In order to obtain the significant coding gains from the modulation codes, we design a new 2/3 four-ary modulation code in order to enlarge the free distance on the trellis for the enhanced error correcting capability. Simulation result shows that the proposed modulation code has more than 1dB gains compared with the conventional modulation code. Therefore, the proposed modulation code could be a good alternative modulation scheme for high density HDS systems.

We-L-06

12:05 **Precise Non-Interferometric Detection of Spatial Quadrature Amplitude Modulated Signal with Continuous Signal Phase Modulation by Transport of Intensity Equation**

Keishiro Yoshidomi[1], Kazutaka Kanno[2], Masatoshi Bunsen[2]

[1]Graduate School of Engineering, Fukuoka University, [2]Department of Electronics Engineering and Computer Science, Fukuoka University (Japan)

The Transport of Intensity Equation is applied to non-interferometric detection and demodulation of the SQAM signal beams in holographic data storage. Spatially-continuous signal phase modulation technique is also proposed to enhance the demodulation accuracy.

We-L-07

12:25 **Reconstruction Characteristics of Elliptical-Polarization Holography at a Large Recording Angle**

Yiying Zhang[1], Xiaodi Tan[1], Guoguo Kang[1], Yong Huang[1], Yin Liu[1], Jue Wang[1], Anan Wu[1], Jinliang Zang[1], Tsutomu Shimura[2], Kazuo Kuroda[3]

[1]Beijing Institute of Technology (China), [2]The University of Tokyo, [3]Utsunomiya University (Japan)

Based on the tensor theory, we report on the reconstruction characteristics of elliptical-polarization holography at a large recording angle. Some peculiar phenomenon such as inverse reconstruction happens when intensity and polarization holography attain a balance.

12:45 - 14:00 **Lunch**

We-M: High-density Holographic Data Storage (Special Session)

Presiders: Takanori Nomura (Wakayama University, Japan)
Tetsuhiko Muroi (NHK, Japan)

We-M-01 Invited

14:00 Holographic Storage for Tera-Byte Era

Toyohiko Yatagai[1], Daisuke Barada[1,2]

[1]Center for Optical Research and Education, Utsunomiya University, [2]Graduate School of Engineering, Utsunomiya University (Japan)

To increase data capacity for holographic mass-data storage, some techniques are presented, including polarization holography and multilevel phase multiplication techniques. Theoretical and experimental results are described.

We-M-02 Invited

14:25 Practical Design of Angular-multiplexing Holographic Data Storage

Taku Hoshizawa[1], Yukinobu Tada[2]

[1]Center for Technology Innovation - Information and Telecommunications, Hitachi Ltd., [2]Development Division, Hitachi-LG Data Storage, Inc. (Japan)

We designed angular-multiplexing holographic data storage of terabytes and gigabits-per-second, and developed required techniques of high-density recording and fast data access. Furthermore we demonstrated data recording and reproduction on a prototype model applying the techniques.

We-M-03 Invited

14:50 High Density Collinear Holographic Data Storage System Using Phase Modulation

Xiaodi Tan[1], Hideyoshi Horimai[2], Ryo Arai[3], Junichi Ikeda[3], Mitsuteru Inoue[4], Xiao Lin[1], Ke Xu[1], Jinpeng Liu[1], Yong Huang[1]

[1]Beijing Institute of Technology (China), [2]HolyMine Corporation, [3]Kyoeisha Chemical Co., LTD., [4]Toyohashi University of Technology (Japan)

We introduced the principle of the collinear holography and its media structure of disc, and discussed some methods to increase the recording density and data transfer rates of using phase modulated page data format.

We-PD: Post Deadline

Presiders: Mitsuru Irie (Osaka Sangyo University, Japan)
Yoshimasa Kawata (Shizuoka University, Japan)

(15:15) We-PD-01

(15:30) We-PD-02

(15:45) We-PD-03

(16:00) We-PD-04

16:15 - 16:35 Award & Closing

AUTHOR INDEX

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International direct flights（国際線）
From Seoul: approx. 110 minutes.
自「ソウル」
From Taipei: approx. 150 minutes.
自「台北」
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自「上海」

Domestic flights（国内線）
From Narita Airport: approx. 90 minutes.
自「成田国際空港」
From Haneda Airport: approx. 80 minutes.
自「東京国際空港」

< From Kansai International Airport (KIX) to Kyoto City >
自「関西国際空港」

Kansai Airport Limited Express HARUKA (JR):
「関空特急はるか」
Traveling time to Kyoto Station is 75 minutes.

Limousine Bus: 「リムジンバス」
Traveling time to JR Kyoto Station is about 105 minutes.

MK Skygateshuttle: 「シャトルバス」
Traveling time to KRP is about 120 minutes.

< Access to JR Kyoto Station >
至「JR 京都駅」

Tokaido Shinkansen line: 「東海道新幹線」
Traveling time from Tokyo Station is 140 minutes.

< From JR Kyoto Station to KRP >
自「JR 京都駅」

JR San-in (Sagano) line (Local):
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Please get off at Tambaguchi Station (4 minutes) .
「丹波口駅」Walk 4 minutes from the station.

TAXI
10 minutes.

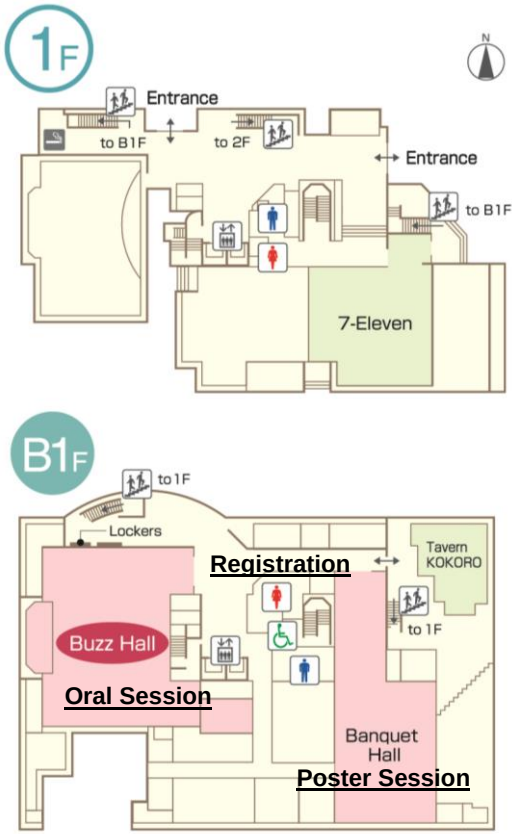
For more information, please refer to the following URL:

http://www.krp.co.jp/english/access_to_krp/

CONFERENCE SITE FLOOR

KRP Site Map

Bild. #4 Map



HOTEL ACCOMMODATIONS

ISOM has assigned Kinki Nippon Tourist Co., Ltd. as the official travel agent for hotel reservation.

We recommend you to make your hotel reservation for ISOM'16 at your earliest convenience through Kinki Nippon Tourist Co., Ltd.
You can make your hotel reservation through Kinki Nippon Tourist Co., Ltd. on the webpage as follows,

ISOM'16 公式宿泊予約サイト（近畿日本ツーリスト）
http://www.knt-ec.net/2016/isom16/index.html
Hotel Reservation Deadline: September 16, 2016

Shown below are hotels arranged for ISOM'16 by Kinki Nippon Tourist Co., Ltd.

[Hotels Near Kyoto Station] 「JR 京都駅 近辺」
To the venue, take JR San-in (Sagano) Line「JR 山陰本線 (嵯峨野線)」from Kyoto Station and get off at Tambaguchi Station「丹波口駅」.

- Hotel Hokke Club Kyoto (1 minute walk from Kyoto Station)
  「ホテル法華クラブ京都」
- El Inn Kyoto (1 minute walk from Kyoto Station)
  「エルイン京都」
- Daiwa Roynet Hotel Kyoto-Hachijoguchi (5 minutes walk from Kyoto Station)
  「ダイワロイネットホテル京都八条口」
- Kyoto Daiichi Hotel (6 minutes walk from Kyoto Station)
  「京都第一ホテル」
- Green Rich Hotel Kyotoeki Minami (8 minutes walk from Kyoto Station)
  「グリーンリッチホテル京都駅南」

[Hotel in the Center of Kyoto City] 「京都市中心部」
To the venue, take Subway Tozai Line「地下鉄 東西線」from Karasuma-Oike Station「烏丸御池駅」and transfer at Nijo Station「二条駅」to JR San-in (Sagano) Line「JR 山陰本線 (嵯峨野線)」and get off at Tambaguchi Station「丹波口駅」.

- Kyoto Garden Hotel (1 minute walk from Karasuma-Oike Station)
  「京都ガーデンホテル」

CITY AND HOTEL MAP

①Hotel Hokke Club Kyoto ②El Inn Kyoto

③Daiwa Roynet Hotel Kyoto-Hachijoguchi

④Kyoto Daiichi Hotel ⑤Green Rich Hotel Kyotoeki Minami

⑥Kyoto Garden Hotel

Kyoto Research Park
134 Chudoji Minamimachi, Shimogyo-ku, Kyoto 600-8813

MEMO

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