# Digital Holography & 3-D Imaging 2015
## Conference Program and Technical Digest

24 - 28 May 2015

Shanghai Institute of Optics and Fine Mechanics

Shanghai, China

## Table of Contents

# Digital Holography and 3-D Imaging (DH)
# Shanghai Institute of Optics and Fine Mechanics, Shanghai, China
# 24 May - 28 May 2015

Welcome to the **Digital Holography and 3-D Imaging (DH)** Topical Meeting in Shanghai, China. The Digital Holography and 3-D Imaging meeting provides a forum for science, technology, and applications of digital holographic, and three-dimensional imaging and display methods.

The DH meeting has consistently grown since its inception in 2007. This year's four-day program will consist of 129 outstanding presentations to include an opening Plenary session, two tutorial speakers, 10 invited speakers, 88 contributed oral presentations, and 29 poster presentations. Topic areas will include interferometry, phase microscopy, novel holographic processes, 3-D and novel displays, integral imaging, computer generated holograms, compressive holography, full-field tomography, and holography with various light sources including coherent to incoherent and X-ray to terahertz waves. This is a highly inter-disciplinary forum with applications in biomedicine, biophotonics, nanomaterials, nanophotonics, and scientific and industrial metrologies.

We all are pleased to have you join us and look forward to your continued participation in this topical meeting.

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*Shanghai Inst of Optics and Fine Mech, China*
General Chair

Partha Banerjee
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# General Information

## Registration Hours

*Multi-Functional Conference Hall Foyer*

| | |
|---|---|
| Sunday, 24 May | 15:00-18:00 |
| Monday, 25 May | 07:30-18:00 |
| Tuesday, 26 May | 07:30-19:00 |
| Wednesday, 27 May | 07:30-16:00 |
| Thursday, 28 May | 08:00-16:00 |

## Exhibit Hours

*Multi-Functional Conference Hall Foyer*

The Digital Holography & 3-D Imaging meeting is open to all registered attendees. Coffee breaks will be held with the exhibit from Monday — Wednesday.

| | |
|---|---|
| Monday, 25 May | 10:00-10:30<br>16:00-16:30 |
| Tuesday, 26 May | 10:00-10:30<br>16:00-16:30 |
| Wednesday, 27 May | 10:00-10:30<br>15:30-16:00 |

## Poster Presentation PDFs

Authors presenting posters have the option to submit a PDF of their poster, which will be attached to their papers in the OSA Publishing's Digital Library. If submitted, poster PDFs will be available three weeks after the conference end date.

## Update Sheet and Postdeadline Papers

All technical program changes will be communicated in the onsite Program Update Sheet. All attendees receive this information with registration materials, and we encourage you to review it carefully to stay informed to changes in the program. Postdeadline papers will also be announced on the update sheet.

## Early Online Access to the Technical Digest and Postdeadline Papers

Full Technical Attendees have both EARLY and FREE continuous access to the digest papers through OSA Publishing's Digital Library. To access the papers go to www.osa.org/DH and select the "Access Digest Papers" essential link on the right hand navigation. As access is limited to Full Technical Attendees, you will be asked to validate your credentials by entering the same login email address and password provided during the meeting registration process. If you need assistance with your login information, please use the "forgot password" utility or "Contact Help" link.

# Special Events

## Opening Plenary Session

*Monday, 25 May, 09:00 - 10:00*
*Multi-Functional Conference Hall*

The Digital Holography & 3-D Imaging Meeting will feature Francis T. S. Yu, an Evan Pugh Emeritus (Univ.) Professor of Electrical Engineering at the Pennsylvania State Univ., who is highly regarded in the industry. Dr. Yu will give the following presentation:

**DM1A• Holography: Rediscovery, Development and Beyond,** *Evan Pugh Emeritus Professor of Electrical Engineering, Pennsylvania State Univ., USA*

Dr. Yu shall begin with a kind of image formation using spatial coherent illumination, which was discovered in the 700's AD in Tang Dynasty China. It was known as the Chinese magic mirror by the Europeans, Japanese mirror in Japan and see-through mirror by the Chinese. The concept of "Wave Front Remonstration" was first theoretically and experimentally discovered by Dennis Gabor in 1948, but owed to poor coherent light source at that time. Nonetheless color-image formation using spatial sampling was first shown by Herbert E. Ives in 1906 for his work on diffraction color photography. It is, however, due to the rediscovery of wave front reconstruction by Emmett N. Leith's transmission-type hologram, as well by Yuri N. Denisyuk's reflection-type hologram in 1962, that made holography a wide spread of practical application. In spite of that, transmission-type holography is profoundly related to Herbert E. Ives's sampling photography developed in 1906, and reflection-type hologram is eminently similar to M. Gabriel Lippmann's color photographic process in 1891. In spite of all, the success of the rediscovery of holography (or wave front reconstruction) was mainly owed to the discovery of a strong coherent light source—the laser in the earlier 1960s. Although the original objective for the development of holography was mainly to improve electron microscopy and reproduction of high quality three-dimensional imageries, it has become a much wider application far beyond its legacy, as Dr. Yu shall show in this talk.

## Tutorial Sessions

The Digital Holography & 3-D Imaging Meeting will feature two highly regarded speakers who will each give a 45-minute tutorial presentation. The following presentations will be given:

*Tuesday, 26 May, 08:00 - 08:45*
*Multi-Functional Conference Hall*
**DT1A.1 • Compressive Phase Retrieval,** George Barbastathis, *Massachusetts Inst. of Technology, USA & Singapore-MIT Alliance for Research and Technology (SMART) Centre, China*

*Wednesday, 27 May, 08:00 - 08:45*
*Multi-Functional Conference Hall*
**DW1A.1 • 3D Depth Capture and Imaging for Microscopy**, Byoungho Lee, *Seoul National Univ., Korea*

## Welcome Reception

*Monday, 25 May, 18:30 - 20:30*
*The Canteen*

Join your fellow attendees for the DH Meeting Welcome Reception. The reception is open to all full technical meetings attendees. Meeting attendees may purchase extra tickets for their guest(s).

## Poster Session

*Wednesday, 27 May 10:00–2:00*
*The Canteen*

The DH Meeting will feature 29 posters. Posters are an integral part of the technical program and offer a unique networking opportunity, where presenters can discuss their results one-to-one with interested parties.

# Plenary and Tutorial Speakers

## Plenary Session

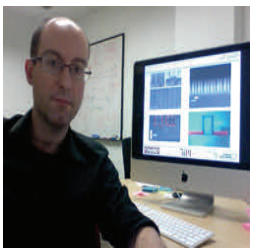
Monday, 25 May, 09:00 - 10:00
*Multi-Functional Conference Hall*

**DM1A.1 • Holography: Rediscovery, Development and Beyond,**
Francis T. Yu, *Evan Pugh Emeritus Professor of Electrical Engineering, Pennsylvania State Univ., USA*

Francis T.S. Yu is an Evan Pugh Emeritus (Univ.) Professor of Electrical Engineering at the Pennsylvania State Univ., Univ. Park. He authored and co-authored twelve text books and co-edited four rnonographs. He is a life fellow of the IEEE, fellow of OSA, SPIE and PSCA. He was the recipient of the 2004 Dennis Gabor Award of the International Society for Optical Engineering and the co-recipient of the IEEE 1998 Donald G. Fink Prize Award. Dr. Yu received a Ph.D. degree (1964) in electrical engineering from the Univ. of Michigan, Ann Arbor. He has published over 300 refereed papers in various professional journals and is the recipient of The 1993 Premier Research Award of the Penn State Engineering Society and the 1993 Faculty Scholar Medal at Penn State Univ.. He is an Honorary Professor of the National Chiao Tung Univ. (Taiwan), Honorary Professor of Nankai Univ. (China) and others. Some of his books have been translated in Russian, Chinese, Japanese and Korean.

## Tutorial Sessions

*Tuesday, 26 May, 08:00 - 08:45*
*Multi-Functional Conference Hall*



**DT1A.1 • Compressive Phase Retrieval,** George Barbastathis, *Massachusetts Institute of Technology, USA & Singapore-MIT Alliance for Research and Technology (SMART) Centre, China*

George Barbastathis received the Diploma in Electrical and Computer Engineering in 1993 from the National Technical Univ. of Athens (Πολυτεχνείο) and the MSc and PhD degrees in Electrical Engineering in 1994 and 1997, respectively, from the California Institute of Technology Caltech). After post-doctoral work at the Univ. of Illinois at Urbana-Champaign, he joined the faculty at MIT in 1999, where he is now Professor of Mechanical Engineering. He has worked or held visiting appointments at Harvard Univ., the Singapore-MIT Alliance for Research and Technology (SMART) Centre, the National Univ. of Singapore, and the Univ. of Michigan — Shanghai Jiao Tong Univ. Joint Institute (密西根交大学院) in Shanghai, People's Republic of China. His research interests are three-dimensional and spectral imaging; phase estimation; holography; and gradient index optics theory and implementation with subwavelength-patterned dielectrics. He is member of the Institute of Electrical and Electronics Engineering (IEEE), the American Society of Mechanical Engineers (ASME) and in 2010, he was elected Fellow of the Optical Society of America.

*Wednesday, 27 May, 08:00 - 08:45*
*Multi-Functional Conference Hall*

**DW1A.1 • 3-D Depth Capture and Imaging for Microscopy**, Byoungho Lee, *Seoul National Univ., Korea*

Byoungho Lee received his Ph.D. degree from Univ. of California at Berkeley (EECS) in 1993. Since September 1994, he has been with Seoul National Univ. as a faculty member. Prof. Lee is a Fellow of OSA, SPIE and IEEE, and a Member of the Korean Academy of Science and Technology. For OSA, he has served as a Board-of-Director, MES Chair, Holography and Diffractive Optics Technical Group Chair, and is serving as the Chair of Fabrication, Design and Instrumentation Technical Division and a topical editor of Optics Letters. He is currently Vice-President of both Optical Society of Korea and the Korean Information Display Society. His research fields are holography, 3D display and plasmonics.

# Grants and Student Awards

## OSA Foundation Student Travel Grant

We are pleased to announce The OSA Foundation Travel Grant recipient for the Digital Holography & 3-D Imaging Meeting:

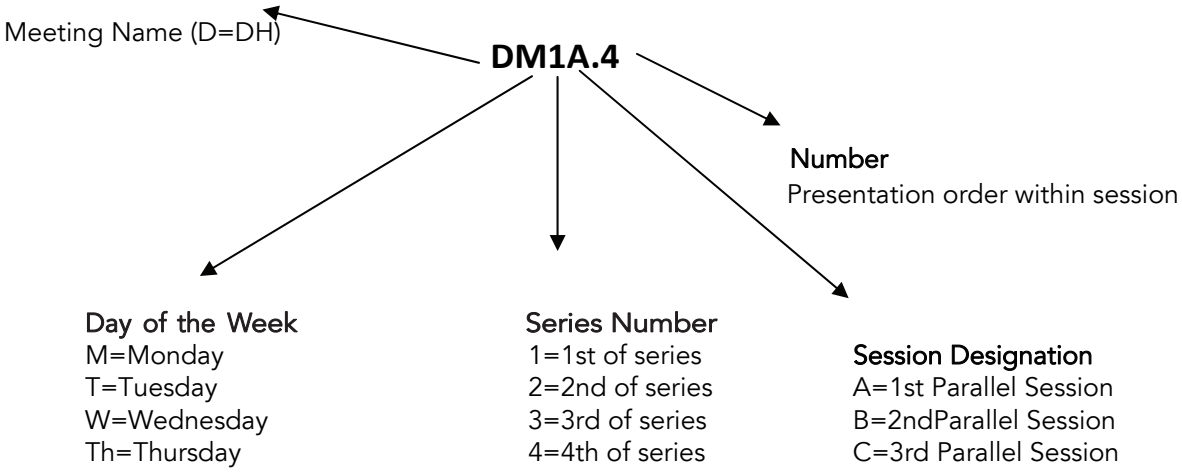
Mingqing Wang, Beihang University, *China*

The OSA Foundation Student Travel Grant Program is designed to provide career development opportunities by assisting students who wish to attend conferences and meetings. The grant is given to a student working or studying science in qualifying developing nations so they can attend OSA-managed technical meetings and conferences. The student receives $1,500 USD in travel support and is selected by the co-chairs of the meeting. Their application is judged on the following criteria:

- Work or study in a qualifying developing nation
- Enrollment in an accredited undergraduate or graduate program
- Demonstrated need for travel support
- Statement on the value of attending the conference

The OSA Foundation was established in 2002 to support philanthropic activities that help further The Optical Society's (OSA) mission. The Foundation is concentrating its efforts on programs that provide career and professional development resources and support awards and honors that recognize technical and business excellence. The grants funded by the Foundation are made possible by the generous donations of its supporters as well as the dollar-for-dollar match by OSA.

# Explanation of Session Codes




The first letter of the code designates the meeting. The second element denotes the day of the week (Sunday =S, Monday=M, Tuesday=T, Wednesday = W, Thursday=Th). The third element indicates the session series in that day (for instance, 1 would denote the first sessions in that day). Each day begins with the letter A in the fourth element and since there are no parallel sessions remains an A throughout the week. The number on the end of the code (separated from the session code with a period) signals the position of the talk within the session (first, second, third, etc.). For example, a presentation coded DM2A.4 indicates that this paper is being presented on Monday (M) in the second series of sessions (2), and is the first parallel session (A) in that series and the fourth paper (4) presented in that session.

## Online Access to Technical Digest Now Available!

Full Technical Attendees now have both EARLY and FREE continuous access to the digest papers through OSA Publishing's Digital Library. To access the papers go to www.osa.org/DH and select the "Access Digest Papers" essential link on the right hand navigation. As access is limited to Full Technical Attendees only, you will be asked to validate your credentials by entering the same login email address and password provided during the conference registration process. If you need assistance with your login information, please use the "forgot password" utility or "Contact Help" link.

# Agenda of Sessions

| Sunday, 24 May | |
|---|---|
| | |
| 15:00 — 18:00 | **Registration,** *Multi-Functional Conference Hall Foyer* |

| Monday, 25 May | |
|---|---|
| | |
| 07:30 — 18:00 | **Registration,** *Multi-Functional Conference Hall Foyer* |
| 08:55 — 10:00 | **DM1A • Opening Remarks and Plenary Session,** *Multi-Functional Conference Hall* |
| 10:00 — 10:30 | **Coffee Break/Exhibits,** *Multi-Functional Conference Hall Foyer* |
| 10:30 — 12:30 | **DM2A • Advances in DH Techniques I,** *Multi-Functional Conference Hall* |
| 12:30 — 14:00 | **Lunch Provided,** *The Canteen* |
| 14:00 — 16:00 | **DM3A • Advances in DH Techniques II,** *Multi-Functional Conference Hall* |
| 16:00 — 16:30 | **Beverage Break/Exhibits**, *Multi-Functional Conference Hall Foyer* |
| 16:30 — 18:30 | **DM4A • Computer Generated Holograms I,** *Multi-Functional Conference Hall* |
| 18:30 — 20:30 | **Welcome Reception,** *The Canteen* |

# Agenda of Sessions

| Tuesday, 26 May | |
|---|---|
| | |
| 07:30 — 19:00 | **Registration,** *Multi-Functional Conference Hall Foyer* |
| 08:00 — 10:00 | **DT1A • Contemporary Methods in DH,** *Multi-Functional Conference Hall* |
| 10:00 — 10:30 | **Coffee Break/Exhibits**, *Multi-Functional Conference Hall Foyer* |
| 10:30 — 12:30 | **DT2A • Computer Generated Holograms II,** *Multi-Functional Conference Hall* |
| 12:30 — 14:00 | **Lunch Provided,** *The Canteen* |
| 14:00 — 16:00 | **DT3A • Digital Holographic Microscopy,** *Multi-Functional Conference Hall* |
| 16:00 — 16:30 | **Beverage Break/Exhibits,** *Multi-Functional Conference Hall Foyer* |
| 16:30 — 18:30 | **DT4A • Digital Holographic Optical Processing,** *Multi-Functional Conference Hall* |
| 18:30 — 19:30 | **Dinner Provided,** *The Canteen* |

| Wednesday, 27 May | |
|---|---|
| | |
| 07:30 — 18:00 | **Registration,** *Multi-Functional Conference Hall Foyer* |
| 08:00 — 10:00 | **DW1A • 3-D Imaging and Display Systems I,** *Multi-Functional Conference Hall* |
| 10:00 — 10:30 | **Exhibits,** *Multi-Functional Conference Hall Foyer* |
| 10:00 — 12:00 | **DW2A • Poster Session & Coffee Break,** *The Canteen* |
| 12:00 — 13:30 | **Lunch Provided,** *Canteen* |
| 13:30 — 15:30 | **DW3A • 3-D Imaging and Display Systems II,** *Multi-Functional Conference Hall* |
| 15:30 — 16:00 | **Beverage Break/Exhibits,** *Multi-Functional Conference Hall Foyer* |
| 16:00 — 18:00 | **DW4A • 3-D Imaging and Display Systems III,** *Multi-Functional Conference Hall* |
| 18:00 — 18:30 | **Beverage Break,** *Multi-Functional Conference Hall Foyer* |
| 18:30 — 20:30 | **DW5A • 3-D Imaging and Display Systems IV,** *Multi-Functional Conference Hall* |
| 20:30 — 21:30 | **Dinner Provided,** *The Canteen* |

# Agenda of Sessions

| Thursday, 28 May | |
|---|---|
| | |
| 08:00 — 16:00 | **Registration,** *Multi-Functional Conference Hall Foyer* |
| 08:00 — 10:00 | **DTh1A • Applications of DH I,** *Multi-Functional Conference Hall* |
| 10:00 — 10:30 | **Coffee Break,** *Multi-Functional Conference Hall Foyer* |
| 10:30 — 12:30 | **DTh2A • Applications of DH II,** *Multi-Functional Conference Hall* |
| 12:30 — 14:00 | **Lunch Provided,** *The Canteen* |
| 14:00 — 16:00 | **DTh3A • Metrology and Profilometry,** *Multi-Functional Conference Hall* |
| 16:00 — 17:00 | **DTh4A • Post Deadline Papers,** *Multi-Functional Conference Hall* |
| 17:00 — 18:00 | **Dinner Provided,** *The Canteen* |

## *Save the Date*

### 2016 Imaging and Applied Optics Congress
### June/July 2016
### Germany

Topical Meetings:

- Applied Industrial Optics: Spectroscopy, Imaging, and Metrology (AIO)
- Computational Optical Sensing and Imaging (COSI)
- Digital Holography and Three-Dimensional Imaging (DH)
- Imaging Systems and Applications (IS)
- Laser Applications to Chemical, Security and Environment Analysis (LACSEA)
- Propagation Through and Characterization of Distributed Volume Turbulence (pcDVT)

07:30 — 18:00 • **Registration,** *Multi-Functional Conference Hall Foyer*

## 08:55 — 10:00
## DM1A • Plenary Session, *Multi-Functional Conference Hall*
*Presider:* Changhe Zhou, *Shanghai Inst of Optics and Fine Mech*, China

**08:55 • Welcome Remarks and Program Kick-Off,** *Ruxin Li, Director of SIOM*

**DM1A.1 • 09:00** **Plenary**
**Holography: Rediscovery, Development and Beyond,** Francis T. S. Yu[1]; [1]*Pennsylvania State Univ., USA.* The original purpose for the development of holography was mainly to reproduce a true three-dimensional imagery by means of wave front reconstruction process. However, since the rediscovery, it has offered a much wider spread of application beyond its legacy!

10:00 — 10:30 • **Coffee Break/Exhibits,** *Multi-Functional Conference Hall Foyer*

## 10:30 — 12:30
## DM2A • Advances in DH Techniques I, *Multi-Functional Conference Hall*
*Presider: Guofan Jin; Tsinghua Univ., China*

**DM2A.1 • 10:30** **Invited**
**Heterodyne Holography: An Optimal and Versatile 2-D Detection Scheme,** Michel Gross[1]; [1]*Laboratoire Charles Coulomb UMR 5221, CNRS-Université de Montpellier, France.* Heterodyne holography is a variant of phase shifting holography in which reference and signal arms are controlled by acousto optic modulators. We will briefly describe the method and illustrate its advantages on experimental examples.

**DM2A.2 • 11:00**
**Frequency Division of Color for Holovideo Displays using Anisotropic Leaky Mode Couplers,** Stephen Mclaughlin[1], Christopher Leach[1], Andrew Henrie[1], Daniel Smalley[1], Sundeep Jolly[2], V. Michael Bove Jr.[2]; [1]*Brigham Young Univ., USA;* [2]*Media Laboratory, Massachusetts Inst. of Technology, USA.* We present optimized fabrication parameters for RGB leaky mode couplers which are bandwidth-matched to GPU outputs to enable highly parallel holographic displays. We also present a semi-automatic characterization apparatus for frequency division of color devices.

**DM2A.3 • 11:15**
**Dual Wavelength Digital Holography for 3-D Particle Image Velocimetry: Experimental Validation,** Denis Lebrun[1], Stanislas Grare[1], Sébastien Coëtmellec[1], Marc Brunel[1], Gerard Gréhan[1]; [1]*UMR 6614 CORIA, France.* A multi-exposure digital in-line hologram of a particle field is recorded by two successive pulses of different wavelengths. This procedure enables avoiding the superimposition of particle images that may be close to each other.

**DM2A.4 • 11:30**
**Table-top Extreme Ultraviolet Holography and Coherent Diffraction Imaging,** Erik B. Malm[2,1]; [1]*Colorado State Univ., USA;* [2]*Synchrotron Radiation, Lund Univ., Sweden.* Single-shot extreme ultraviolet Fourier transform holography and coherent diffraction imaging techniques were developed for 2-D and 3-D microscopy.

**DM2A.5 • 11:45**
**Axial Localization of Fluorescence Samples Using Single-Shot Self-Interference Digital Holography,** Tianlong Man[1], Yuhong Wan[1], Fan Wu[1], Dayong Wang[1]; [1]*Beijing Univ. of Technology, China.* Application of self-interference digital holography for axial localization is demonstrated. The axial coordinates of the fluorescence sample are extracted from a single-shot hologram and localization accuracy of the proposed method is discussed in the paper.

**DM2A.6 • 12:00**
**Color Optical Scanning Holography,** Taegeun Kim[1], Hayan Kim[1], You Seok Kim[1]; [1]*Sejong Univ., Korea.* In this paper, we propose a color optical scanning holography (OSH) having common path for Red(R), Green(G) and Blue(B) channels with heterodyne multiplexing. In the proposing color OSH, RGB beams modulated by different heterodyne frequencies follow common path. We record the color complex hologram of an object using the color OSH.

**DM2A.7 • 12:15**
**Single-Shot Dual-Wavelength Digital Holography With Polarization-Multiplexing Transmission,** Zhe Wang[1,2], Zhuqing Jiang[1,2], Yifei Chen[1,2], Ye Zhao[1,2]; [1]*College of Applied Sciences, Beijing Univ. of Technology, China;* [2]*Inst. of Information Photonics Technology, Beijing Univ. of Technology, China.* A new single-shot dual-wavelength digital holographic configuration with polarization-multiplexing transmission is proposed. Two orthogonal linear-polarized waves with different wavelengths are employed to form dual-wavelength digital holograms onto one CCD camera in the co-path optical configuration.

12:30 — 14:00 • **Lunch Provided,** *The Canteen*

## 14:00 — 16:00
## DM3A • Advances in DH Techniques II , *Multi-Functional Conference Hall*
*Presider: Partha Banerjee; Univ. of Dayton, USA*

**DM3A.1 • 14:00** Invited
**Holographic 3-D Touch Sensing Display,** Masahiro Yamaguchi[1]; [1]*Tokyo Inst. of Technology, Japan.* A 3-D image floating in the air is reproduced by a 3-D light-field display using a holographic screen, and a 3-D touch interface is implemented by detecting the touch to the reproduced real image.

**DM3A.2 • 14:30**
**Diffraction Grating for Self-Referenced Holographic Interferometry,** Jean-Michel Desse[1], Pascal Picart[2], François Olchewsky[1]; [1]*Onera, France;* [2]*Ensim, France.* A multi directional holographic grating is performed to validate self-referenced digital holographic interferometry. From diffraction orders, the field of gradient phase is reconstructed along specific directions. The results are compared with those obtained by digital holography using a separated reference.

**DM3A.3 • 14:45**
**Self-Interference Incoherent Digital Holography for Holographic Fluorescence Microscopy,** David C. Clark[1], Changwon Jang[2], Jonghyun Kim[2], Byoungho Lee[2], Myung . Kim[1]; [1]*Univ. of South Florida, USA;* [2]*Dept. Electrical Engineering, Seoul National Univ., Korea.* We present recent progress in the development of self-interference incoherent digital holography for holographic fluorescence microscopy, including aberration compensation of fluorescent holographic image and 3-D differential holography.

**DM3A.4 • 15:00**
**Experimental Demonstration of High Dynamic-Range Digital Holography,** Yonghee Lee[1], Peng Xia[3,1], Ryosuke Yonesaka[1], Yasuhiro Awatsuji[1], Kenzo Nishio[1], Osamu Matoba[2]; [1]*Kyoto Inst. of Technology , Japan;* [3]*Kobe Univ., Japan.* We present a digital holography using high dynamic-range imaging, which can improve the quality of the reconstructed image of digital holography. We experimentally demonstrated the effectiveness of the technique.

**DM3A.5 • 15:15**
**Influence of Quantization in High Speed Digital Holographic Metrology,** Pascal Picart[1], Julien Poittevin[1,2], François Gautier[1], Charles Pezerat[1]; [1]*LAUM CNRS Université du Maine, France;* [2]*IRT Jules Verne, France.* We study the influence of quantization on phase measurement when recording is performed at very high frame rate. Influence of both the ratio between the reference and object waves and the sensor dynamics are discussed.

**DM3A.6 • 15:30**
**Self-healing Behavior of the Non-diffracting Asymmetric Bessel Beams,** Lei Gong[1], Xing-Ze Qiu[1], Qian Zhao[1], Yinmei Li[1]; [1]*Univ of Science and Technology of China, China.* We present a more generalized asymmetric Bessel mode with arbitrary orientation. Furthermore, the unique non-diffraction and self-reconstruction behaviors of the asymmetric Bessel beam is investigated by numerical simulation.

**DM3A.7 • 15:45**
**Multi-Wavelength Digital Holographic Microscopy Using a Telecentric Reflection Configuration,** Georges Nehmetallah[1]; [1]*EECS, Catholic Univ. of America, USA.* A telecentric recording configuration for multi-wavelength digital holographic microscopy (MW-DHM) is proposed. The advantage of this configuration is to optically remove, without post-processing, the parabolic phase distortion caused by the microscope objective in traditional MW-DHM.

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16:00 — 16:30 • **Beverage Break,** *Multi-Functional Conference Hall Foyer*

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All Technical papers are currently available for online download.
Access paper at
**www.osa.org/DH**
and click on
**"Access Digest Papers"**
under
**Essential Links**

## 16:30 — 18:30
## DM4A • Computer Generated Holograms I, *Multi-Functional Conference Hall*
*Presider: Hoonjong Kang; Korea Electronics Technology Inst., Korea*

**DM4A.1 • 16:30** Invited
**Improving the Layer-based Approach for Rapid Hologram Generation,** Daping Chu[1]; [1]*Univ. of Cambridge, UK.* This paper introduces the use of depth-fused 3-D (DFD) method to improve the speed of the layer-based method, which we developed for 3-D hologram calculation.

**DM4A.2 • 17:00**
**Mesh Boundary Removal and Fast Shading Effect Update for Mesh-Based Computer-Generated-Hologram,** Jae-Hyeung Park[1], Hee-Jae Kim[1], HuiJun Zhang[1], BoNi Li[1], Han-Ju Yeom[1], Yeong-Min Ji[1], Sang-Hoo Kim[1]; [1]*Inha Univ., Korea.* We propose a mesh-based computer-generated-hologram synthesis technique that removes dark artifacts on the boundary between the meshes and enables fast update of the shading effect for realistic representation of the 3-D objects. The proposed method adjusts the mesh vertex positions and pre-calculates the Fourier components of the shading model.

**DM4A.3 • 17:15**
**Binary Hologram of Very Large Space Bandwidth Product Designed by the Genetic Algorithm,** Yunlong Sheng[1]; [1]*Universite Laval, Canada.* Modern e-beam lithography provides the computer generated hologram with very high resolution to be explored for high quality projected images. Binary hologram with polygonal apertures is designed with hybrid Genetic Algorithm and floating co-vertices of the elementary triangles.

**DM4A.4 • 17:30**
**Calculation for Computer-Generated Holograms Using Fully Computed Holographic Stereogram Based Method,** Hao Zhang[1], Yan Zhao[1], Liangcai Cao[1], Guofan Jin[1]; [1]*Tsinghua Univ., China.* An algorithm for calculating computer-generated holograms with accurate depth information is proposed based on fully computed holographic stereogram, which could perform quality reconstructions of 3-D scenes with arbitrary depth information.

**DM4A.5 • 17:45**
**Full-Color MGSA-Type Computer Generated Holography Floating Projection System,** Chih-Hao Chuang[1], Chien-Yue Chen[1], Hsuan-Ting Chang[1], Pei-Jung Wu[2], Tsung-Jan Chang[1]; [1]*Nat'l Yunlin Univ. of Sci. & Tech., Taiwan;* [2]*National Chiao Tung Univ., Taiwan.* Modified Gerchberg-Saxton algorithm is used for compiling the RGB computer generated holography. A dynamic floating full-color MGSA-type CGH is projected after reconstructing and modulating the white-light image.

**DM4A.6 • 18:00**
**Frequency Filtering for Reduction of Memory Usage in Computer Holography,** Kyoji Matsushima[1], Sumio Nakahara[1]; [1]*Kansai Univ., Japan.* A novel technique using frequency filtering is presented for cutting down memory usage required for creating high-definition computer-generated holograms. The memory usage is reduced to one-fourth of what it was before by this technique.

**DM4A.7 • 18:15**
**Computer-Generated Hologram Calculation Without the Trigonometric Functions,** Takashi Nishitsuji[1], Tomoyoshi Shimobaba[1], Takashi Kakue[1], Tomoyoshi Ito[1]; [1]*Chiba Univ., Japan.* We propose an algorithm for calculating computer-generated holograms without the trigonometric functions using linear interpolation and a recurrence relation. As a result, we improved the calculation time about 5 times faster than the conventional method.

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**18:30 — 20:30 • Welcome Reception,** *The Canteen*

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**07:30 — 19:00 • Registration,** *Multi-Functional Conference Hall Foyer*

## 08:00 — 10:00
## DT1A • Contemporary Methods in DH, Multi-Functional Conference Hall
*Presider: Ting-Chung Poon; Virginia Tech, USA*

**DT1A.1 • 08:00** Tutorial
**Compressive Phase Retrieval,** George Barbastathis[1]; [1]*Massachusetts Inst. of Technology, USA & Singapore-MIT Alliance for Research and Technology (SMART) Centre, China.* Sparsity priors improve the condition of ill-posed or undersampled inverse problems. I will discuss how this principle applies to phase retrieval and discuss examples from digital holography, transport of intensity, phase-space tomography, and ptychography.

**DT1A.2 • 08:45**
**Reconstruction of Diffraction Field From Its Samples Distributed Over Space,** Gokhan B. Esmer[1], Otilia Popescu[2], Dimitrie C. Popescu[3]; [1]*Marmara Univ., Turkey;* [2]*Department of Engineering Technology, Old Dominion Univ., USA;* [3]*Department of Electrical and Computer Engineering, Old Dominion Univ., USA.* A new approach based on L1-norm minimization for accurate calculation of diffraction field from a set of sample points is presented. The proposed approach provides perfect reconstruction of the original diffraction field by using much fewer sample points taken over the space compared to an alternative one based on L2-norm minimization.

**DT1A.3 • 09:00**
**Reconstruction Resilience to Subsampling in Compressive Fresnel Holography,** Stijn Bettens[1], Hao Yan[2], Shaun Bundervoet[1], Colas Schretter[1], Ann Dooms[1], Peter Schelkens[1]; [1]*Vrije Universiteit Brussel, Belgium;* [2]*Shanghai Jiao Tong Univ., China.* The reconstruction resilience of a Projected Gradient Method (PGM), POCS and TwIST to randomly subsampled image wavefields is investigated. POCS and PGM do not consider noisy data, but they return a better reconstruction than TwIST.

**DT1A.4 • 09:15**
**Referenceless 3D Reconstruction Of Amplitude Objects Embedded in a Liquid,** Partha P. Banerjee[1], Ujitha Abeywickrema[1], Mahmudunnabi Basunia[1], Sarat C. Praharaj[2]; [1]*Univ. of Dayton, USA;* [2]*DMS Tech, USA.* Transport of intensity is used to recover the image of an amplitude object embedded in a liquid heated by a focused laser beam. Our work can find applications in 3-D imaging of debris in a fireball.

**DT1A.5 • 09:30**
**Phase Imaging Using a Hybrid Approach: Combining Wavefront Sensing With the Transport-of-Intensity Equation,** Zhengyun Zhang[1], Wensheng Chen[1], George Barbastathis[2]; [1]*Singapore-MIT Alliance for Res & Tech Ct, Singapore;* [2]*Mechanical Engineering, Massachusetts Inst. of Technology, USA.* We propose a novel phase imaging method, leveraging weighted least squares to fuse measurements from wavefront sensing, which faithfully captures low spatial frequencies, and transport-of-intensity equation methods, which faithfully capture high spatial frequencies.

**DT1A.6 • 09:45**
**Superresolution TIE Phase Imaging By Structured Illumination,** Yunhui Zhu[1], George Barbastathis[1,2]; [1]*Department of Mechanical Engineering, MIT, USA;* [2]*Singapore-MIT Alliance for Research and Technology Center, Singapore.* We demonstrate superresolution TIE phase imaging using structured illumination. The modulation shifts the phase spectrum so that previously missing high frequency components of the phase are detected with a low resolution camera.

**10:00 — 10:30 • Beverage Break,** *Multi-Functional Conference Hall Foyer*

## 10:30 — 12:30
## DT2A • Computer Generated Holograms II , *Multi-Functional Conference Hall*
*Presider: Yoshio Hayasaki; Utsunomiya Univ., Japan*

DT2A.1 • 10:30
**60-degree Three-dimensional Image Generation by Table Screen Holographic Display,** Tatsuaki Inoue[1], Yasuhiro Takaki[1]; *[1]Inst. of Engineering, Tokyo Univ. of Agriculture and Technology, Japan.* A table screen 360-degree holographic display is proposed. A screen size is increased and a reduced and localized viewing zone is scanned circularly around the table screen. The reconstruction of 360-degree three-dimensional images was achieved.

DT2A.2 • 10:45
**Full-Color 3-D Holographic Display Using a Phase-Only Spatial Light Modulator,** Gaolei Xue[1], Juan Liu[1], Xin Li[1], Jian Han[1], Yongtian Wang[1]; *[1]Beijing Inst. of Technology, China.* A multiplexing encoding method is proposed to generate CGHs for realizing full-color holographic display using a phase-only spatial light modulator (SLM). The numerical and experimental results show that the desired image can be achieved successfully.

DT2A.3 • 11:00
**Fast Generation of Computer Generated Cylindrical Hologram Using Wave-Front Recording Surface,** Nam Kim[1], Yu Zhao[1], Gang Li[2], Jaeuk Jeong[1], Jong-Rae Jeong[3]; *[1]Chungbuk National Univ., Korea; [2]Seoul National Univ., Korea; [3]Suwon Science College, Korea.* We proposed a fast calculation method for a computer generated cylindrical hologram by use of wave-front recording surface.

DT2A.4 • 11:15
**A Hologram Watermarking Scheme Based on Scrambling Embedding and Image Inpainting,** Shuming JIAO[1], Peter Tsang[1]; *[1]City Univ. of Hong Kong, Hong Kong.* This paper proposes a hologram watermarking scheme based on scrambling embedding and image inpainting. It has advantages in simplicity, high embedding capacity and good reconstruction quality of the cover hologram.

DT2A.5 • 11:30
**Holographic Image Projection with Phase Only Spatial Light Modulators via Non-Iterative CGH Computation Method,** Deniz Mengu[1], Erdem Ulusoy[1], Hakan Urey[1]; *[1]Electrical and Electronics Engineering, Koc Univ., Turkey.* A holographic image projection system using a non-iterative CGH computation method to encode a phase-only Spatial Light Modulator (SLM) is proposed. Experimental results indicate that the correlated encoding noise smooth out by time averaging.

DT2A.6 • 11:45
**Computer Generated Fourier Holograms Application for Projection Type Holographic Memory System,** Alexander Betin[2], Sergey Donchenko[2], Sergey B. Odinokov[2], Nina M. Verenikina[2], Rostislav Starikov[1], Evgeny Zlokazov[1,2]; *[1]National Research Nuclear Univ. "MEPhI", Russian Federation; [2]Bauman Moscow State Technical Univ., Russian Federation.* The specificities of synthesis, record and reconstruction of computer generated Fourier-microholograms for application in projection type holographic memory optical system are discussed. Also we represent the computer generated 1D-Fourier holograms suitable for multiplexed record.

DT2A.7 • 12:00
**R-N-LUT Method For Computer Generated Hologram,** Kai Zhao[1], Yingqing Huang[2], Xingpeng Yan[1], Xiaoyu Jiang[1]; *[1]Department of Information Engineering, Academy of Armored Forces Engineering, China; [2]Department of Scientifc Research, Academy of Armored Forces Engineering, China.* Two principal fringe patterns are stored for each depth. The principal fringe pattern is chosen randomly for obtaining fringe pattern of each object point. The experiments show the proposed method could eliminate coherent noise effectively.

DT2A.8 • 12:15
**Image Quality Evaluation of a Computer-Generated Hologram,** Hiroshi Yoshikawa[1]; *[1]Nihon Univ., Japan.* Image quality of a computer-generated hologram is evaluated on diffraction efficiency and peak signal-to-noise ratio. Theory and numerical experimental results are shown on Fourier transform hologram. However, it is also applicable to the other hologram.

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**12:30 — 14:00 • Lunch Provided,** *The Canteen*

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## 14:00 -- 16:00
## DT3A • Digital Holographic Microscopy , *Multi-Functional Conference Hall*
*Presider: Yunlong Sheng; Universite Laval, Canada*

**DT3A.1 • 14:00** Invited
**Quantitative Phase Imaging with a Digital Holographic Microscope Using a Spherical Reference Beam,** Eriko Watanabe[1]; [1]*UEC, Japan.* We designed a digital holographic microscope (DHM) using a spherical reference beam and an autofocusing method to facilitate high-precision wide-field phase measurement. We then developed a portable DHM using the proposed design method.

**DT3A.2 • 14:30**
**Autofocusing and Resolution Enhancement in Speckle-Illuminated Digital Holographic Microscopy,** Peng Gao[2,1], Juanjuan Zheng[2], Baoli Yao[2], Giancarlo Pedrini[1], Wolfgang Osten[1]; [1]*Institut für Technische Optik, Universität Stuttgart, Germany;* [2]*State Key Laboratory of Transient Optics and Photonics, Xi'an Inst. of Optics and Precision Mechanics,, China.* Sequential speckle illumination is incorporated into digital holographic microscopy (DHM) for autofocusing and resolution enhancement. The feasibility of the proposed method is demonstrated by microscopic phase imaging on a transparent sample.

**DT3A.3 • 14:45**
**Measurements of Squeeze Flow with Varying Temperature at UV-Nanoimprint via Micro Digital Holographic Particle Tracking Velocimetry,** Shin-ichi . Satake[1], Noriyuki Unno[1], Motoharu Asano[1], Jun Taniguchi[1]; [1]*Tokyo Univ. of Science, Japan.* Measurements of flow field of UV curable resin at a press process accompanied by a heating of UV-NIL were carried out using micro-DHPTV system. The temperature dependence of UV curable resin was evaluated.

**DT3A.4 • 15:00**
**Angular- and Polarization-Multiplexing With Spatial Light Modulators for Resolution Enhancement in Digital Holographic Microscopy,** Han-Yen Tu[2], Xin-Ji Lai[1], Yu-Chih Lin[1], Chau-Jern Cheng[1]; [1]*Inst. of Electro-Optical Science and Technology, National Taiwan Normal Univ., Taiwan;* [2]*Department of Electrical Engineering, Chinese Culture Univ., Taiwan.* This work demonstrates angular- and polarization-multiplexing based on spatial light modulators for resolution enhancement in synthetic aperture digital holographic microscopy. Frequency bands can be dynamically selected in single-shot for the hologram synthesis and frequency coverage.

**DT3A.5 • 15:15**
**A Common-Mode Architecture for a Digital Holographic Microscope,** J. Kent Wallace[1,2], Stephanie Rider[2], Eugene Serabyn[1], Chris Lindensmith[1], Jay Nadeau[3]; [1]*Jet Propulsion Laboratory, USA;* [2]*California Inst. of Technology, USA;* [3]*McGill Univ., Canada.* A new architecture for a digital holographic microscope is presented. The advantages for the new approach are many including: simplicity, stability, low-cost and high reliability. We present the design and quantify performance under sub-freezing environments.

**DT3A.6 • 15:30**
**Simultaneous High-Speed Motion-Picture Sensing Of Visible and Invisible Light With a Monochromatic Image Sensor by Using Digital Holography,** Tatsuki Tahara[1], Toru Kaku[1], Yasuhiko Arai[1]; [1]*Kansai Univ., Japan.* Visible and invisible motion-picture images are simultaneously recorded with a monochromatic image sensor by digital holography. Holographic motion-picture images of a freely swimming biological specimen at the wavelengths of 532 and 806 nm are obtained.

**DT3A.7 • 15:45**
**Self-Interference Low-Coherent Digital Holography By Engineered Volume Holographic Pupils,** POHAO WANG[1]; [1]*NTU, Taiwan.* We report a self-interference digital holographic technique through engineered volume holographic pupils. Two holographic pupils diffracted wavefronts will interfere at CCD plane with low-coherence source, and reconstructed object images will be retrieved using Fresnel propagation.

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16:00 — 16:30 • Beverage Break/Exhibits, *Multi-Functional Conference Hall Foyer*

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## 16:30 -- 18:30
## DT4A • Digital Holographic Optical Processing, *Multi-Functional Conference Hall*
*Presider: Byoungho Lee; Seoul National Univ., Korea*

**DT4A.1 • 16:30** Invited
**Scalable Spatial Light Modulators for Digital Holography,** Hoon Jeong[1], Jaewu Choi[1]; [1]*Kyung Hee Univ., Korea.* Digitized spatial light modulators (DSLMs) are essential instruments for realization of digital holography. Unfortunately DSLMs are suffering from limited space-bandwidth product (SBP). This presentation shows how to increase the effective SBP using scalable SLM-micromesh heterostructures.

**DT4A.2 • 17:00** Invited
**Digital Optical Phase Conjugator and the Applications,** Ching-Cherng Sun[1]; [1]*National Central Univ., Taiwan.* In this paper, we present a study of digital optical phase conjugator (DOPC) with precise alignment based on a fast optical phase conjugator, which is called Kitty SPPCM. The DOPC is used to form a focusing spot through a diffuse medium. The optical property of the focusing spot is studied and other applications are introduced.

**DT4A.3 • 17:30**
**Features of Reconstruction Process in Holographic Scanning Microscopy,** Yuri Zakharov[1,2], Mariya Muravyeva[2], Le Qiu[1], Lev Perelman[1]; [1]*Harvard Univ., USA;* [2]*Lobachevsky Univ. of Nizhny Novgorod, Russian Federation.* Laser scanning microscope based holographic setup introduces phase distortion in signal wave, so regular reconstruction leads to incorrectness. Analysis of light propagation through the schematics allow to offer reconstruction procedures depending on recording conditions.

**DT4A.4 • 17:45**
**Autofocusing of Optical Scanning Holography Based on Entropy Minimization,** Zhenbo Ren[1], Ni Chen[1], Antony Chan[1], Edmund Y. Lam[1]; [1]*Department of Electrical and Electronic Engineering, The Univ. of Hong Kong, Hong Kong.* In optical scanning holography, extracting distance of object is an indispensable step for numerical reconstruction. In this paper, we use entropy as a measurement to achieve autofocusing under different situations.

**DT4A.5 • 18:00**
**Evaluation of De-Noising Algorithms for Phase Data Filtering in Digital Holographic Metrology,** Pascal Picart[1], Sophie Verhaerghe[2], Pierre-Yves Quehe[2], Silvio Montresor[1]; [1]*LAUM CNRS Université du Maine, France;* [2]*ENSIM, France.* This paper presents a comparison between image denoising algorithms in the context of speckle noise in phase data from digital holography. Denoising algorithms are tested on simulated noisy speckled phases and images.

**DT4A.6 • 18:15**
**Image Division Multiplexing Digital Holography for Effective Noise Suppression Without Bandwidth Loss,** Mingqing Wang[1], Jian Wu[1], Kai Wang[1], Weipeng Zhang[1], Ming Zheng[1]; [1]*Beihang Univ., China.* We describe an image division multiplexing digital holography approach, with which the noises are completely suppressed without loss of image bandwidth, even if the image and the noises are close to each other.

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**18:30 — 19:30 • Dinner Provided,** *The Canteen*

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07:30 — 16:00 • **Registration,** *Multi-Functional Conference Hall Foyer*

## 08:00 — 10:00
## DW1A • 3D Imaging and Display Systems I, *Multi-Functional Conference Hall*
*Presiders: Presider: George Barbastathis; Massachusetts Inst. of Technology, USA*

**DW1A.1 • 08:00** Tutorial
**3-D Depth Capture and Imaging for Microscopy,** Byoungho . Lee[1]; [1]*Seoul National Univ., Korea.* I will discuss in detail the principles, advantages and disadvantages of 3-D capture and imaging methods for microscopy of some specific methods such as light field imaging, digital holographic microscopy and others.

**DW1A.2 • 08:45**
**See-through Integral Imaging Display with Background Occlusion Capability,** Yuta Yamaguchi[1], Yasuhiro Takaki[1]; [1]*Tokyo Univ of Agriculture and Technology, Japan.* An integral imaging display with see-through and background occlusion capabilities is proposed. A symmetric integral imaging system consisting of multiple lens arrays is combined with modulation and masking layers. The system is experimentally verified.

**DW1A.3 • 09:00**
**Segmentation-Based Occlusion Removal Technique For Partially Occluded 3D Objects in Integral Imaging System,** Hongjia Qu[1], Yongri Piao[1], Luyan Xing[1], Miao Zhang[2]; [1]*School of Information and Communication Engineering, Dalian Univ. of Technology, China;* [2]*School of Software Technology, Dalian Univ. of Technology, China.* Generally, the occlusion information can degrades the quality of the reconstructed 3-D images in integral imaging system. To remove the occlusion effects, we present a segmentation-based occlusion removal method for the partially occluded 3-D reconstruction. The preliminary experimental results can confirm the feasibility of the proposed method.

**DW1A.4 • 09:15**
**Depth Controlled Far 3-D Objects Reconstruction in Integral Imaging System,** Luyan Xing[1], Yongri Piao[1], Hongjia Qu[1], Miao Zhang[2], Donghak Shin[3]; [1]*School of Information and Communication Engineering, Dalian Univ. of Technology, China;* [2]*School of Software Technology, Dalian Univ. of Technology, China;* [3]*Inst. of Ambient Intelligence, Dongseo Univ., China.* In this paper, we present a depth controlled far 3D objects reconstruction in integral imaging system. In order to reduce the reconstruction distance, a set of depth controlled elemental images are recorded by the integral imaging with a Plano concave lens. The preliminary experimental results can confirm the feasibility of the proposed method.

**DW1A.5 • 09:30**
**Viewing angle enhancement of integral imaging using layered display,** BoNi Li[1], Yeong-Min Ji[1], Jae-Hyeung Park[1]; [1]*Inha Univ., Korea.* Integral imaging three-dimensional display has many advantages, but its narrow viewing angle is a problem. In this paper, we propose a method to enhance the viewing angle using two display panels which can present directional elemental images. The principle of the proposed method and experiment results will be presented.

**DW1A.6 • 09:45**
**Study about change of accommodative responses at the angular resolution boundary of integral floating display,** KiHong Choi[1], Young Min Kim[1], Sung-Wook Min[1]; [1]*Kyung Hee Univ. , USA.* The change of accommodative responses to the integral floating display with regard to the angular resolution boundary which is derived from the integral floating systems, especially by manipulating the floating gap, is assessed and analyzed.

**10:00 — 10:30 • Coffee Break/Exhibits,** *Multi-Functional Conference Hall Foyer*

**10:00 — 12:00**
**DW2A • Poster Session,** *The Canteen*

DW2A.1
**Three-Dimensional Position Measurement of Gold Nanoparticles Using Low-Coherence Digital Holographic Microscope With Twilight-Field Method,** Kazufumi Goto[1], Yoshio Hayasaki[1]; *[1]Center for Optical Research & Education, Japan.* The twilight-field method improved an accuracy of the position measurement and minimized the measurable size of gold nanoparticles. An adequate control of the coherence of illumination light also improved the accuracy.

DW2A.2
**Digital Color Holographic Reconstruction Based On A Virtual Digital Hologram,** Pascal Picart[1], Junchang LI[2], Qinghe SONG[2], Zujie PENG[2]; *[1]LAUM CNRS Université du Maine, France; [2]KUST, China.* This paper presents a reconstruction algorithm based on an intermediate virtual digital hologram that can reconstruct color images with a controlled sampling pitch and pixel number. Experimental results confirm the suitability of the proposed method.

DW2A.3
**Depth Enhancement of Optical Scanning Holography with a Spiral Phase Plate,** Ni Chen[1], Zhenbo Ren[1], Antony Chan[1], Xing Sun[1], Edmund Y. Lam[1]; *[1]The Univ. of Hong Kong, Hong Kong.* A spiral phase plate is applied to the optical scanning holography system to improve the depth resolution of the reconstruction, the simulation results show that the depth interval can be resolved at a 0.4 mm with only a single hologram.

DW2A.4
**Real-Time Integral Imaging Display Using an Adaptive Lens Array,** Munkh-Uchral Erdenebat[1], Ki-Chul Kwon[1], Ji-Seong Jeong[1], Kwan-Hee Yoo[1], Nam Kim[1]; *[1]Chungbuk National Univ., Korea.* Integral imaging display using an adaptive lens array which provides with the flat and curved lens array-based systems is proposed. GPU parallel processing is applied for the real-time display. By the experiment, adaptive lens array-based novel real-time integral imaging display has been demonstrated.

DW2A.5
**Multicolor reflection holography using time-scheduling recording method in photopolymer,** Mei-Lan Piao[1], Kwon-Yeon Lee[2], Nam Kim[1]; *[1]Chungbuk National Univ., Korea; [2]Sunchon National Univ., Korea.* A technique is described for determining three-color exposure energies to achieve a uniform color balance in multicolor reflection holographic recordings. Three-color holographic gratings exposed sequentially in experimental full-color photopolymer film.

DW2A.6
**Edge Extraction Based on Aperture Synthesis in Optical Scanning Holography,** Haiyan Ou[1], Edmund Y. Lam[2], BIngzhong wang[1]; *[1]Inst. of Applied Physics, Univ. of Electronic Science and Technology of China, China; [2]Department of Electrical and Electronic Engineering, Univ. of Hong Kong, Hong Kong.* We present an edge extraction method based on aperture synthesis with different pupils in optical scanning holography. By utilizing two sub-holograms covering different spatial frequency ranges of the object, sharp edges can be extracted successfully.

DW2A.7
**Improved Full Analytical Polygon-Based Method Using Fourier Analysis Of 3-D Affine Transformation,** Yijie Pan[1], Yongtian Wang[1], Juan Liu[1], Xin Li[1], Jia Jia[2]; *[1]Beijing Inst. of Technology, USA; [2]Tsinghua Univ., China.* An improved full analytical polygon-based method is proposed to speed up the computation of hologram synthesis in accordance with Fourier analysis of three-dimensional affine transformation. Numerical and Optical experiment proved the proposed method could save computation time and reconstruct three-dimensional(3D) scene precisely.

DW2A.8
**An Iterative Algorithm For Computer-Generated Holograms Calculation,** Weirui Yue[1], Qiang Song[1], Jingdan Liu[1,2], Guohai Situ[1]; *[1]SIOM, CAS, USA; [2]School of Optoelectronics, Beijing Inst. of Technology, China.* We propose an iterative algorithm by introducing the strategy of gradient decent and magnitude modification into the Gerchburg-Saxton (GS) algorithm. Simulations and experimental results demonstrate its better performance for holographic display comparing with the GS.

DW2A.9
**Optical Scanning Holography in Partial-Coherence Condition,** Jung-Ping Liu[1]; *[1]Feng Chia Univ., Taiwan.* General theoretical model is built to investigate optical scanning holography in partial-coherent mode. It is found that serious noise appears in the reconstructed image for the partial-coherent mode due to nonlinear filtering.

DW2A.10
**Portable and Low-Cost Digital Holographic Microscope using RGB LED Illumination,** Yutaka Endo[1], Junichi Itoi[1], Tomoyoshi Shimobaba[1], Marie Sano[1], Takashi Kakue[1], Tomoyoshi Ito[1]; *[1]Chiba Univ., Japan.* We developed the portable and low-cost digital holographic microscope using RGB LED illumination, the cost and size of which were 46,350 yen (approximately 393 US dollars) and 14(D)×10(W)×6.5(H) cm, respectively.

DW2A.11
**Image Reconstruction by Applying Fresnel Transform on Phase-Only Computer Generated Hologram at Tilted Planes,** Hsuan-Ting Chang[1], Chien-Yue Chen[1], Jhe-Sian Lin[1], Wu-Jhyun Li[1]; *[1]National Yunlin Univ of Science and Tech, Taiwan.* A method of determining the phase-only computer generated hologram using the modified Gerchberg–Saxton algorithm is proposed to accommodate Fresnel diffraction on the tilted plane. Both the simulation and experimental results successfully verify the proposed method.

DW2A.12
**Self-imaging of optical vortices for 3-D localization and wavefront assessment,** Michal Baranek[1], Petr Bouchal[2], Zdenek Bouchal[1]; *[1]Palacky Univ., Czech Republic; [2]Brno Univ. of Technology, Czech Republic.* The self-imaging of vortices adapted to optical imaging systems is demonstrated and utilized for an accurate aberration insensitive 3D localization of microscopic objects and an assessment of the spherical aberration.

DW2A.13
**Generation of Parabolic Non-diffracting Waves with Digital Micromirror Device,** Xing-Ze Qiu[1], Lei Gong[1], Qian Zhao[1], Yinmei Li[1]; *[1]Univ of Science and Technology of China, China.* The super-pixel method is exploited for high-quality generation of the parabolic non-diffracting waves based on binary amplitude masks using a digital micromirror device (DMD). Additionally, the diffraction-free property of the beams is experimentally demonstrated here.

DW2A.14
**Complex Hologram Display Using Single SLM And Circular Grating,** Le Thanh Bang[1], Mei-Lan Piao[1], Seok-Hee Jeon[2], Nam Kim[1]; *[1]Chungbuk National Univ., Korea; [2]Incheon National Univ., Korea.* Holographic display has limited reconstruction quality, we usually cannot see the full reconstructed hologram due to the characteristics of phase modulation and amplitude modulation holograms.

DW2A.15
**Solid Immersion Fresnel Zone Plate,** Yaoju Zhang[1]; *[1]Wenzhou Univ., China.* A solid immersion Fresnel zone plate (SIFZP) is designed and its near-field imaging characteristics are analyzed using the vector angular spectrum method. Results show SIFZP can generate a high intensity and subwavelength focus.

DW2A.16
**Three-Dimensional Display With Digitally Generated Tomographic Images And A Lenticular Lens Array,** Xunbo Yu[1], Xinzhu Sang[1], Xin Gao[1], Wei Duan[1], Duo Chen[1], Peng Wang[1], Binbin Yan[1], Chongxiu Yu[1], Daxiong Xu[1]; *[1]Beijing Univ. of Posts and Tele, China.* A three-dimensional display combining digitally generated tomograhic images with a lenticular-lens-array is demonstrated. Angular spectrum analysis method is used to analyze the parallax images. Experiment results show the 3D display with the smooth parallax.

DW2A.17
**Real-Time Visualization Of Fluidic Field Using Point-Diffraction Digital Holographic Interferometry,** Junwei Min[1], Peng Gao[1], Rongli Guo[1], Meiling Zhou[1], Baoli Yao[1]; *[1]Xi'an Inst Optics & Precision Mech CAS, China.* The dynamic fusion process of two different fluidic fields is visualized and quantitatively analyzed by using common-path point-diffraction digital holographic interferometry. The measurement results are compared with that from other techniques, verifying the practicability of the proposed method.

DW2A.18
**Hologram Acquisition by Using Time Resolved Analysis in Optical Scanning Holography,** Munseob Lee[1], Gihyeon Min[1], Nacwoo Kim[1], Byung-Tak Lee[1]; *[1]ETRI, Korea.* We propose the new hologram acquisition method based on the time resolved analysis in optical scanning holography. By applying the Fourier transform or four phase shifting algorithm, we can obtain complex hologram without reference clocking.

DW2A.19
**A Strong Adaptable Autofocusing Approach Of Off-Axis Digital Holography,** Ning Liu[1], Yingying Zhang[1], Jun Xie[1]; *[1]Nanjing Xiaozhuang Univ., China.* An innovative autofocusing criterion for the reconstruction of digital holograms. This criterion has extremely great adaptability under different quality conditions of holograms.Even for hologram degraded by destructive interference, our method still performs well.We are sure that this technology can do great help in real world applications.

**DW2A.20**
**A Combination of Computer-Generated Fourier Holograms and Light Guide Substrates With Diffractive Optical Elements For Optical Display and Sighting System,** Alexander Betin[1], Sergey Donchenko[1], Michael Kovalev[1], Sergey Odinokov[1], Artem Solomashenko[1], Evgeniy Zlokazov[1,2]; *[1]Bauman Moscow State Technical Univ., Russian Federation; [2]National Research Nuclear Univ. "Moscow Engineering Physics Inst.", Russian Federation.* A combination of computer-generated Fourier holograms (CGFH) and light guide substrate with diffractive optical elements (DOE) is described. The experimental results show that this combination can be used in display and sighting systems.

DW2A.21
**Laser Speckle Micro-angiography,** Riwei Liao[2,1], Yaguang Zeng[1], Dingan Han [1]; *[1]Department of photoelectric technology, foshang Univ., China; [2]Department of physics, South China Normal Univ., China.* We introduce a laser speckle micro-angiography (LSMA) to reconstruct the 2D visualization of the blood flows. In vivo Biological experiments on the ears of rabbits and mice verify the outstanding performance of our LSMA in imaging microcirculatory network.Provided an potential to develop a label-free optical micro-angiography in retinal imaging.

DW2A.22
**Compressive Holographic Imaging By Self-Interference Digital Holography,** Fan Wu[1,2], Yuhong Wan[1,2], Tianlong Man[1,2], Ying Han[1,2]; *[1]College of Applied Sciences, Beijing Univ. of Technology, China; [2]Beijing Engineering Research Center of Precision Measurement Technology and Instruments (Beijing Univ. of Technology), China.* The self-inference incoherent Fresnel digital holography was verified obeying well compressive sensing framework. Compressive holographic imaging of incoherently illuminated colorful objects by Michelson interferometer is demonstrated experimentally, thus the great potential of the technology for multidimensional imaging is showed.

DW2A.23
**Practical Method for Computer-generated Hologram of Real-existing Scene with Large Viewing Angle,** Yong Li[1], Haiyan Li[1], Yile Shi[1], Hongzhen Jin[1], Hui Wang[1]; *[1]Inst. of Information Optics, Zhejiang Normal Univ., China.* First, The 3D information and texture of scene is captured with a 3D scanner moved on a track. Then the partial computer-generated hologram (CGH) corresponding to every viewing point of 3D camera is calculated.

DW2A.24
**Phase Modulation of Adjacent Data Pixels for Inter-page Noise Cancellation in Collinear Holographic Storage System,** Yabin Cheng[1]; *[1]Beijing Inst. of Technology, China.* We propose inter-page noise reduction method through phase modulation to adjacent data pixels in collinear holographic storage system. The performance of proposed method was studied by numerical simulation.

DW2A.25
**Layered Display that Presents Different Three-Dimensional Images to Multiple Viewers Simultaneously,** Yeong-Min Ji[1], Jae-Hyeung Park[1]; *[1]Inha Univ., Korea.* Layered display which consists of two or more panels in a stack can present three-dimensional images with high resolution by reconstructing corresponding ray field. In this paper, we propose a multi-view display showing absolutely different three-dimensional images to different viewpoints by using layered display configuration.

DW2A.26
**A Method to Achieve Reconstructed Image Motion Using Digital Lens Area Sampling,** Dehong Wang[1], Di Wang[1], Qionghua Wang[1]; *[1]Sichuan Univ., China.* A method of digital lens area sampling to readjust the position of reconstructed image is proposed, which can compensate the chromatic aberration caused by the uncoincidence of reconstructed image center without Fourier lens.

DW2A.27
**Compensation of Color Distortion on Full-color Holographic Optical Elements,** Keehoon Hong[1,2], Changwon Jang[2], Byoungho . Lee[2], Hyon-gon Choo[1], Jinwoong Kim[1]; *[1]ETRI, Korea; [2]Seoul National Univ., Korea.* Colorimetry analysis for compensating color distortion on full-color holographic optical elements (HOEs) is proposed. Color distortion on full-color HOEs is measured by spectrometer, and weighting factors of external imaging device are calculated for color compensation.

DW2A.28
**Single-Beam Phase Retrieval With Partially Coherent Light,** Meiling Zhou[1], Junwei Min[1], Gao Peng[1], Yansheng Liang[1], Ming Lei[1], Baoli Yao[1]; *[1]State Key Laboratory of Transient Optics and Photonics, Xi'an Inst. of Optics and Precision Mechanics, Chinese Academy of Sciences, China.* A single-beam iterative phase retrieval method with partially coherent beam is proposed. Reference-less system make it high immunity to environmental disturbance and partially coherent light improve the image quality with low coherent noise.

DW2A.29
**Abruptly Autofocusing Properties of Approximate Dual Airy Beam Generated From Symmetric Cubic Phase,** Weiwei Liu[1]; *[1]Univ of Science and Technology of China, USA.* We propose an amplitude modulation method on symmetric cubic phase to generate a new abruptly autofocusing beam. This beam owns two airy beam branches and autofocus much sharply than rectangular symmetric airy beam.

## 13:30 — 15:00
## DW3A • 3D Imaging and Display Systems II, *Multi-Functional Conference Hall*
*Presider: Chau-Jern Cheng; National Taiwan Normal Univ., Taiwan*

**DW3A.1 • 13:30** Invited
**High-efficiency Real-time Optical Holographic Display Using Quantum Dot Doped Liquid Crystal,** Yikai Su[1]; [1]*Shanghai Jiao Tong Univ., China.* We report a 60-Hz real-time optical holographic display using quantum-dot-doped liquid crystal. The transient first-order diffraction efficiency is improved to 20%.

**DW3A.2 • 14:00**
**Volumetric Display With Holographic Parallel Two-Photon Excitations and Multilayer Fluorescence Screen,** Kota Kumagai[1], Satoshi Hasegawa[1], Yoshio Hayasaki[1]; [1]*Utsunomiya Univ., Japan.* We demonstrate a volumetric display based on holographic parallel access to two-photon excitation using a computer-generated hologram displayed on a spatial light modulator and a multilayer fluorescence colored screen.

**DW3A.3 • 14:15**
**Color Reconstructions in Holographic Display With White Light LED Illumination and Complex Modulation,** Tomasz Kozacki[1], Maksymilian Chlipala[1], Weronika Zaperty[1]; [1]*Politechnika Warszawska, Poland.* In this work we investigate the holographic display system with white light LED source. We show, that in the system with complex modulation and color filters it is possible to obtain high quality color reconstructions.

**DW3A.4 • 14:30**
**Demonstration Of Perfect Holographic Display On Commercial 4K Plane Displayer,** Frank C. Fan[1], Sam Choi[1], Chaochuan Jiang[1]; [1]*AFC Technology Co., Ltd, China*. A novel method for perfect holographic display by means of lens array and holographic functional screen is proposed. The process of acquisition, coding, restoration and display is described in detail. A holo-video system based on commercial 4K displayer is demonstrated as the result.

**DW3A.5 • 14:45**
**Speckle Suppression In Phase-Only Holographic Display By Optimizing Phase Distribution,** Chenliang Chang[1], Jun Xia[1], Wei Lei[1]; [1]*Southeast Univ. (China), China*. A method of speckle suppression in phase-only holographic display is proposed. The phase-only computer generated hologram (CGH) is calculated based on the two-coefficient error diffusion (TCED) algorithm. The phase distribution of the reconstructed image is optimized uniformly and the speckle suppressed image can be obtained.

**DW3A.6 • 15:00**
**Layer-Based Angular Spectrum Holographic Display Using A Phase-Only Spatial Light Modulator,** Liangcai Cao[1], Yan Zhao[1], Hao Zhang[1], Guofan Jin[1]; [1]*Tsinghua Univ., China*. A layer-based angular spectrum method is proposed for computer-generated hologram. Experimental results demonstrate the feasibility of reconstructing three dimensional objects by using a phase-only spatial light modulator.

**DW3A.7 • 15:15**
**Crosstalk-free 360-Degree Viewable 3D Display based on Pyramidal Mirrors and Diaphragms,** Guowen Chen[1], Cong Ma[1], Dong Zhao[1], Zhencheng Fan[1], Hongen Liao[1]; [1]*Department of biomedical engineering, Tsinghua Univ., China.* We propose a crosstalk-free 360-Degree display system based on n-gonal pyramidal mirrors assemblage with attached diaphragms and 3D imaging sources. Moreover, we evaluate the 3D floating display system by simulations and experiments.

**15:30 — 16:00 • Beverage Break,** *Multi-Functional Conference Hall Foyer*

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## 16:00 — 18:00
## DW4A • 3-D Imaging and Display Systems III, *Multi-Functional Conference Hall*
*Presider: Peter Tsang, City University of Hong Kong, Hong Kong*

**DW4A.1 • 16:00** Invited
**When 3D Holgographic Display Meets with Nanotechnology,** Juan Liu[1]; [1]*Beijing Inst. of Technology, China.* Dynamic nano-pixelated modulator is a key device for 3D holographic display. This talk will review the current solutions for nano-pixelated modulator, and also propose a dynamic model based on metasurface for the first time.

**DW4A.2 • 16:30**
**See-Through Three-Dimensional Display Using Printed Holographic-Optical-Element,** Jisoo Hong[1], Jiwoon Yeom[2], Youngmin Kim[1], Joosup Park[1], Jaebum Cho[2], Sunghee Hong[1], Kwang-Mo Jung[1], Hoonjong Kang[1], Byoungho . Lee[2]; [1]*Realistic Media Platform Research Center, Korea Electronics Technology Inst., Korea;* [2]*School of Electrical Engineering, Seoul National Univ., Korea.* Holographic-optical-element which has freely designed optical functionality can be printed out by holographic-wavefront-printer without the aid of any physical reference. We show that the printed holographic-optical-element can be successfully applied for see-through three-dimensional display.

**DW4A.3 • 16:45**
**Reduction of Specular Reflection Problem in Three-Dimensional Display for Video Teleconference,** Jiseob Yoon[1], Changhwan Park[1], Sungjin Lim[1], Joonku Hahn[1]; [1]*School of Electronics Engineering, Kyungpook National Univ., Korea.* In our three-dimensional teleconference system, we proposed two practical methods to reduce the specular reflection problem. One is to change the optical path with a beamsplitter and the other is to insert the optical films.

**DW4A.4 • 17:00**
**Synchronized Rendering of Super-multiview Videos for the Frontal Projection Three-dimensional Display,** Yuli Wang[1], Xinzhu Sang[1], Kuiru Wang[1], Binbin Yan[1], Chongxiu Yu[1]; [1]*Beijing Univ. of Posts and Telecommunications, China.* Distributed high speed and fully-synchronized rendering of super-multiview videos for a frontal projection system based on a projector array is demonstrated. Experimental result shows a stable frame-rate at 60 frame- per-second could be achieved.

**DW4A.5 • 17:15**
**Analysis of an effect of the un-sampled area on the perceived image quality in the spatial interlacing 3D display,** Minyoung Park[1], Hee-Jin Choi[1]; [1]*Sejong Univ., Korea.* In this paper, the effect of the un-sampled area in the spatial interlacing 3D display is analyzed using the 2AFC method and a mirror stereoscope to optimize the perceived image quality.

**DW4A.6 • 17:30**
**Spatiotemporal-multiplexing super-multiview display technology based on planar-aligned *OLED* microdisplay,** Dongdong Teng[1], Yi Xiong[1], Zhiyong Pang[1], Lilin Liu[1]; [1]*Sun Yat-Sen Univ., China.* A super multi-view display technology based on planar-aligned *OLED* microdisplays is proposed. Through combining time-multiplexing with the spatial-multiplexing, a prototype system is demonstrated to present 40 parallax views by only 10 *OLED* micro-displays.

**DW4A.7 • 17:45**
**Full-Parallax Colorful 3-D Imaging Using Orthogonal-Stacked Lenticular Sheets and Computer-Generated Stereogram,** Huadong Zheng[1], Xiaoqian Lu[1], Fa Wu[1], Tao Sun[1], Zhenxiang Zeng[1], Hongyue Gao[1], Yingjie Yu[1]; [1]*Shanghai Univ. , China.* This paper proposes a full-parallax colorful three-dimensional (3D) imaging method based on orthogonal-stacked lenticular sheets (OLSs) and computer-generated stereogram. Colorful 3D image with full-parallax is observed by matching the printed stereogram with the OLS.

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**18:00 — 18:30 • Beverage Break,** *Multi-Functional Conference Hall Foyer*

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**18:30 — 20:30**

## DW5A • 3D Imaging and Display Systems IV, *Multi-Functional Conference Hall*

*Presider: Hiroshi Yoshikawa; Nihon Univ., Japan*

DW5A.1 • 18:30

**Depth Extraction from Full-parallax Multiview Images,** Vladimir V. Saveliev[1,2], Sung-Kyu Kim[1]; [1]*Korea Inst. of Science & Technology, Korea;* [2]*Hanyang Univ., Korea.* The full-parallax multi-view images of geometric structures are generated from the reference functions (voxel patterns). The computer-generated images of wireframe three-dimensional objects are analyzed qualitatively in order to extract the spatial information.

DW5A.2 • 18:45

**Depth Analysis For Multi-Layered 3-D Display,** Hogil Baek[1], Young Min Kim[1], Sung-Wook Min[1]; [1]*Kyung Hee Univ. , Korea.* Multi-layered 3D displays consist of multiple layers to represent 3D image. In this paper, we analyze beam waists using computer simulation when an active-type lamina 3D display reconstructs 3D images in order to determine influencing relationship between depth and minimum-beam waist.

DW5A.3 • 19:00

**A novel computer-generated hologram achieving scheme using point cloud based on integral imaging pickup system,** Wei-Na Li[1], Mei-Lan Piao[1], Sang-Keun Gil[2], Nam Kim[1]; [1]*Chungbuk National Univ., Korea;* [2]*Suwon Univ., Korea.* We proposed a novel scheme to achieve a computer-generated hologram based on integral imaging pickup system.A more continues depth map can be obtained and a clearer display of the 3D scene can be presented. Moreover, the inherent drawback pseudoscopic problem of integral imaging can also be overcome.

DW5A.4 • 19:15

**Real-Time Calculation and Reconstruction of Computer-Generated Holograms for Aerial Projection System Based on Electro-Holography with Parabolic Mirrors,** Takashi Kakue[1], Atsushi Yoshida[1], Tetsuya Kawashima[1], Keisuke Suzuki[1], Takashi Nishitsuji[1], Tomoyoshi Shimobaba[1], Tomoyoshi Ito[1]; [1]*Chiba Univ., Japan.* We report the aerial projection system based on electro-holography with two parabolic mirrors. We succeeded in reconstructing a three-dimensional motion picture at the rate of 29 frames per second by a graphics processing unit.

DW5A.5 • 19:30

**Reflection Image-plane Conical Multiplex Holography using Optical System with Curved Object Plane,** Yih-Shyang . Cheng[1]; [1]*National Central Univ., Taiwan.* With both recording film and input object bent as partial cones during holographic recording, conical multiplex hologram can be fabricated. Procedure in preparing distorted input information is described. Experimental result is supported by theoretical simulation.

DW5A.6 • 19:45

**Simplified Modal Method For Holographic Grating,** Shubin Li[1], Changhe Zhou[1], Shaoqing Wang[1], Hongchao Cao[1], Wei Jia[1], Jun Wu[1]; [1]*Shanghai Inst of Optics & Fine Mechanics, USA.* we present the simplified modal method for the holographic grating, which is a physical insight method. The difficult diffraction process can be vividly interpreted by this simple method.

DW5A.7 • 20:00

**Design of a Diffractive Projection Apparatus for Volumetric Three-Dimensional Display,** Wei-Feng Hsu[1], Chun-Hao Lee[1], Tai-Yuan Chen[1], Ming-Hong Weng[1]; [1]*National Taipei Univ. of Technology, Taiwan.* We present designs of volumetric 3D display system using an LCOS SLM as input device, a 3D cube as static screen, and a mirascope as 3D display to provide viewers true perception of 3D scenes.

DW5A.8 • 20:15

**Empirical Equations For Sub-Wavelength Fused-Silica Gratings,** Zhumei Sun[1], Changhe Zhou[1], Hongchao Cao[1], Jun Wu[1], Wei Jia[1], Shaoqing Wang[1]; [1]*Shanghai Inst. of Optics and Fine Me, China.* Two empirical equations are presented to reveal the restrictions on relative grating parameters for 1×2 beam splitter of dielectric rectangular transmission gratings under second Bragg incidence for TE polarized light.

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**20:30 — 21:30 • Dinner Provided,** *The Canteen*

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**08:00 — 16:00 • Registration,** *Multi-Functional Conference Hall Foyer*

## 08:00 — 10:00
## DTh1A • Applications of DH I, *Multi-Functional Conference Hall*
*Presider: Wolfgang Osten; Institut für Technische Optik, Germany*

DTh1A.1 • 08:00 Invited
**Optical Near-field Processes and Their Applications to Intelligence and Volumetric Display,** Makoto Naruse[1]; [1]*National Inst Information & Comm Tech, Japan*. Optical near-field interactions occurring in the subwavelength scale provide interesting functionalities for intelligence and display applications. Here we show some of recent research regarding solution searching, magic mirror, and volumetric display based on near-field processes.

DTh1A.2 • 08:30
**Dynamic Dehydration Observation Based on Terahertz In-line Digital Holography,** Lu Rong[1], Tatiana Latychevskaia[2], Xun Zhou[3], Haochong Huang[1], Dayong Wang[1], Yunxin Wang[1]; [1]*Beijing Univ. of Technology, China;* [2]*Univ. of Zurich, Switzerland;* [3]*CAEP, China.* We report here terahertz digital holography for dehydration observation of fresh-water algae. Temporal sequence of absorption images were obtained at the temporal resolution of 1 frame/sec.

DTh1A.3 • 08:45
**Resolution Enhancement in Terahertz Digital Holography,** Haochong Huang[1,3], Weihua Li[2], Lu Rong[1,3], Qinghua Deng[2], Bin Li[1,3], Min Wan[1,3], Yunxin Wang[1,3], Dayong Wang[1,3]; [1]*Beijing Univ. of Technology, China;* [2]*Chinese Academy of Engineering Physics, China;* [3]*Beijing Engineering Research Center of Precision Measurement & Control Technology and Instruments, China.* We built the experimental setup of terahertz in-line digital holography based on terahertz quantum cascade laser (QCL) source. The synthetic hologram was captured and the reconstructed results shown that observed resolution was 125 μm.

DTh1A.4 • 09:00
**GPU Accelerated Pre-calculation Algorithm for 3-D Multi-channel Holographic Display,** Fan Yang[1], Tim Wilkinson[1]; [1]*Univ. of Cambridge, UK*. The calculation speed for computer generated hologram (CGH) is increased dramatically by exploiting both pre-calculated point source and GPU parallel computing. In addition, the viewing angle can be increased by dividing hologram into different channels.

DTh1A.5 • 09:15
**Characterizing Spatio-Temporal Phase Variation Of Pixelated Liquid Crystal On Silicon Using Digital Holographic Microscopy,** Yu-Chih Lin[1], Han-Yen Tu[2], Chau-Jern Cheng[1]; [1]*National Taiwan Normal Univ., Taiwan;* [2]*Department of Electrical Engineering, Chinese Culture Univ., Taiwan*. A spatio-temporal measurement technique for observing the phase variation of the LCoS devices using digital holographic microscopy is proposed. The spatial distribution of phase variation in pixelated field was measured and characterized in millisecond scale.

DTh1A.6 • 09:30
**Digital Holography Based 3D Object Recognition Under Varying Light Illumination Using Photon Counting Imaging,** Dhirendra Kumar[1]; [1]*Indian Inst. of Technology Patna, India*. Three-dimensional (3D) object recognition using digital holography under varying light illumination has been demonstrated. The 3D reconstructed images obtained from digital hologram (DH) and photon limited DH are compared using nonlinear joint transform correlator.

DTh1A.7 • 09:45
**A New Compact Self-referenced Holographic Setup Tested on a Fluorescent Target,** Márton Zsolt Kiss[1,2]; [1]*MTA SZTAKI, Hungary;* [2]*PPKE ITK, Hungary*. We propose a new self-referenced holographic microscope setup based on a special bifocal lens. This setup can detect and visualize fluorescent objects. The new principle and the experimental results of the imaging are also presented.

**10:00 — 10:30 • Beverage Break/Exhibits,** *Multi-Functional Conference Hall Foyer*

## 10:30 — 12:30
## DTh2A • Applications of DH II, *Multi-Functional Conference Hall*
*Presider: Yongtian Wang; Beijing Inst. of Technology, China*

DTh2A.1 • 10:30
**The Quad-Cell Gradient Sensor for the Quantitative Determination of The Phase In Microscopy,** Ignacio Iglesias[1]; [1]*Universidad de Murcia, Spain.* This paper shows that the quad-cell sensing scheme allows the quantitative measure of the index distribution in microscopy and that, in digital holography, a similar approach can be implemented to circumvent the need for unwrapping.

DTh2A.2 • 10:45
**Multi Slice Elements Damage Detection With 3-D Ptychographical Iterative Engine,** Haiyan Wang[1], Cheng Liu[1], Xingchen Pan[1], Jiangqiang Zhu[1]; [1]*Shanghai Inst of Optics and Fine Mech, China.* 3D Ptychographical Iterative Engine(PIE) is used in damages detection of elements. By splitting elements into axial sections, the complex transmittance of each slice could be reconstructed simultaneously through iterative calculations with a resolution of 3.7μm.

DTh2A.3 • 11:00
**Reconstruction of Axisymmetric Liquid Flow Field in Digital Holographic Interferometry,** Jianglei Di[1], Minru Li[1], Shan Kang[1], Yang Gao[1], Jiajun Li[1], Jianlin Zhao[1]; [1]*Northwestern Polytechnic Univ., China.* We present a hologram reconstruction algorithm based on Abel inversion in the paper and use this for measurement of axisymmetric liquid flow field in the thermocapillary migration process of droplets by using digital holographic interferometry.

DTh2A.4 • 11:15
**Quantitative Phase Imaging Of Drug Effect On The Deformability Of Malaria-Infected Red Blood Cells,** Hyeok Jun Byeon[1], Young-Ran Ha[1], Sang Joon Lee[1]; [1]*Pohang Univ of Science & Technology, Korea.* Employing quantitative phase imaging technique, the shear moduli of healthy RBC, RBC infected by Plasmodium falciparum (iRBC), drug-treated iRBC are compared. This study on antimalarial drug effects would be helpful for understanding the effects of drug on iRBCs.

DTh2A.5 • 11:30
**Measurement of 2D Refractive Index Distribution using Digital Holographic Interferometry based on Total Internal Reflection,** Jiwei Zhang[1], Jianglei Di[1], Teli Xi[1], Jianlin Zhao[1]; [1]*Key Laboratory of Space Applied Physics and Chemistry, Ministry of Education, and Shaanxi Key Laboratory of Optical Information Technology, School of Science, Northwestern Polytechnical Univ., Xi'an 710072, China, China.* Digital holographic interferometry based on total internal reflection is used to measure 2D refractive index distribution dynamically with large range and no calibration is required previously. Experimental implementation and results of mixed liquids are presented.

DTh2A.6 • 11:45
**Holographic Imaging Of Zebrafish Embryo Blood Flow With Dually Oriented Illumination Beams,** Daniel Alexandre[1], Georges Lutfalla[2], Michel Gross[1]; [1]*Laboratoire Charles Coulomb UMR 5221, CNRS-Université de Montpellier,, France;* [2]*Dynamique des Interactions Membranaires Normales et Pathologiques, UMR 5235, CNRS-Université de Montpellier, France.* An holographic laser Doppler scheme using two illumination beams is proposed to image blood vessel in fish embryo. The coincidence of the reconstructed images made for each illumination orientation leads to an accurate z sectioning.

DTh2A.7 • 12:00
**Optical Focusing through Scattering Media by Time-reversing the Diffused Complex Field by Using a Single SLM,** Qiang Yang[1,2], Xinzhu Sang[1], Liangcai Cao[2], Guofan Jin[2]; [1]*State Key Laboratory of Information Photonics and Optical Communications, Beijing Univ. of Posts and Telecomm, China;* [2]*State Key Laboratory of Precision Measurement Technology and Instruments, Tsinghua Univ., China.* To focus light through scattering media, time-reversing light is generated to reconstruct both the phase and amplitude of a simulated diffused wavefront by using a single phase-only SLM.

DTh2A.8 • 12:15
**Speckle-Based Volume Holographic Microscopy For Optically Sectioned Multi-Depths Fluorescent Imaging,** Hsi-Hsun Chen[1,3], Vijay R. Singh[2], yuan luo[3,4]; [1] *Graduate Inst. of Photonics and Optoelectronics, National Taiwan Univ., Taiwan;* [2]*Singapore-MIT Alliance for Research and Technology (SMART) Centre, Singapore;* [3]*Center for Optoelectronic Medicine, National Taiwan Univ., Taiwan;* [4]*Inst. of Medical Devices and Imaging, National Taiwan Univ., Taiwan.* The optically sectioned imaging techniques can provide good interpretation for fine features of volumetric sample. We report a speckle-based volume holographic microscopy to generate non-scanning, multi-depths images with good optically sectioned capability, validated with experiments.

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**12:30 — 14:00 • Lunch Provided,** *The Canteen*

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## 14:00 — 16:00
## DTh3A • Metrology and Profilometry, *Multi-Functional Conference Hall*
*Presider: Pascal Picart; LAUM CNRS Université du Maine, France*

**DTh3A.1 • 14:00**
**Long-Wave Infrared Digital Holographic Interferometry For Deformation Measurement Of The Segmented Detector Array Of The Space EUCLID Mission,** Jean-François Vandenrijt[1], Cédric Thizy[1], Florent Beaumont[2], José Garcia[2], Christophe Fabron[2], Laurent Martin[2], Thierry Maciaszek[2], Marc P. Georges[1]; *[1]Centre Spatial de Liège, Université de Liège, Belgium; [2]Laboratoire d'Astrophysique de Marseille, France.* Digital holographic interferometry in LWIR is used for following the deformation and relative movement of an assembly of detectors to be used in space. The setup is incorporated in a vacuum chamber for cryogenic testing.

**DTh3A.2 • 14:15**
**Simultaneous 3-D Location And Size Measurement Of Mixed Bubbles And Sand Particles In A Flow Using Interferometric Particle Imaging,** Lila Ouldarbi[1], Huanhuan Shen[1], Gaele Perret[2], Sebastien Coetmellec[1], Denis Lebrun[1], Gerard Gréhan[1], Marc . Brunel[1]; *[1]CNRS UMR 6614 CORIA, France; [2]UMR 6294 LOMC, France.* We present an original set-up to determine simultaneously the 3D positon and the size of bubbles and irregular sand particles in a flow. The characteristics of the irregular sand particles are obtained from the analysis of their speckle-like pattern.

**DTh3A.3 • 14:30**
**Characterizations of Near-Field Transparent Particle Holography Using Debye Series,** Yingchun Wu[2,1], Longchao Yao[1], Xuecheng Wu[1], Denis Lebrun[2], Sébastien Coëtmellec[2], Marc . Brunel[2], Renxian Li[3], Gerard Grehan[2]; *[1]State Key Lab. of Clean Energ. Utiliz., China; [2]UMR 6614/ CORIA, CNRS, France; [3]School of Sciences,Xidian Univ., China.* Effects of light with different scattering processes (diffraction, reflection, transmission, and refractions etc.), on the typical phenomena in the transparent particle holography in the near field are revealed with the Debye series decomposition.

**DTh3A.4 • 14:45**
**Interferometric Profiling Of Transparent Objects in Zero-Fringe Mode Using 2D Fan Wavelets,** Sam A. Dehaeck[1], Yannis Tsoumpas[1], Pierre Colinet[1]; *[1]Universite Libre de Bruxelles, Belgium.* Complex closed fringe images are analysed using a novel 2D Wavelet Transform based algorithm outperforming in speed the current state-of-the-art by 10 times and 'Windowed Fourier' techniques by up to 200 times.

**DTh3A.5 • 15:00**
**Real-Time Imaging Through Thin Scattering Layer and Looking Around The Opaque Surface,** Alok K. Singh[1], Dinesh N. Naik[1], Giancarlo Pedrini[1], Mitsuo Takeda[1], Wolfgang Osten[1]; *[1]Inst für Tech Optik, Univ. Stuttgart, Germany.* Retrieving the object information which is obscured by a diffused medium or hidden around the corner, in real-time, is a huge challenge and has vast range of applications. Here we propose two different techniques based on digital holography and intensity correlation to retrieve 3-D object from the scattered field.

**DTh3A.6 • 15:15**
**Reliability Improvement in Digital Holographic Particle Measurement,** Yuto Asai[1], Shigeru Murata[2], Yohsuke Tanaka[2]; *[1]Graduate School of Science and Technology, Kyoto Inst. of Technolgy, Japan; [2]Mechanical and System Engineering, Kyoto Inst. of Technology, Japan.* This paper investigates a method to improve reliability in digital holographic particle measurement. This method successfully separates particle images from speckle-like noise. The effect of this method is evaluated by numerical simulation.

**DTh3A.7 • 15:30**
**Curvature Measurement based on Talbot Effect and Image Moiré Interferometry,** Yen-Chang Chu[2], Jing-Heng Chen[1], Kun-Huang Chen[3]; *[1]Department of Photonics, Feng Chia Univ., Taiwan; [2]Ph.D. program of Electrical and Communications Engineering, Feng Chia Univ., Taiwan; [3]Department of Electrical Engineering, Feng Chia Univ., Taiwan.* A method for measuring the curvature of object is proposed based on Talbot effect and image moiré interferometry. To show the validity of this method, stainless steel balls were measured with resolution of $2.8X10^{-3}$ $mm^{-1}$.

**DTh3A.8 • 15:45**
**Three Dimensional Profile Measuring Method Based on Coupled Dammann Gratings,** Shaoqing Wang[1], Changhe Zhou[1], Shengbin Wei[1], Kun Liu[1], Fan Xin[2]; *[1]Shanghai Inst of Optics & Fine Mechanics, China; [2]ShanghaiTech Univ., China.* A novel measuring method of three-dimensional (3D) profile by using coupled Dammann gratings is proposed. The profile of a statue of Apollo with complex topology was measured and reconstructed.

## 16:00 — 17:00 • Postdeadline Papers, *Multi-Functional Conference Hall*
Postdeadline papers will also be announced on the update sheet.

## 17:00 — 18:00 • Dinner Provided, *The Canteen*

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