Digital Holography and Three-Dimensional Imaging (DH)

OSA Topical Meeting and Tabletop Exhibit

Collocated with:

Fourier Transform Spectroscopy (FTS)
Hyperspectral Imaging and Sensing of the Environment (HISE)
Novel Techniques in Microscopy (NTM)
Optical Trapping Applications (OTA)

Technical Conference: April 26-30, 2009
Exhibition: April 27-29, 2009
Sheraton Vancouver Wall Centre Hotel
Vancouver, BC, Canada

PDP Submissions Deadline: April 2, 2009, 12:00 p.m. noon, EDT (16.00 GMT)
Housing Deadline: March 25, 2009
Pre-Registration Deadline: April 1, 2009

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Byoungho Lee, *Seoul National Univ.*, *Korea,* **General Chair**
Hiroshi Yoshikawa, *Nihon Univ.*, *Japan,* **General Co-Chair**

About Digital Holography and Three-Dimensional Imaging

The topical meeting on Digital Holography and Three-Dimensional Imaging provides a forum for disseminating the science and technology of holographic interferometry for deformation or contour measurement, new technologies for phase unwrapping, 3-D optical remote sensing, 3-D holographic microscopy, 3-D optical image processing, 3-D display, and digital holography for life science or nanophotonics applications.

Topics to Be Considered

- Digital holography theory and systems
- Diffractive optics
- Optical data storage
- Phase unwrapping and phase retrieval
- Computer generated holograms
- Spatial light modulators for holography
- Incoherent digital holography
- Holographic optical elements
- 2-D and 3-D pattern recognition
- Optical correlators
- Three-dimensional imaging and processing
- Three-dimensional display
- Stereo-matching and stereoscopic cameras
- 2-D-3-D content conversion
- Shape and deformation measurement
- Polarization analysis
- Holographic imaging and microscopy
- Holographic nanofabrication methods
- Holographic optical micro-manipulation

About Digital Holography and Three-Dimensional Imaging

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Exhibitor Listings

ADVANCES in IMAGING

2009 OSA OPTICS AND PHOTONICS CONGRESS

April 26-30, 2009
Vancouver, BC
Canada

Collated Meetings:

Digital Holography and Three-Dimensional Imaging (DH)

Fourier Transform Spectroscopy (FTS)

Hyperspectral Imaging and Sensing of the Environment (HISE)

Novel Techniques in Microscopy (NTM)

Optical Trapping Applications (OTA)

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The organizers of the Advances in Imaging Congress and Tabletop Exhibit wish to acknowledge the following for their support:

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- National Institute of Biomedical Imaging and Bioengineering/Department of Health and Human Services / National Institutes of Health
- The OSA Foundation

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Special Events

Meet the Applied Optics Editors Dinner

Date: April 28, 2009
Time: 7:00 PM
Where: The Relish Restaurant & Lounge, 888 Nelson ST. (Between Hornby & Howe), Vancouver, BC, Canada (Website: http://www.relishrestaurants.com/relish/index.asp).

Don’t miss this great opportunity to meet Applied Optics Information Processing Editors:

Prof. T.-C. Poon (Division Editor, Virginia Tech)
Prof. Partha P. Banerjee (Topical Editor, Univ. of Dayton)
Prof. Byoungho Lee (Topical Editor, Seoul National Univ., Korea)

All conference attendees, especially students, are invited to this casual networking dinner. You can sign-up onsite at the OSA Registration Desk at the Grand Ballroom Foyer Coatroom. Please RSVP by Tuesday, April 28 by 1:00 pm. **Please note: Participants pay for their own dinners.**

2009 OSA Optics & Photonics Congress
Advances In Imaging
April 26-30, 2009
Vancouver, British Columbia, Canada

OSA GROUP DINNER

Have Dinner with *Applied Optics* Editors

Students are Welcome!

All OSA conference attendees are invited to a casual networking dinner where you will have the opportunity to meet *Applied Optics Information Processing* Editors:

Prof. T.- C. Poon (Division Editor, Virginia Tech)
Prof. Partha P. Banerjee (Topical Editor, Univ. of Dayton)
Prof. Byoungho Lee (Topical Editor, Seoul National Univ., Korea)

Tuesday, April 28, 2009, 7:00 p.m.

THE RELISH RESTAURANT & LOUNGE
888 Nelson St. (between Hornby & Howe) Vancouver, BC
Website: http://www.relishrestaurants.com/relish/index.asp

Sign up at the OSA Registration Desk
[Grand Ballroom Foyer, Coat Room]
by 1:00 p.m. on Tuesday, April 28

Note: Participants pay for their own dinners

Sponsored by the OSA External Relations Advisory Group

Invited Speakers

Digital Holography and Three-Dimensional Imaging (DH) / Novel Techniques in Microscopy (NTM) Joint Session

Digital Holography for MEMS Application, Anand Asundi, Vijay Raj Singh; *Nanyang Technological Univ., Singapore.*

Image Formation in Holographic Microscopy and Tomography, Colin Sheppard; *Data Storage Inst., Singapore.*

Digital Holography with Multiple-Plane Phase-Error Correction, Abbie E. Tippie, James R. Fienup; *Univ. of Rochester, USA.*

Digital Holography and Three-Dimensional Imaging (DH) / Optical Trapping Applications (OTA) Joint Session

Three-Dimensional Imaging by Three-Dimensional Point Spread Function Encoding, Rafael Piestun; *Univ. of Colorado at Boulder, USA.*

Optoelectronic Trapping of Cells, Nanowires, and Nanoparticles, Ming C. Wu; *Univ. of California at Berkeley, USA.*

Plenary Speakers

Principles and Applications of Phase-Shifting Digital Holography, Ichirou Yamaguchi[1,2]; [1]*Toyo Seiki Seisaku-sho, Ltd., Japan,* [2]*Scientist Emeritus of RIKEN, Japan.*

Tutorials

Increased Flexibility for Optical Metrology by Digital Holography, Wolfgang Osten; *Univ. of Stuttgart, Germany.*

Optical Scanning Holography, Ting-Chung Poon; *Virginia Tech, USA.*

Computer-Generated Holography; Principles and Applications, Toyohiko Yatagai; *Utsunomiya Univ., Japan.*

Invited Speakers

Digital Holography for MEMS Application, Anand Asundi, Vijay Raj Singh; *Nanyang Technological Univ., Singapore.*

Deflectometry Challenges Interferometry: 3-D-Metrology from Nanometer to Meter, Gerd Haeusler; *Univ. of Erlangen-Nuremberg, Germany*

Real-Time Computation for Electro-Holography, Tomoyoshi Ito[1], Tomoyoshi Shimobaba[2]; [1]*Chiba Univ., Japan,* [2]*Yamagata Univ., Japan.*

Dynamic Holography, Nickolai V. Kukhtarev; *Alabama A&M Univ., USA.*

Applications of Computer Generated Holograms, Wai-Hon Lee; *Hoetron, USA.*

Acquisition and Manipulation of the Three-Dimensional Information Based on Integral Imaging, Jae-Hyeung Park; *Chungbuk Natl. Univ., Republic of Korea.*

Harmonic Holography, Demitri Psaltis; *Ecole Polytechnique Fédérale de Lausanne (EPFL), Switzerland.*

Digital Holographic Encryption, Kehar Singh; *Indian Inst. of Technology, Delhi, India.*

The 3-D Imaging Researches and Activities in Taiwan, Chao-Hsu Tsai; *Industrial Technology Res. Inst., Taiwan.*

	Grand Ballroom A	*Junior Ballroom D*	*Junior Ballroom C*	*Grand Ballroom B*	*Junior Ballroom A/B*
Sunday, April 26					
3:00 p.m.–6:00 p.m.	**Registration Open,** *Grand Ballroom Foyer Coatroom*				
Monday, April 27					
7:30 a.m.–6:30 p.m.	**Registration Open,** *Grand Ballroom Foyer Coatroom*				
8:30 a.m.–10:30 a.m.	**DMA • Advances in Digital Holography**	**JMA • FTS/HISE Joint Session**		**NMA • Superresolution I**	**OMA • Transport, Guiding and Sorting**
10:30 a.m.–11:00 a.m.	**Coffee Break,** *Grand Ballroom C/D*				
10:30 a.m.–4:30 p.m.	**Exhibits Open,** *Grand Ballroom C/D*				
11:00 a.m.–12:30 p.m.	**DMB • Novel Technologies in Holography (ends at 1:00 p.m.)**	**FMA • James W. Brault Memorial Session**	**HMA • Climate Absolute Radiance and Refractivity Observatory**	**NMB • Superresolution II**	**OMB • Physics Insights by Means of Optical Trapping I**
12:30 p.m.–2:00 p.m.	**Lunch Break (on your own)**				
2:00 p.m.–4:00 p.m.	**JMB • DH/OTA Joint Session**	**FMB • Combs and Static FTS**	**HMB • Clouds and Aerosols I**	**NMC • Nonlinear Microscopy I**	
4:00 p.m.–4:30 p.m.	**Coffee Break/Exhibits,** *Grand Ballroom C/D*				
4:30 p.m.–6:00 p.m.	**DMC • Metrology by Digital Holography and Profilometry (ends at 6:15 p.m.)**	**FMC • Space and Flight Projects**	**HMC • Future Missions and Sensor Calibration**	**NMD • Nonlinear Microscopy II**	**OMC • Physics Insights by Means of Optical Trapping II**
6:30 p.m.–8:00 p.m.	**Conference Reception,** *Junior Ballroom Foyer*				
Tuesday, April 28					
7:30 a.m.–6:30 p.m.	**Registration Open,** *Grand Ballroom Foyer Coatroom*				
8:30 a.m.–10:30 a.m.	**JTuA • DH/NTM Joint Session: Digital Holographic Microscopy**	**FTuA • FTS for Astronomy and Astrophysics**	**HTuA • Interpretation of Hyperspectral/Multispectral Data Through Observations and Simulations**		**OTuA • Biophotonics Applications**
10:30 a.m.–11:00 a.m.	**Coffee Break,** *Grand Ballroom C/D*				
10:30 a.m.–6:00 p.m.	**Exhibits Open,** *Grand Ballroom C/D*				
11:00 a.m.–12:30 p.m.	**DTuA • Holographic Microscopy**	**FTuB • Combs, Optical Fiber and Fast-Scanning**	**HTuB • Particle Scattering Models**	**NTuA • Phase Microscopy and Tomography**	**OTuB • Novel Uses and Applications**
12:30 p.m.–2:00 p.m.	**Lunch Break (on your own)**				
2:00 p.m.–4:00 p.m.	**DTuB • Holography Applications**	**FTuC • Gosat and Akari**	**HTuC • New Remote Sensing Perspectives**	**NTuB • Optical Coherence Tomography**	**OTuC • Dynamics of Multiple and Parallel Trapping (ends at 3:30 p.m.)**
4:00 p.m.–4:30 p.m.	**Coffee Break/Exhibits,** *Grand Ballroom C/D*				
4:30 p.m.–6:00 p.m.	**JTuB • DH/FTS/HISE/NTM/OTA Joint Poster Session,** *Grand Ballroom C/D*				
6:00 p.m.–6:45 p.m.	**DTuC • Optical Scanning Holography**				

	Grand Ballroom A	*Junior Ballroom D*	*Junior Ballroom C*	*Grand Ballroom B*	*Junior Ballroom A/B*
Wednesday, April 29					
7:30 a.m.–6:30 p.m.	**Registration Open,** *Grand Ballroom Foyer Coatroom*				
8:30 a.m.–10:30 a.m.	**DWA • Three-Dimensional Imaging and Display**	**FWA • Earth Sensing**	**HWA • Hyperspectral IR and Imager Data Analyses (ends at 10:00 a.m.)**	**NWA • New Techniques I**	
10:30 a.m.–11:00 a.m.	**Coffee Break,** *Grand Ballroom C/D*				
10:30 a.m.–12:30 p.m.	**Exhibits Open,** *Grand Ballroom C/D*				
11:00 a.m.–12:30 p.m.	**DWB • DH Poster Session,** *Grand Ballroom C/D*				
11:00 a.m.–12:30 p.m.		**FWB • Visible and Ultra Violet**	**HWB • Clouds and Aerosols II**	**NWB • Superresolution III**	
12:30 p.m.–2:00 p.m.	**Lunch Break (on your own)**				
2:00 p.m.–4:00 p.m.	**DWC • Computer-Generated Holograms**	**FWC • Spatial Heterodyne**	**HWC • Validation of Cloud and Aerosol Products**	**NWC • Endomicroscopy**	
4:00 p.m.–4:30 p.m.	**Coffee Break,** *Grand Ballroom C/D*				
4:30 p.m.–6:30 p.m.	**DWD • Electro-Holography and Computer-Generated Holography**	**FWD • Laboratory and Miniature FTS (ends at 6:00 p.m.)**	**HWD • Hyperspectral Applications (ends at 6:00 p.m.)**	**NWD • New Techniques II (ends at 5:30 p.m.)**	
Thursday, April 30					
7:30 a.m.–10:30 a.m.	**Registration Open**, *Grand Ballroom Foyer Coatroom*				
8:30 a.m.–10:30 a.m.	**FThA • Spectral Imaging,** *Grand Ballroom A*				

Key to Shading	
DH Sessions	No Shading
FTS Sessions	
HISE Sessions	
NTM Sessions	
OTA Sessions	

Digital Holography and Three-Dimensional Imaging (DH) Abstracts

• Sunday, April 26, 2009 •

Grand Ballroom Foyer Coatroom
3:00 p.m.–6:00 p.m.
Registration Open

• Monday, April 27, 2009 •

Grand Ballroom Foyer Coatroom
7:30 a.m.–6:30 p.m.
Registration Open

DMA • Advances in Digital Holography

Grand Ballroom A
8:30 a.m.–10:30 a.m.
Myung K. Kim; Univ. of South Florida, USA, Presider

DMA1 • 8:30 a.m. Plenary
Principles and Applications of Phase-Shifting Digital Holography, *Ichirou Yamaguchi[1,2]; [1]Tokyo Seiki Seisakusho, Ltd., Japan, [2]Scientist Emeritus of RIKEN, Japan.* Phase-shifting digital holography provides the complex amplitude at the CCD plane directly and improves the quality of the reconstructed images. Basic procedures and applications for microscopy, imaging, and surface shape and deformation measurement are surveyed.

DMA2 • 9:15 a.m.
One-Shot Digital Holography for Real-Time Recording of Moving Color 3-D Images, *Kohei Maejima, Kunihiro Sato; Univ. of Hyogo, Japan.* A new method is developed for one-shot recording of the complex-amplitude hologram. This method is generalized for the reference light with general phase distribution, and the limitation of bandwidth is also discussed.

DMA3 • 9:30 a.m.
Fast Iterative Sectional Image Reconstruction in Optical Scanning Holography, *Xin Zhang[1], Edmund Y. Lam[1], T.-C. Poon[2]; [1]Univ. of Hong Kong, China, [2]Virginia Polytechnic Inst. and State Univ., USA.* Inverse imaging is a versatile technique for sectional image reconstruction in optical scanning holography. Now we develop a fast iterative method that circumvents the problem by taking advantage of the structures in the matrices.

DMA4 • 9:45 a.m.
Digital Reconstruction of Axially-Thick Potentials, *Christopher Barsi, Jason W. Fleischer; Princeton Univ., USA.* The holographic reconstruction of objects typically assumes that the object is axially thin. Here, we demonstrate a simple approach that works for axially-thick objects which evolve dynamically. Results are verified by reconstructing linear scattering experiments.

DMA5 • 10:00 a.m.
Application of Digital Micro-Mirror Devices to Spherical Reference Beam Digital in-Line Holography, *Adekunle A. Adeyemi, Thomas E. Darcie; Dept. of Electrical and Computer Engineering, Univ. of Victoria, Canada.* We describe a technique for programming the pinhole in digital in-line holography by addressing the elements of digital micro-mirror devices. Results show expansion of the view field by 35% and projection view of 3-D features.

DMA6 • 10:15 a.m.
High-Speed Contouring of an Adaptive Fluidic Lens with Two-Wavelength Single-Pulse Digital Holography, *Thomas Hansel[1], Günter Steinmeyer[1], Ruediger Grunwald[1], Uwe Griebner[1], Florian Schneider[2], Ulrike Wallrabe[2]; [1]Max Born Inst., Germany, [2]Dept. of Microsystems Engineering, Univ. of Freiburg, Germany.* Contouring of dynamic phase changes of a piezoelectrically driven fluidic lens with a temporal resolution of 410 frame/s is presented. Using a dual-wavelength few-ps source, optical path differences of several 10 μm are unambiguously detected.

Grand Ballroom C/D
10:30 a.m.–11:00 a.m.
Coffee Break/ Exhibits

DMB • Novel Technologies in Holography

Grand Ballroom A
11:00 a.m.–1:00 p.m.
Partha P. Banerjee; Univ. of Dayton, USA, Presider

DMB1 • 11:00 a.m. Invited
Dynamic Holography, *Nickolai V. Kukhtarev[1], T. Kukhtareva[1], P. Banerjee[2]; [1]Alabama A&M Univ., USA, [2]Univ. of Dayton, USA.* We will discuss novel types of the dynamic holographic interferometers as double-functional optical and electrical holographic single-pixel interferometer, analog and digital. Theoretical approach is compared with experimental results.

DMB2 • 11:30 a.m.
All Fourteen Bravais Lattices Can Be Fabricated by Two-Beam Holographic Lithography, *Yuzo Ono; Ritsumeikan Univ., Japan.* This paper proposes and experimentally shows that three-dimensional photonic crystals with all fourteen Bravais lattice structures and arbitrary lattice constant can be fabricated by triple recording of two-beam interference fringes in a photoresist.

DMB3 • 11:45 a.m.
Holographic and Dynamical Imaging of Weak Patterns in Noise, *Dmitry V. Dylov, Jason W. Fleischer; Princeton Univ., USA.* We consider reconstruction of low-level images hidden in intense noise by two nonlinear techniques: coherence gating via holography and coherence resonance via dynamical signal-noise coupling. The latter is a new type of threshold-less stochastic resonance.

DMB4 • 12:00 p.m.
Space-Bandwidth Transfer in Spherical Reference Holography Using Wigner Transforms, *Nick Loomis[1], George Barbastathis[1,2]; [1]MIT, USA, [2]Singapore-MIT Alliance for Res. and Technology Ctr., Singapore.* Wigner transforms are used to intuitively explain how spherical reference waves magnify object images. Limits for optimal spatial extent and spatial frequency are given for known (or estimated) space-bandwidth content.

DMB5 • 12:15 p.m.
Computer Generated Polarization Holograms with Defined Magnitude and Orientation of Each Pixel's Birefringence, *Markus Fratz[1,2], Dominik M. Giel[1], Peer Fischer[2]; [1]Fraunhofer Inst. for Physical Measurement Techniques, Germany, [2]Rowland Inst. at Harvard, USA.* We present polarization holograms with space-variant magnitude and orientation of the birefringence. They are fabricated in an Azobenzene thin-film and allow full control of the amplitude and phase of the diffracted fields.

DMB6 • 12:30 p.m.
New Concepts for Depth Resolved Holographic Imaging, *Nektarios Koukourakis[1], Christoph Kasseck[1], Nils C. Gerhardt[1], Martin R. Hofmann[1], Daniel Rytz[2], Sebastian Köber[3], Michael Salvador[3], Klaus Meerholz[3]; [1]Photonics and Terahertz Technology, Ruhr-Univ. Bochum, Germany, [2]FEE GmbH, Germany, [3]Inst. of Physical Chemistry, Univ. of Cologne, Germany.* We present two new depth resolved holographic imaging concepts. First, variable depth resolution is achieved by changing the tuning width of a tunable laser. Furthermore, a concept for single-shot recording of a 3-D-image is introduced.

DMB7 • 12:45 p.m.
Reconstruction of Holograms with Automatic Extraction of Distance Parameter, *Taegeun Kim[1], Ting-Chung Poon[2]; [1]Sejong Univ., Republic of Korea, [2]Virginia Tech., USA.* We show experimentally that the reconstruction of complex holograms recorded by optical scanning holography is possible without a searching process. We extract the distance parameter from the complex hologram by direct processing of the hologram.

1:00 p.m.–2:00 p.m.
Lunch Break (on your own)

JMB • DH/OTA Joint Session

Grand Ballroom A
2:00 p.m.–4:00 p.m.
Christian Depeursinge; École Polytechnique Fédérale de Lausanne, Switzerland, Presider

JMB1 • 2:00 p.m. Invited
Optoelectronic Trapping of Cells, Nanowires, and Nanoparticles, *Ming C. Wu; Univ. of California at Berkeley, USA.* The principle and recent experimental results of optoelectronic tweezers (OET) will be presented. Based on light-induced dielectrophoresis, OET can trap and sort colloidal particles, biological cells, nanowires and nanoparticles using a digital light projector.

JMB2 • 2:30 p.m. Invited
Three-Dimensional Imaging by Three-Dimensional Point Spread Function Encoding, *Rafael Piestun; Univ. of Colorado at Boulder, USA.* Pupil-encoded point spread functions are implemented for three-dimensional image data acquisition. These systems are passive and work under broadband illumination. Applications include nanolocalization of small emitters and machine vision.

JMB3 • 3:00 p.m. Invited
Optical Tweezers Shed Light on Cell Motility, *Eric Dufresne; Yale Univ., USA.* Optical tweezers are an elegant platform for the biochemical and mechanical stimulation of live cells. I will discuss the application of holographic optical tweezers to chemotaxis in neutrophils and mechanotransduction in neurons.

JMB4 • 3:30 p.m.
Motility-Contrast Imaging: Digital Holography of Cellular Motion in 3-D Tissues, *David D. Nolte, John Turek; Purdue Univ., USA.* We present the first three-dimensional assays of intrinsic cellular motion applied to tissues using motility contrast imaging (MCI), a new digital holographic imaging technique that detects sub-cellular motion as a novel fully-endogenous imaging contrast agent.

JMB5 • 3:45 p.m.
Application of 3-D Tracking, Multi-Wavelength Techniques and Color Imaging in Digital Holographic Microscopy, *Björn Kemper[1], Patrik Langehanenberg[1], Sebastian Kosmeier[1], Xiaoli Mo[1], Sabine Przibilla[1], Angelika Vollmer[1], Steffi Ketelhut[1], Jinghui Xie[2], Gert von Bally[1]; [1]Ctr. for Biomedical Optics and Photonics, Univ. of Muenster, Germany, [2]School of Information Science and Technology, Beijing Inst. of Technology, China.* In an overview results obtained by digital holographic microscopy demonstrate 3-D-tracking of cells without mechanical focus realignment, reduction of amplitude and phase noise by using multi-wavelength techniques and prospects for subsequent refocusing of color images.

Grand Ballroom C/D
4:00 p.m.–4:30 p.m.
Coffee Break/ Exhibits

DMC • Metrology by Digital Holography and Profilometry

Grand Ballroom A
4:30 p.m.–6:15 p.m.
Jae-Hyeung Park; Chungbuk Natl. Univ., Republic of Korea, Presider

DMC1 • 4:30 p.m. Tutorial
Increased Flexibility for Optical Metrology by Digital Holography, *Wolfgang Osten; Univ. of Stuttgart, Germany.* Abstract not available.

DMC2 • 5:15 p.m.
Depth Estimation and Optical Sectioning by Parallax Analysis, *Barak Katz, Joseph Rosen; Ben-Gurion Univ. of the Negev, Israel.* We present a blind method of optical sectioning for general three-dimensional imaging. A parallax analysis on multiple view projections of a white light illuminated three-dimensional scene yields undistorted slices along the optical axis.

DMC3 • 5:30 p.m.
Automatic 3-D Shape Measurement Noise Reduction for an Optical Profilometer, *Song Zhang, David Eisenmann, Scott Chumbley; Iowa State Univ., USA.* This paper presents a technique to automatically reduce the measurement noise of an optical profilometer. By approximating polynomials line-by-line horizontally and vertically, the bad measurement points are detected and fixed automatically.

DMC4 • 5:45 p.m. Invited
Deflectometry Challenges Interferometry: 3-D-Metrology from Nanometer to Meter, *Gerd Häusler[1,2], M. C. Knauer[1], C. Faber[1], C. Richter[1], S. Peterhänsel[1], C. Kranitzky[1], K. Veit[2]; [1]Univ. of Erlangen-Nuremberg, Germany, [2]3D-Shape GmbH, Germany.* We will discuss deflectometry from the physicist's and from the information theoretical point of view. The intrinsic features of deflectometry - incoherence, source encoding, high dynamical range, simplicity, and scalability- enable new sensors and unexpected applications.

Junior Ballroom Foyer
6:30 p.m.–8:00 p.m.
Conference Reception

NOTES

• Tuesday, April 28, 2009 •

Grand Ballroom Foyer Coatroom
7:30 a.m.–6:30 p.m.
Registration Open

JTuA • DH/NTM Joint Session: Digital Holographic Microscopy

Grand Ballroom A
8:30 a.m.–10:30 a.m.
Hiroshi Yoshikawa; Nihon Univ., Japan, Presider

JTuA1 • 8:30 a.m. Invited
Image Formation in Holographic Microscopy and Tomography
Colin Sheppard[1], Shan S. Kou[2]; [1]Div. of Bioengineering, Natl. Univ. of Singapore, Singapore, [2]Graduate School for Integrative Sciences and Engineering, Natl. Univ. of Singapore, Singapore. Coherent transfer functions for imaging in holographic microscopy and holographic tomography are discussed. For holographic microscopy, there is poor spatial frequency coverage, but it can be extended by illumination at a range of different angles.

JTuA2 • 9:00 a.m. Invited
Digital Holography for MEMS Application, *Anand Asundi[1], Vijay Raj Singh[2]; [1]Nanyang Technological Univ., Singapore, [2]Ngee Ann AEM Ctr. of Innovation, Singapore.* Studies on digital holographic microscopy for full field high resolution 3-D profiling of MEMS and micro-devices are presented. Applications for thin film thickness measurement and studies on a MEMS accelerometer are presented.

JTuA3 • 9:30 a.m.
Second Harmonic and Fundamental Wavelength Digital Holographic Microscopy, *Etienne Shaffer, Nicolas Pavillon, Jonas Kühn, Christian Depeursinge; École Polytechnique Fédérale de Lausanne, Switzerland.* We report on a new, multi-functional second harmonic generation digital holographic microscope that allows retrieval of an object complex diffraction wavefront at both second harmonic and fundamental wavelengths.

JTuA4 • 9:45 a.m.
Three-Dimensional Phase Images Using Photothermal Microscope Integrated with Digital Holographic Interferometry, *Srivathsan Vasudevan, George C. K. Chen, Andass C. K. Teu, Niladri B. Puhan, Zhiping Lin; Nanyang Technological Univ., Singapore.* Photothermal microscope (PTM), offering high resolutions (~ 40 nanometers and nanoseconds) provides temperature distribution within a cell. Integrating PTM with digital holography is proposed to obtain quantitative three-dimensional images aiding real-time monitoring of biological assays.

JTuA5 • 10:00 a.m. Invited
Digital Holography with Multiple-Plane Phase-Error Correction, *Abbie E. Tippie, James R. Fienup; Univ. of Rochester, USA.* We correct phase screens that introduce anisoplanatic blurring in digital holography. Numerical propagations of fields, avoiding non-physical aliasing, and a sharpness metric in a nonlinear optimization designed to overcome false oversharpening effects are described.

Grand Ballroom C/D
10:30 a.m.–11:00 a.m.
Coffee Break/ Exhibits

DTuA • Holographic Microscopy

Grand Ballroom A
11:00 a.m.–12:30 p.m.
George Barbastathis; MIT, USA, Presider

DTuA1 • 11:00 a.m. Invited
Harmonic Holography, *Chia-Lung Hsieh[1,2], Rachel Grange[1], Ye Pu[1,2], Demetri Psaltis[1,2]; [1] École Polytechnique Fédérale de Lausanne (EPFL), Switzerland, [2]Caltech, USA.* We demonstrate the three-dimensional imaging capability of harmonic holographic microscopy by using 30-nm $BaTiO_3$ particles. Three-dimensional distributions of nanoparticles in artificial structures and biological cells are recorded and interpreted from a digital hologram.

DTuA2 • 11:30 a.m.
Exploring Cell Dynamics with Digital Holographic Microscopy, *Benjamin Rappaz[1], Pascal Jourdain[1], Daniel Boss[2,3], Christian Depeursinge[2], Pierre Magistretti[1,3], Pierre Marquet[3]; [1]Brain Mind Inst., École Polytechnique Fédérale de Lausanne, Switzerland, [2]Lab d'Optique Appliquée, École Polytechnique Fédérale de Lausanne, Switzerland, [3]Univ. of Lausanne, Switzerland.* Quantitative phase signal (QPS) provided by digital holographic microscopy has permitted to investigate Cellular Membrane nano-Fluctuations (CMnF), of red blood cells as well as to perform an optical measurement of cell electrical activity.

DTuA3 • 11:45 a.m.
Tomography of Red Blood Cells by Multiple-Wavelength Digital Holographic Microscopy, *Jonas Kühn[1], Frédéric Montfort[2], Tristan Colomb[2], Benjamin Rappaz[3], Corinne Moratal[3], Nicolas Pavillon[1], Pierre Marquet[3], Christian Depeursinge[1]; [1]Lab of Applied Optics, École Polytechnique Fédérale de Lausanne, Switzerland, [2]Lyncée Tec SA, Switzerland, [3]Brain Mind Inst., École Polytechnique Fédérale de Lausanne (EPFL), Switzerland.* We present a method enabling cell-tomography by multiple-wavelength digital holographic microscopy. 20 reflection-holograms between 485 and 670 nm are sequentially acquired, then the wavefronts are summed to obtain 3-D tomographic reconstruction of red blood cells.

DTuA4 • 12:00 p.m.
Quantitative Phase Imagery with Total Internal Reflection Holographic Microscopy, *William M. Ash, Myung K. Kim; Univ. of South Florida, USA.* Total internal reflection holographic microscopy is used to produce quantitative phase images of biological specimens. Quantitative cellular images, algorithmic considerations and optomechanical implementation are presented and discussed. Applications include characterization of membranes, motility and metastasis.

DTuA5 • 12:15 p.m.
Recording of Wide Hologram for Microscopic Images with Large Depth Using One CCD, *Osamu Murata, Hiroyuki Toge, Kunihiro Sato; Univ. of Hyogo, Japan.* A new technology of the holographic microscope is developed for recording 3-D image with large depth. A number of holograms are recorded using one CCD, and are arranged for generating a wide hologram.

12:30 p.m.–2:00 p.m.
Lunch Break (on your own)

DTuB • Holography Applications

Grand Ballroom A
2:00 p.m.–4:00 p.m.
William Dallas; Univ. of Arizona,USA, Presider

DTuB1 • 2:00 p.m. Invited
Digital Holographic Encryption, *Anith Nelleri, Joby Joseph, Kehar Singh; Indian Inst. of Technology, Delhi, India.* We demonstrate that the experimental and computational degrees of freedom offered by digital holography can be used to secure three-dimensional (3-D) or complex data. Implications in the design of whole information security systems are presented.

DTuB2 • 2:30 p.m.
Digital Holographic Encryption Using Electrically Addressed Phase Key Masks, *Chau-Jern Cheng[1], Jin-Wen Chou[1], Yi-Ta Lee[1], Xin-Ji Lai[1], Han-Yen Tu[2,3], Jen-Shiun Chiang[3]; [1]Natl. Taiwan Normal Univ., Taiwan, [2]St. John's Univ., Taiwan, [3]Tamkang Univ., Taiwan.* This work describes a novel digital holographic Fresnel encryption scheme using computer-programmable random phase key masks, which are performed by electrically addressed liquid-crystal spatial light modulators for securing data via on-line optical processing.

DTuB3 • 2:45 p.m.
Holographic 3-D Visualization of Water Droplets, *Partha P. Banerjee[1], George Nehmetallah[1], Nickolai V. Kukhtarev[2], Sarat C. Praharaj[3]; [1]Univ. of Dayton, USA, [2]Alabama A&M Univ., USA, [3]DMS Technologies Inc., USA.* A digital holographic technique to visualize the shape, size and deformation of a water droplet in 3-D in static and dynamic modes is presented. Extension to water droplets in cloud/rain, and sand particles is discussed.

DTuB4 • 3:00 p.m.
Fingerprint Biometry Applications of Digital Holography and Low-Coherence Interference Microscopy, *Myung K. Kim, Mariana Potcoava; Univ. of South Florida, USA.* Two-dimensional latent images as well as three-dimensional images of finger print molds are produced using quantitative phase microscopy by digital holography, digital interference holography, and low-coherence interference microscopy.

DTuB5 • 3:15 p.m.
Spectral-Spatial Depth Sectioning of Biological Samples Using Silicon Oxide Nano-Particles Doped PQ-PMMA, *Yuan Luo[1], Paul Gelsinger[2], Jennifer Barton[2], George Barbastathis[1,3], Raymond Kostuk[2]; [1]MIT, USA, [2]Univ. of Arizona, USA, [3]Singapore-MIT Alliance for Res. and Technology Ctr., Singapore.* We use silicon oxide nanoparticles in PQ-PMMA to enhance the diffraction efficiency of angle multiplexed in-plane reference beam holograms. We experimentally demonstrate this technique in use for holographic spatial-spectral imaging filters and present experimental results.

DTuB6 • 3:30 p.m.
Localization of Microfibers within Volumes Using Digital Holographic Video, *Emmanouil Darakis[1,2], Michel Kempkes[3], Taslima Khanam[2], Arvind Rajendran[2], Vinay Kariwala[2], Thomas J. Naughton[1,4], Marco Mazzotti[3], Anand K. Asundi[2]; [1]Natl. Univ. of Ireland, Maynooth, Ireland, [2]Nanyang Technological Univ., Singapore, [3]ETH Zurich, Switzerland, [4]Univ. of Oulu, Finland.* Carbon fibers are studied using digital holographic sequences. Fibers have distinct orientation in space. An algorithm to identify the orientation and the size of suspended fibers from the digitally recorded holographic sequences is presented.

DTuB7 • 3:45 p.m.
Real-Time Fringe Pattern Generation with High Quality, *Hoonjong Kang[1], Fahri Yaraş[1], Levent Onural[1], Hiroshi Yoshikawa[2]; [1]Bilkent Univ., Turkey, [2]Nihon Univ., Japan.* A hologram computation procedure and its GPU implementation are presented. The procedure is based on partitioning. Each segment has an approximate but simpler frequency domain representation. Quality of the results is comparable to Fresnel holograms.

Grand Ballroom C/D
4:00 p.m.–4:30 p.m.
Coffee Break/ Exhibits

JTuB • DH/FTS/HISE/NTM/OTA Joint Poster Session

Grand Ballroom C/D
4:30 p.m.–6:00 p.m.

JTuB1
Holographic Microscopy Based on Phase Shifting Interferometry and Twin-Image Analysis to Measure Optical Field of Plasmonic Beaming Light, *Yongjun Lim, Joonku Hahn, Byoungho Lee; Seoul Natl. Univ., Republic of Korea.* We propose a holographic microscopy based on phase shifting interferometry and detect the optical far-field distribution of plasmonic off-axis light beaming. The twin-image analysis in spatial frequency domain is adopted to reconstruct optical fields.

JTuB2
Single-Shot Optical-Path-Length-Shifting Digital Holography, *Yasuhiro Awatsuji[1,2], Takamasa Koyama[1], Tatsuki Tahara[1], Kenichi Ito[1], Yuki Shimozato[1], Takeshi Wakamatsu[1], Atsushi Kaneko[1], Kenzo Nishio[1], Shogo Ura[1], Toshihiro Kubota[3], Osamu Matoba[4]; [1]Kyoto Inst. of Technology, Japan, [2]JST, Japan, [3]Kubota Holography Lab Corp., Japan, [4]Kobe Univ., Japan.* The authors propose a single-shot in-line digital holography that can record two interference-fringe images generated at different planes using an image sensor. The technique was successfully demonstrated by numerical simulation and preliminary experiment.

JTuB3
Optical Image Multiplexing Encryption Using Digital Holography in a JTC Architecture, *Edgar Rueda[1], John F. Barrera[1], Rodrigo Henao[1], Roberto Torroba[2]; [1]Univ. de Antioquia, Colombia, [2]Univ. de la Plata, Argentina.* An optical scheme that uses a digital holographic technique in a joint transform correlator architecture to encrypt and decrypt images is presented. A filtering procedure is implemented to improve the multiplexing capabilities of the system.

JTuB4
Advances in Quarduature-Phase-Shifting Digital Holography, *Jung-Ping Liu[1], Ting-Chung Poon[2]; [1]Dept. of Photonics, Feng Chia Univ., Taiwan, [2]Bradley Dept. of Electrical and Computer Engineering, Virginia Tech, USA.* We present a technique called two-step-only quadrature phase-shifting holography in which solely two holograms are required to reconstruct a complex amplitude of the object. Neither reference wave intensity nor an object wave intensity is needed.

JTuB5
Mask-Based Vision Systems by Use of the Wigner Distribution Function and Ambiguity Function, *Se Baek Oh[1], Ramesh Raskar[2], Douglas Lanman[3], George Barbastathis[1]; [1]MIT, USA, [2]MIT Media Lab, USA, [3]Brown Univ., USA.* We analyze complex pupils in mask-based vision systems using the Wigner Distribution Function and Ambiguity Function. The amplitude and phase variations behave differently; this formulation provides a novel approach to the design of imaging systems.

JTuB6
3-D Selective Imaging of Sound Sources in Air from 1-D Laser Vibrometry Measurements, *Erik Olsson, Mikael Sjödahl; Luleå Univ. of Technology, Sweden.* Digital holographic and tomographic reconstruction algorithms have been used for imaging of sound sources. Making the tomographic reconstruction first produces images with higher quality. Higher resolution and selective imaging is obtained by using multiple frequencies.

JTuB7
On-Axis Phase-Shifting Profilometry with Two Spatial Frequencies Using Concentric-Circular Patterns, *Eun-Hee Kim, Joonku Hahn, Byoungho Lee; Seoul Natl. Univ., Republic of Korea.* On-axis phase-shifting profilometry with two spatial frequencies is proposed. The carrier frequency results from the difference in positions of camera and projector on common axis. We use concentric-circular patterns to extract the depth of objects.

Posters JTuB8–JTuB16 can be found in the FTS abstracts section.
Posters JTuB17–JTuB21 can be found in the HISE abstracts section.
Posters JTuB22–JTuB29 can be found in the NTM abstracts section.
Posters JTuB30–JTuB35 can be found in the OTA abstracts section.

DTuC • Optical Scanning Holography

Grand Ballroom A
6:00 p.m.–6:45 p.m.
Mikael Sjödahl; Luleå Univ. of Technology, Sweden, Presider

DTuC1 • 6:00 p.m. Tutorial
Optical Scanning Holography, *Ting-Chung Poon; Virginia Tech, USA.* Abstract not available.

• Wednesday, April 29, 2009 •

Grand Ballroom Foyer Coatroom
7:30 a.m.–6:30 p.m.
Registration Open

DWA • Three-Dimensional Imaging and Display

Grand Ballroom A
8:30 a.m.–10:30 a.m.
Sung-Kyu Kim; Korea Inst. of Science and Technology, Republic of Korea, Presider

DWA1 • 8:30 a.m. Invited
Acquisition and Manipulation of the Three-Dimensional Information Based on Integral Imaging, *Jae-Hyeung Park; Chungbuk Natl. Univ., Republic of Korea.* Integral imaging provides a useful tool for dealing with the three-dimensional information of the object space. Various approaches to acquire and manipulate the three-dimensional information based on integral imaging principle are presented.

DWA2 • 9:00 a.m.
Joint Source-Channel Coding for Transmitting Digital Holographic Data over Noisy Channel, *Li-Chien Lin[1], Ho-En Liao[1], Kuo-Kuei Lin[2]; [1]Dept. of Communications Engineering, Feng Chia Univ., Taiwan, [2]Dept. of Information Engineering and Computer Science, Feng Chia Univ., Taiwan.* We propose a joint source-channel coding (JSCC) scheme to minimize the end-to-end image distortion within a given transmission rate. The optimal quantizer and Rate-compatible punctured code are employed before the transmission of the holographic data.

DWA3 • 9:15 a.m.
Depth Conversion Method in Curved Integral Imaging System Using a Large Aperture Lens, *Yongri Piao[1], Dong-Hak Shin[2], L. Liliana[2], Eun-Soo Kim[1]; [1]Kwangwoon Univ., Republic of Korea, [2]Dongseo Univ., Republic of Korea.* We propose a computational method of depth conversion in curved integral imaging system using a large-aperture lens. The proposed method can be implemented by a simple pixel transform without information loss of elemental images.

DWA4 • 9:30 a.m.
Real-Time Multiple SLM Color Holographic Display Using Multiple GPU Acceleration, *Fahri Yaraş, Hoonjong Kang, Levent Onural; Bilkent Univ., Turkey.* A real-time color holographic video display system computes holograms from point cloud of a rigid object by using multi-GPU system and uses three different colored LEDs for reconstruction. Experimental results are satisfactory.

DWA5 • 9:45 a.m.
Calibration of Elemental Images in Integral Photography Capture for Electric Holography, *Kenji Yamamoto, Tomoyuki Mishina, Makoto Okui; NICT, Japan.* Calibration of elemental images in integral photography is necessary for high quality imaging. We introduce our live electronic holography initially, and mention our calibration. We will show reconstructed objects both with and without our calibration.

DWA6 • 10:00 a.m. Invited
The 3-D Imaging Researches and Activities in Taiwan, *Chao-Hsu Tsai; Industrial Technology Res. Inst., Taiwan.* More and more companies, research institutes, and universities are throwing in the development of the related technologies. In this paper, the recent researches and activities of 3-D imaging technologies in Taiwan are presented.

Grand Ballroom C/D
10:30 a.m.–11:00 a.m.
Coffee Break/ Exhibits

DWB • DH Poster Session

Grand Ballroom C/D
11:00 a.m.–12:30 p.m.

DWB1
Improved Three-Dimensional Depth Extraction Using Super Resolved Elemental Image Set, *Keehoon Hong[1], Jisoo Hong[1], Jin-mo Kang[1], Jae-Hyun Jung[1], Jae-Hyeung Park[2], Byoungho Lee[1]; [1]Seoul Natl. Univ., Republic of Korea, [2]Chungbuk Natl. Univ., Republic of Korea.* We proposed a new method to improve depth extraction in integral imaging using super-resolution algorithm. Simulation results show the extractable depth resolution is enhanced after the super-resolution procedure.

DWB2
Laser Based Method for Real-Time Three-Dimensional Monitoring of Chest Wall Movement, *Matija Jezersek[1], Matjaz Flezar[2], Janez Mozina[1]; [1]Univ. of Ljubljana, Slovenia, [2]Univ. Clinic Golnik, Slovenia.* Novel method for monitoring three-dimensional chest wall movement is presented. It is based on laser multiple-line triangulation technique. The measuring frequency is 80Hz. The method was developed for training persons with breathing diseases.

DWB3
Design and Fabrication of Computer Generated Holograms for Fresnel Domain Lithography, *Jose A. Dominguez-Caballero[1], Satoshi Takahashi[1], Sung J. Lee[2], George Barbastathis[1,3]; [1]MIT, USA, [2]Samsung Electronics Co. Ltd., Republic of Korea, [3]Singapore-MIT Alliance for Res. and Technology Ctr., Singapore.* An optimization algorithm for the design of Fresnel domain computer-generated holograms for

lithographic applications is presented. The holograms are fabricated experimentally and their performance characterized. A sensitivity analysis is performed to estimate potential fabrication errors.

DWB4
The Wigner Distribution Function of Volume Holographic Optical Elements, *Se Baek Oh[1], George Barbastathis[1,2]; [1]MIT, USA, [2]Singapore-MIT Alliance for Res. and Technology Ctr., Singapore.* We present the Wigner Distribution Function of volume holographic optical elements by adopting a linear-systems approach. Specifically, the Wigner Distribution Function of a volume holographic optical element recorded by two plane waves is derived analytically.

DWB5
Extended Depth-of-Field and 3-D Information Extraction in Digital Holographic Microscopy, *Isabelle Bergoënd[1], Tristan Colomb[2], Nicolas Pavillon[1], Yves Emery[2], Christian Depeursinge[1]; [1] École Polytechnique Fédérale de Lausanne, Switzerland, [2]Lyncée Tec SA, Switzerland.*
A comparison of algorithms for depth-of-field extension in the particular field of digital holographic microscopy is presented. Using the reconstruction properties of holography, a simple 3-D reconstruction method from a single hologram is deducted.

DWB6
A Proposal for Digital Holographic Microscopy Observable in Multi-View and Multi-Resolution, *Tomoyoshi Shimobaba[1], Tomoyoshi Ito[2]; [1]Yamagata Univ., Japan, [2]Chiba Univ., Japan.* We propose a new digital holographic microscopy, that enables simultaneous multi-view reconstructed images with a large area and high-resolution, using Shifted-Fresnel diffraction instead of Fresnel diffraction.

DWB7
Three-Dimensional Shape Measurement Using Binary Spatio-Temporal Encoded Illumination, *Yong Li[1], Haihua Zhang[1], Fang Song[2], Hongzhen Jin[1], Hui Wang[1]; [1]Zhejiang Normal Univ., China, [2]Inst. of Command and Technology, People's Liberation Army, China.* A method for 3-D imaging by pseudorandom sequence projecting is proposed. The symbols for constructing sequence are encoded with local spatial and temporal coordinates of adjacent pixels. Both the shape and texture can be obtained.

DWB8
Fast Calculation Method for Computer Generated Hologram Using Three-Dimensional Affine Transformation in Real Space, *Hironobu Sakata, Yuji Sakamoto; Graduate School of Information Science and Technology, Hokkaido Univ., Japan.* We propose a method using three-dimensional affine transformation in real space to calculate holograms at high-speed from patch model, and report the experimental result.

DWB9
Partially Coherent Digital in-Line Holographic Microscopy, *Jorge Garcia-Sucerquia[1], Diana Alvarez-Palacio[2], Jurgen Kreuzer[3]; [1]Univ. Nacional de Colombia, Colombia, [2]Univ. de Antioquia, Colombia, [3]Dalhousie Univ., Canada.* Using a blue LED we show that Digital In-line Holography Microscopy (DIHM) can yield micron resolution. With compact LED-DIHM we study biological samples with comparable results to those obtained with more expensive and complex LASER-DIHM.

DWB10
Diffractive Spatiotemporal Lens with Wavelength Dispersion Compensation, *Kouhei Kimura[1], Satoshi Hasegawa[1], Satoshi Yamashita[2], Yoshio Hayasaki[1,2]; [1]Utsunomiya Univ., Japan, [2]Univ. of Tokushima, Japan.* A diffractive spatiotemporal lens that performs simultaneous spatial and temporal focusing is proposed. The diffractive lens also achieves a compensation of wavelength dispersion for a femtosecond laser pulse.

DWB11
Quadrature Phase-Shifting Digital Holography, *Suezou Nakadate, Tomohiro Kiire, Masato Shibuya; Tokyo Polytechnic Univ., Japan.* Digital holography using a quadrature phase-shifting interferometer is presented. Two quadrature phase-shifted holograms are acquired to give the digital phase hologram. The object image is reconstructed by digital convolutions with the Fast Fourier Transform algorithm.

DWB12
Quantization Noise: An Additional Constraint for the Extended Sampling Theorem, *Damien P. Kelly[1], Nitesh Pandey[1], Bryan M. Hennelly[1], Thomas J. Naughton[1,2]; [1]Natl. Univ. of Ireland, Maynooth, Ireland, [2]Univ. of Oulu, Finland.* Recovery of spatial frequencies above the Nyquist limit is of interest in digital holography. We examine how finite pixel size and quantization error introduced by a CCD camera affect the recovery of these frequencies.

DWB13
Rapid SLM Design for Grid-Free Multispot Positioning in 2-D and 3-D with a Modified Gerchberg-Saxton Algorithm, *David Engström[1], Anders Frank[2], Jan Backsten[2], Mattias Goksör[1], Jörgen Bengtsson[2]; [1]Univ. of Gothenburg, Sweden, [2]Chalmers Univ. of Technology, Sweden.* A single-plane FFT-based algorithm which optimizes a defocused field corresponding to a desired spatial configuration of focused spots is presented. The defocused target field allows for grid-free spot positioning in 2-D and 3-D.

DWB14
Integral Imaging Microscope Using Point Light Source Array, *Young-Tae Lim, Jae-Hyeung Park, Nam Kim, Ki-Chul Kwon; Chungbuk Natl. Univ., Republic of Korea.* Three-dimensional integral imaging microscope using point light source array is proposed. The specimen is illuminated by the point light source array and captured as a form of the elemental images.

DWB15
Interferometric Procedure for Decoupling Morphometry and Refractive Index Measurements via Digital Holographic Microscopy, *Freddy Alberto Monroy Ramírez[1], Jorge Garcia-Sucerquia[2]; [1]Physics Dept., Univ. Nacional de Colombia, Colombia, [2]Physics School, Univ. Nacional de Colombia, Colombia.* An experimental decoupling procedure that separates the thickness and the relative refraction index of transparent objects is discussed with Digital Holography Microscopy. The sample is immersed into different media. Experimental results are presented.

DWB16
Reconstruction of Digital Hologram by Use of the Wavelet Transform, *Jingang Zhong, Jiawen Weng, Cuiying Hu; Inst. of Optoelectronic Engineering, Jinan Univ., China.* A reconstruction approach for digital holography by use of Gabor wavelet transform is described. The zero-order diffraction image and the twin-image are eliminated automatically without spatial filtering. The theory and experimental results are shown.

DWB17
Computational Depth Conversion Technique for Display of Orthoscopic 3-D Real Images in Integral Imaging, *Dong-Hak Shin[1], L. Liliana[1], Byung-Gook Lee[1], Eun-Soo Kim[2]; [1]Dongseo Univ., Republic of Korea, [2]Kwangwoon Univ., Republic of Korea.* We propose a computational depth conversion technique for displaying orthoscopic 3-D real images in integral imaging. In the proposed technique, depth-converted elemental image array is obtained through smart pixel mapping process and image interpolation technique.

DWB18
Computational Integral Imaging Reconstruction Method of 3-D Images Based on Pixel-to-Pixel Mapping and Interpolation Technique, *Dong-Hak Shin, Dong-Jin Kim, Byung-Gook Lee; Dongseo Univ., Republic of Korea.* We propose a novel computational integral imaging reconstruction method using a pixel-to-pixel mapping and an interpolation technique. To confirm the feasibility of the proposed system, some experiments are carried out and the results are presented.

DWB19
Efficient Generation of Video Hologram Using Spatio-Temporal Redundant Data of 3-D Video, *Seung-Cheol Kim, Eun-Soo Kim; 3-D Display Res. Ctr., Kwangwoon Univ., Republic of Korea.* In this paper, a new method for efficient generation of video hologram for 3-D video is proposed by combined use of redundant data of 3-D video and look-up table techniques.

DWB20
Efficient Generation of Hologram Crawl Caption Using N-LUT Method, *Seung-Cheol Kim, Eun-Soo Kim; 3-D Display Res. Ctr., Kwangwoon Univ., Republic of Korea.* In this paper, generation method of hologram crawl caption for hologram TV system is proposed. That is, the hologram caption is generated using pre-calculated elemental fringe pattern for each character.

DWB21
Correct Depth Analysis on the Stereoscopy, *Kwang Hoon Lee[1,2], Dong-Wook Kim[2], Yong-Moo Kwon[2], Nam-Ho Hur[3], Sung-Kyu Kim[2]; [1]Konkuk Univ., Republic of Korea, [2]Korea Inst. of Science and Technology, Republic of Korea, [3]ETRI, Republic of Korea.* In stereoscopy, the image distance by the focused object distance at camera model makes a different disparity compared to the original at pin-hole model and it will be one of the causes of depth distortion.

DWB22
Improving Intensity of Reconstructed Image by Digital Blazed Grating in Opto-Electronic Holography, *Tao Wang, Ying-jie Yu, Hua-dong Zheng, Wen-jing Zhou; Dept. of Precision Mechanical Engineering, Shanghai Univ., China.* Multi-order images appear in the reconstruction of hologram with liquid crystal spatial light modulator (LC-SLM) which leads to low intensity. Digital blazed grating is added to hologram which can improve the intensity impressively by 479.2%.

DWB23
Study on Phase Stitching Technique on Digital Holography, *Wenjing Zhou[1], Gang Chen[1], Yingjie Yu[1], Weijuan Qu[2]; [1]Shanghai Univ., China, [2]Nanyang Technological Univ., Singapore.* A phase stitching approach on multi-apertures digital holograms is proposed to enlarge the testing area with high resolution. An experiment for a USAF test targets is performed and a favorable stitching result is obtained.

DWB24
Modified Goldstein Algorithm Using Boundary Information in Phase Unwrapping, *Seon Kyu Yoon[1,2], Sung-kyu Kim[1]; [1]Korea Inst. of Science and Technology, Republic of Korea, [2]Korea Univ., Republic of Korea.* In phase unwrapping process, Goldstein algorithm is well known but it is not an adequate method to perfectly restore the sharp edge of the object from the wrapped information. We suggested the solution to overcome it.

DWB25
Seam Elimination on 3-D Image Generated by Integral Floating Display, *Joohwan Kim[1], Gilbae Park[1], Younghoon Kim[1], Sung-Wook Min[2], Byoungho Lee[1]; [1]Seoul Natl. Univ., Republic of Korea, [2]Kyung Hee Univ., Republic of Korea.* We propose a method for seam elimination of three-dimensional image generated by integral floating display

using eye tracking scheme. The tracked location of observer's eye is reflected in determining the locations of virtual cameras.

DWB26
2-D/3-D Convertible Display Using PSS Film, *Byoung-Sub Song, Soon-gi Park, Sung-Wook Min; Kyung Hee Univ., Republic of Korea.* 2-D/3-D convertible display using PSS film is proposed using the integral imaging method, which can be implemented easier and simpler than the conventional systems. The proposed system is explained and verified with some experimental results.

DWB27
Enhancement of Viewing Angle and Viewing Distance in Integral Imaging by Head Tracking, *Gilbae Park, Jisoo Hong, Yunhee Kim, Byoungho Lee; Seoul Natl. Univ., Republic of Korea.* We present a head-tracking based method for improving viewing angle and viewing distance in integral imaging system. Elemental images can be made in different regions as the position of a viewer dynamically changes.

DWB28
High Fidelity Microlithography Patterning Using Computer Generated Holograms, *Richard McWilliam[1], Alan Purvis[1], Gavin L. Williams[2], Jesus Toriz-Garcia[2], Luke N. Seed[2], Peter A. Ivey[3]; [1]Durham Univ., UK, [2]Univ. of Sheffield, UK, [3]Innotec Ltd., UK.* We investigate the achievable fidelity of line patterns produced by iterative and analytically derived computer generated holographic photomasks for the fabrication of microelectronic circuits by photolithographic exposure. Metrics for comparison are given.

DWB29
Phase Compensation of Optical Holographic Microscopy Using Image Processing Algorithm, *Chiung-Liang Chen[1], Li-Chien Lin[2], Chen-Hui Lien[2]; [1]Aletheia Univ., Taiwan, [2]Feng Chia Univ., Taiwan.* An image processing algorithm is proposed to find the minimum variation region of phase information to meet the neighborhood constraint in phase unwrapping algorithm. This algorithm is applied to the phase aberration compensation in DHM.

DWB30
Monocular Depth Cue in MF 3-D Display, *Sung-Kyu Kim[1], Dong-Wook Kim[1], Yong-Moo Kwon[1], Jung-Young Son[2]; [1]Imaging Media Ctr., Korea Inst. of Science and Technology, Republic of Korea, [2]Daegu Univ., Republic of Korea.* Experimental results of the monocular MF 3-D display show clear monocular focus on four different depths. Therefore, we can apply the MF 3-D display to monocular 3-D displays.

DWB31
Wide-Viewing Angle Multi-Layer Integral Imaging Display, *Ganbat Baasantseren[1], Jae-Hyeung Park[1], Nam Kim[1], Jae-Jeong Eun[2]; [1]Chungbuk Natl. Univ., Republic of Korea, [2]Changwon National Univ., Republic of Korea.* Wide-viewing angle integral imaging three-dimensional display using two layered masks is proposed. In experiment, the viewing angle of the proposed method is measured to be two times wider than conventional integral imaging display.

DWB32
Adaptive Computation of Computer-Generated Holograms, *Shuhong Xu[1], Farzam Farbiz[1], Sanjeev Solanki[2], Xinan Liang[2], Xuewu Xu[2]; [1]Inst. for Infocomm Res., Agency for Science, Technology and Res., Singapore, [2]Data Storage Inst., Agency for Science, Technology and Res., Singapore.* Regular Effective Hologram Regions (EHRs) for object subspaces are pre-calculated. Object points are categorized online and the corresponding EHRs are used for hologram computation. The use of EHRs increases computational speed and benefits reconstruction quality.

DWB33
Quasi-Cylindrical Digital Hologram by Superposition of Digital Holograms Recorded on Concyclic Positions, *Takanori Nomura, Yusuke Teranishi, Eiji Nitanai, Takuhisa Numata; Wakayama Univ., Japan.* The method to generate a quasi-cylindrical digital-hologram by numerical propagation is presented. A number of digital holograms of an central object recorded on concyclic positions are used for superposition.

DWB34
Experimental Report on Fully Interferometric Three-Dimensional Imaging Spectrometry, *Kyu Yoshimori, Masumi Sasamoto; Iwate Univ., Japan.* Three-dimensional spectral image has been obtained by fully passive interferometric technique. This paper reports new experimental results in which measured object is composed of a pair of monochromatic point sources having different frequencies.

DWB35
Collimating Transfer System with Generalized Arbitrary Phase-Step Digital Holography, *Wang-Ta Hsieh[1], Min-Tzung Shiu[1], Chung-Sheng Chiang[1], Ming-Kuei Kuo[2], Je-Chuang Wang[3], Chi-Ching Chang[4]; [1]School of Defense Science, Natl. Defense Univ., Taiwan, [2]Dept. of Electronic and Electrical Engineering, Natl. Defense Univ., Taiwan, [3]Dept. of Applied Chemistry and Material Engineering, Natl. Defense Univ., Taiwan, [4]Inst. of Electro-Optical Engineering, Ming Dao Univ., Taiwan.* The working principle of collimating transfer system with generalized arbitrary phase-step digital holography is presented. The images can be reconstructed by operator analysis and optical means. Applications to microscopy and 3-D imaging are under development.

DWB36
Computer-Generated Holographic Stereograms, *William J. Dallas[1,2], Tom D. Milster[1], Pierre-Alexander Blanche[1], Arnold C. Friedman[2], Hans Roehrig[1,2], Elizabeth A. Krupinski[2]; [1]College of Optical Sciences, Univ. of Arizona, USA, [2]Dept. of Radiology, Univ. of Arizona, USA.* We examine one type of holographic stereogram and its implementation on two

widely different media. The first medium is photoresist for a conventional computer-generated hologram. The second medium is photo-refractive polymer for re-writable holograms.

12:30 p.m.–2:00 p.m.
Lunch Break (on your own)

DWC • Computer-Generated Holograms

Grand Ballroom A
2:00 p.m.–4:00 p.m.
Presider to Be Announced

DWC1 • 2:00 p.m. Tutorial
Computer-Generated Holography; Principles and Applications, *Toyohiko Yatagai; Utsunomiya Univ., Japan.* Principles and applications of computer-generated holograms including interferometry, information processing, 3-D display and so on are presented.

DWC2 • 2:45 p.m.
Fast Generation of Hologram Sub-Lines Based on Field Programmable Gate Array, *Peter Tsang[1], Jung-Ping Liu[2], Ting-Chung Poon[3], Wai Keung Cheung[1]; [1]City Univ. of Hong Kong, Hong Kong, [2]Feng Chia Univ., Taiwan, [3]Virginia Tech, USA.* An economical hardware solution based on Field Programmable Gate Array (*FPGA)* for generating horizontal-parallax-only (*HPO*) hologram sub-lines at a rate of over 100M pixels per second is reported.

DWC3 • 3:00 p.m.
Computer Generated Holograms Designed to Reduce Intensity Fluctuations During SLM Update, *Martin Persson[1], David Engström[1], Anders Frank[2], Jan Backsten[2], Mattias Goksör[1], Jörgen Bengtsson[2]; [1]Biophotonics Group, Dept. of Physics, Univ. of Gothenburg, Sweden, [2]Photonics Lab, Dept. of Microtechnology and Nanoscience, Chalmers Univ. of Technology, Sweden.* We have investigated design criteria for calculation of computer generated holograms, aiming to reduce the deterioration of the spot pattern during SLM updates. A modified Gerchberg-Saxton algorithm that efficiently minimizes unwanted intensity fluctuations is introduced.

DWC4 • 3:15 p.m.
Real-Time Generation of Full Color Image Hologram with Compact Distance Look-up Table, *Hiroshi Yoshikawa, Takeshi Yamaguchi, Ryo Kitayama; Nihon Univ., Japan.* The full parallax image hologram is generated with look-up table. The speed of 19 frames per second is obtained with PC. The hologram has 1,400 x 1,050 pixels and consists of 10,000 object points.

DWC5 • 3:30 p.m. Invited
Applications of Computer Generated Holograms, *Wai-Hon Lee; Finity Labs Inc., USA, USA.* In this paper we describe the use of computer-generated holograms in creating light diffusing film for use in back lighted liquid crystal displays (LCD). Method of producing this type of optical film is also described

Grand Ballroom C/D
4:00 p.m.–4:30 p.m.
Coffee Break/ Exhibits

DWD • Electro-Holography and Computer-Generated Holography

Grand Ballroom A
4:30 p.m.–6:30 p.m.
Takanori Nomura; Wakayama Univ., Japan, Presider

DWD1 • 4:30 p.m. Invited
Real-Time Computation for Electro-Holography, *Tomoyoshi Ito[1], Tomoyoshi Shimobaba[2]; [1]Chiba Univ., Japan, [2]Yamagata Univ., Japan.* This paper describes hardware-based real-time electro-holography. We developed high-speed computational system for an electro-holographic display, holographic particle image velocimetry and digital holographic microscopy, using a field programmable gate array and a graphic processing unit.

DWD2 • 5:00 p.m.
Band-Limited Zoneplate Method for Elimination of the Conjugate Image in Electronic Holography, *Yumi Tanemoto, Yasuhiro Takaki; Inst. of Symbiotic Science and Technology, Tokyo Univ. of Agriculture and Technology, Japan.* The use of a band-limited zoneplate to eliminate the conjugate image is discussed. Computational complexity is reduced by interpolating a complex-amplitude zoneplate sampled with a pitch twice as large as the pixel pitch of SLM's.

DWD3 • 5:15 p.m.
High Speed Digital Image Plane Holography for Measuring Three Component Velocity Fields in Brain Aneurism Models, *Virginia Palero, Julia Lobera, M. Pilar Arroyo; I3A-Univ. of Zaragoza, Spain.* The applicability of Digital Image Plane Holography for fluid velocimetry can be broadened with high repetition-rate set-ups. Implementation of such systems requires solving problems of low coherence length, big pixel size and complex shape objects.

DWD4 • 5:30 p.m.
Doppler Phase-Shifting Digital Holography, *Daisuke Barada, Yuichi Kikuchi, Toyohiko Yatagai; Ctr. for Optical Res. and Education (CORE), Utsunomiya Univ., Japan.* A novel reconstruction method utilizing optical Doppler effect for digital holography was proposed. Some images were obtained by a high speed camera to remove the zeroth-order and conjugate images and recorded object images were reconstructed.

DWD5 • 5:45 p.m.
Blu-Ray Mastering Process Applied to the Manufacturing of Computer Generated Holograms, *Christophe Martinez, Alain Fargeix, Olivier Lemonnier, Brigitte Martin, Marie-Francoise Armand, Roseline*

Templier; CEA-Leti Minatec, France. We present a Blu-ray mastering process based on PtOx layer laser engraving. The process has been upgraded for maskless lithography and applied to the manufacturing of Computer Generated Holograms.

DWD6 • 6:00 p.m.
Multi-Lambda Digital Holography with Auto Calibration of Temporal Phase-Shifts and Synthetic Wavelengths. *Daniel Carl, Markus Fratz, Marcel Pfeifer, Dominik M. Giel, Heinrich Höfler; Fraunhofer Inst. for Physical Measurement Techniques, Germany.* A fast auto calibration method for (lensless) multi-wavelength digital holography with arbitrary temporal phase-shifts is presented. The calibration algorithm is simple to calculate and needs just one additional image acquisition per wavelength.

DWD7 • 6:15 p.m.
Mutual Influence of Time-Shared Optical Traps Studied by Means of Video Holographic Microscopy, *Peter D. J. van Oostrum[1], Astrid van der Horst[2], Alfons van Blaaderen[1]; [1]Soft Condensed Matter, Debye Inst. for Nanomaterials Science, Utrecht Univ., Netherlands, [2]Dept. of Physics, Simon Fraser Univ., Canada.* Holographic microscopy and calculations in three dimensions are used to explore how properties of an optical trap, such as stiffness and trapping position, are influenced by other traps in its vicinity.

NOTES

Key to Authors and Presiders

(**Bold** denotes Presider or Presenting Author)

Advances in Imaging
OSA Optics & Photonics Congress and Tabletop Exhibit 2009
UPDATE SHEET

Withdrawals:

NMC6	JTuB34
FTuA4	JTuB35
OTuA5	HTuC6
JTuB23	DWA3
JTuB29	DWB2
JTuB30	HWD4

Substituted Papers:

The paper **HTuC6** that is in your program will not be presented. During this time slot, the following postdeadline paper will be presented in its place: **PHTuC6, Airborne Radiometer Measurements of Above Cloud Reflectance in the Presence and Absence of Aerosols,** *Odele Coddington[1], Peter Pilewskie[1], Tomislava Vukicevic[1], John Livingston[2], Steve Platnick[3], Gala Wind[3], Jens Redemann[4], Philip B. Russell[4]; [1]Univ. of Colorado at Boulder, USA, [2]SRI Intl., USA, [3]NASA GSFC, USA, [4]NASA AMES, USA.*

The poster **JTuB17** will be presented during the session **HWA•Hyperspectral IR and Imager Data Analyses** (April 29, 2009, 8:30 a.m.–10:30 a.m., Junior Ballroom C) as oral presentation **HWA5.**

Presider Updates:

Nickolai V. Kukhtarev; Alabama A&M Univ., USA, will preside over session **DMB• Novel Technologies in Holography,** on Monday, April 27, 2009, 11:00 a.m. –1:00 p.m. in Grand Ballroom A.

Yoshio Hayasaki; Utsunomiya Univ., Japan, will preside over session **DWC•Computer-Generated Holograms**, on Wednesday, April 29, 2009, 2:00 p.m.–4:00 p.m. in Grand Ballroom A.

Presenter Changes:

DTuA1, Harmonic Holography will now be presented by *Chia-Lung Hsieh[1,2], [1]Ecole Polytechnique Fédérale de Lausanne (EPFL), Switzerland, [2]Caltech, USA.*

NTuA5, Linear Phase-Gradient Imaging with Asymmetric Illumination Based Differential Phase Contrast (AIDPC), will now be presented by *Colin J. R. Sheppard, Natl. Univ. of Singapore, Singapore.*

Time Changes:

HWA will end a half hour later at 10:30 a.m.
Exhibits will end at 12:30 p.m. on Wednesday, April 29, 2009.

Postdeadline Paper Programs:

Post deadline Paper Programs are available at Registration.

Special Events:

Meet the *Applied Optics* Editors Dinner on Tuesday, April 28, 2009, 7:00 p.m. All conference attendees, especially students, are invited to this casual networking dinner. More information is available at Registration.

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POSTDEADLINE PAPERS

ADVANCES IN IMAGING

- Digital Holography and Three-Dimensional Imaging (DH)
- Fourier Transform Spectroscopy (FTS)
- Hyperspectral Imaging and Sensing of the Environment (HISE)
- Novel Techniques in Microscopy (NTM)
- Optical Trapping Applications (OTA)

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•Tuesday, April 28, 2009•

Junior Ballroom C
2:00 p.m.–4:00 p.m.
HTuC • New Remote Sensing Perspectives
Anthony Baran; Met Office, UK, Presider

PHTuC6 • 3:45 p.m.
Airborne Radiometer Measurements of above Cloud Reflectance in the Presence and Absence of Aerosols, *Odele Coddington[1], Peter Pilewskie[1], Tomislava Vukicevic[1], John Livingston[2], Steve Platnick[3], Gala Wind[3], Jens Redemann[4], Philip B. Russell[4]; [1]Univ. of Colorado at Boulder, USA, [2]SRI Intl., USA, [3]NASA GSFC, USA, [4]NASA AMES, USA.* We present cloud retrieval results from SSFR measurements made in the presence and absence of aerosols and show comparisons to MODIS. A method for treating aerosol bias in retrievals as systematic model uncertainty is described.

Grand Ballroom C/D
4:30 p.m.–6:00 p.m.
JTuB • DH/FTS/HISE/NTM/OTA Joint Poster Session

PJTuB36
Automated Particle Characterization Using Holographic Video Microscopy, *Fook Chiong Cheong, David G. Grier; New York Univ., USA.* With an efficient particle identification algorithm, combine with hardware acceleration and software optimization, holographic microscopy data can be analysis in near real time with sufficient accuracy to enable unattended holographic tracking and particle characterization.

PJTuB37
Incoherent Optical Imaging Using Synthetic Aperture with Fresnel Elements, *Barak Katz, Joseph Rosen; Ben-Gurion Univ. of the Negev, Israel.* We present a new lensless incoherent holographic system operating in a synthetic aperture mode. Spatial resolution exceeding the Rayleigh limit is obtained by tiling several holographic elements into a complete Fresnel hologram of observed objects.

PJTuB38
CrIS Radiance Spectra Modeling and End-to-End Error Analysis, *Nikita Pougatchev, Gregory Cantwell, Gail Bingham; Space Dynamics Lab, Utah State Univ., USA.* We present the Cross-track Infrared Sounder (CrIS) end-to-end error model consisting of instrument model and Validation Assessment Model. Models' descriptions along with examples of application are presented.

PJTuB39
SPDM - Single Molecule Superresolution of Receptor Clusters in *E. coli* Bacteria, *Thomas Ruckelshausen[1], Paul Lemmer[1], Victor Sourjik[2], Christoph Cremer[1,3,4]; [1]Kirchhoff-Inst. for Physics, Univ. of Heidelberg, Germany, [2]Ctr. for Molecular Biologie Heidelberg, Univ. of Heidelberg, Germany, [3]Inst. for Pharmacy and Molecular Biotechnology, Univ. of Heidelberg, Germany, [4]Inst. for Molecular Biophysics, The Jackson Lab, USA.* In *E. coli* bacteria the chemotaxis phosphatase protein CheZ was labeled with YFP (yellow fluorescent protein). Their reversible photobleaching is used for an optical isolation in time. An average localization precision of 22nm was achieved.

•Wednesday, April 29, 2009•

Junior Ballroom C
8:30 a.m.–10:30 a.m.
HWA • Hyperspectral IR and Imager Data Analyses
Allen Huang; Univ. of Wisconsin at Madison, USA, Presider

PHWA6 • 10:15 a.m.
Investigations of Cirrus in the Far Infrared with the Tropospheric Airborne Fourier Transform Spectrometer (TAFTS), *Caroline Cox[1], Neil Humpage[1], Paul Green[1], Juliet Pickering[1], John Harries[1], Jonathan Taylor[2], Anthony Baran[2], Alan Last[1], Jon Murray[1]; [1]Imperial College London, UK, [2]Met Office, UK.* An overview of the results of recent field campaigns performed with the Tropospheric Airborne Fourier Transform Spectrometer (TAFTS) to study the radiative properties of cirrus in the far infrared spectral region is presented.

Grand Ballroom C/D
11:00 a.m.–12:30 p.m.
DWB • DH Poster Session

PDWB37
Femtosecond Time-Resolved Off-Axis Digital Holography, *Tadas Balciunas, Andrius Melninkaitis, Andrius Vanagas, Valdas Sirutkaitis; Laser Res. Ctr., Vilnius Univ., Lithuania.* We present time-resolved off-axis digital holography for investigation of laser-induced plasma filaments in condensed media. An experimental setup with tilted reference pulse allows larger crossing angles to be used for recording of digital holograms.

PDWB38
A High-Definition Full-Parallax CGH Created by the Polygon-Based Method, *Kyoji Matsushima, Sumio Nakahara; Kansai Univ., Japan.* A large-scaled full-parallax CGH with 4 billion pixels is produced by a polygon-based method. The CGH reconstructs a fine 3-D image and gives a large sensation of depth owing to the silhouette-masking technique.

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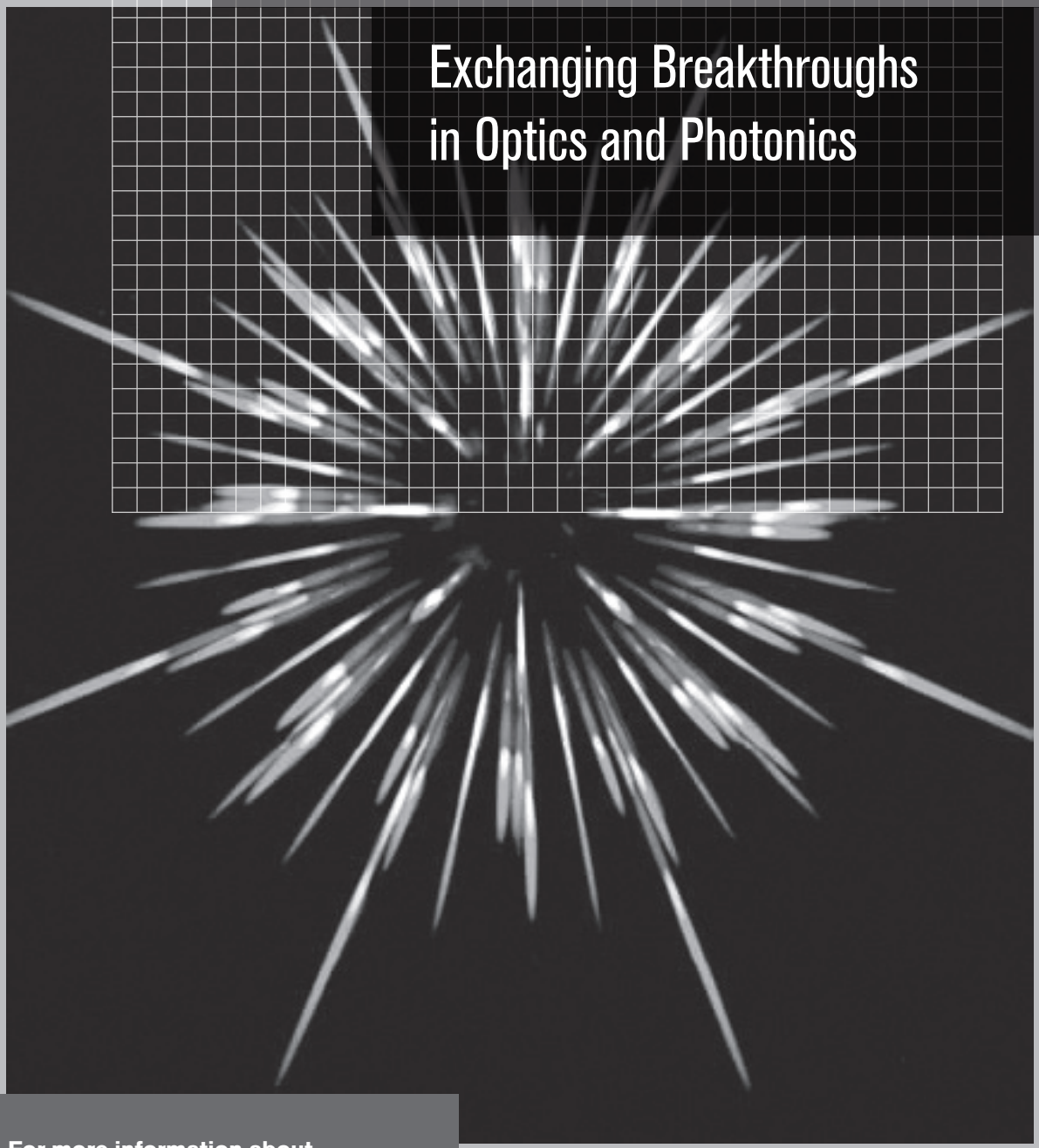

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