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2018台日雙邊智慧光電與農業生醫應用論壇

2018 Taiwan-Japan Bilateral Symposium in Optics for Intelligent Information Science & Technology: Biophotonics & Agricultural Photonics

April 16 ~ 20, 2018

College of Photonics, NCTU,

Tainan, Taiwan

Adviser

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Welcome Message

Welcome to Taiwan-Japan Bilateral Symposium in Optics 2018!

The heritage of this symposium series was first initiated and organized by Professor Toyohiko Yatagai at the Utsunomiya University in 2008. It was followed by Professor Shean-Jen Chen at National Cheng Kung University in 2011, and then by Professor Yoshimasa Kawata at Shizuoka University in 2013. National Chiao Tung University (NCTU) is happy and honored to be the host for this year 2018.

The theme for this year is Optics for Intelligent Information Science & Technology: Biophotonics & Agricultural Photonics. This is in echo to the recent advancements in optical information technology, sensing, metrology, image processing, displays, storage, holography, nano-photonics, functional materials, machine learning, neural networks, artificial intelligence, bio-photonics and agricultural applications etc. We hope you will enjoy the symposium, and that through the forum, the symposium will continue to provide a knowledge exchange platform for attendees from all over the world.

Ken-Yuh Hsu

04-16-2018

Program

Date: Monday, 16 April, 2018

Venue: B2 府城廳, Shangri-La's Far Eastern Plaza Hotel (89 Section West, University Road, Tainan)

18:30~	**Welcome Reception and Dinner (Japanese delegates and invited speakers only)**

Date: Tuesday, 17 April, 2018

Venue: International Conference Room, Southern Taiwan Science Park Bureau (AI_ROBOT@STSP, No. 22, Nanke 3rd Rd., Xinshi Dist., Tainan)

09:00~09:15	**Opening Remarks** Deputy Director-general Chen-Kang Su (Southern Taiwan Science Park Bureau) Senior Vice President Chiun-Hsun Chen (NCTU)
Session I	**Chair: Dean Ken-Yuh Hsu**
09:15~09:55	Plenary Talk: Prof. Jumpei Tsujiuchi Image Restoration by Coherent and Incoherent Optical Methods
09:55~10:25	Invited Talk: Prof. Shean-Jen Chen R&D of Unmanned Vehicles with Agri-Photonics in College of Photonics, NCTU
10:25~10:45	**Coffee Break**
Session II	**Chair: Prof. Shean-Jen Chen**
10:45~11:25	Plenary Talk: Prof. Toyohiko Yatagai Polarization Holography and its Application to Optical Memory
11:25~11:55	Invited Talk: Prof. Chih-Chung Yang Gold Nanoparticles of Specialized Geometries for Photothermal and Photodynamic Therapies
11:55~12:25	Invited Talk: Prof. Ichiro Ishimaru Mid-infrared Hyperspectral Portable-camera for Healthcare Sensors, Environmental Measurements and Cultural Properties
12:25~13:30	**Lunch@ PREMIER Restaurant** 1F No. 26, Nanke 3rd Rd., Xinshi Dist., Tainan City 74147
Session III	**Chair: Prof. Ichiro Ishimaru**
13:30~14:00	Invited Talk: Prof. Kenji Harada Polarization Color and Its Applications
14:00~14:30	Invited Talk: Prof. Mitsuo Takeda Complex-valued Neural Networks Revisited

14:30~15:00	Invited Talk: Prof. Ching-Cherng Sun Smart 3D Indoor Mapping Based on Optical and Artificial Intelligence Technology
15:00~15:20	**Coffee Break**
Session IV	**Chair: Prof. Ching-Cherng Sun**
15:20~15:50	Invited Talk: Prof. Jun Tanida Application of Machine Learning for Optical Sensing and Imaging through Scattering Media
15:50~16:30	Plenary Talk: Prof. Din Ping Tsai Meta-device for Photonics in Demand
16:30~17:00	Invited Talk: Prof. Po-Sheng Hu Cs0.33WO3 Compound Nanomaterерial-Incorporated Thin Film Enhances Output of Thermoelectric Conversion in Ambient Temperature Environment
17:00~17:30	**Visiting Southern Taiwan Science Park Bureau**
18:00~20:30	**Conference Banquet @ PREMIER Restaurant** 1F No. 26, Nanke 3rd Rd., Xinshi Dist., Tainan City 741-47

Date: Wednesday, 18 April, 2018

Venue: 2F Advantech International Conference Hall, College of Photonics, NCTU (AI_Photonic_Agricultural_Robot@COPNCTU, No. 301, Gaofa 3rd Rd., Guiren Dist., Tainan)

Session V	**Chair: Dean Ken-Yuh Hsu**
09:00~09:30	Invited Talk: Prof. Arthur E.T. Chiou Bio- Physical and Chemical Properties of Head and Neck Cancer Cell Lines with Distinct EMT (Epithelial-Mesenchymal Transition) Phenotypes in 2D and 3D Environments
09:30~10:00	Invited Talk: Prof. Kazuo Kuroda Measurement of Color Speckle in Laser Display
10:00~10:30	Invited Talk: Prof. Kuo-Ping Chen Narrow-band Optical Absorber by Metasurface and Tamm Plasmon
10:30~10:50	**Coffee Break**
Session VI	**Chair: Prof. Kazuo Kuroda**
10:50~11:20	Invited Talk: Kazuhiko Oka Channeled Polarimetry — Snapshot and Compact Method for Polarization Measurement
11:20~11:50	Invited Talk: Prof. Chau-Jern Cheng Digital Holographic Microscopy: From Ultrafast to Superresolution Imaging
11:50~12:20	Invited Talk: Prof. Yoshio Hayasaki

	Two-color Pump-probe Digital Holography
12:20~13:30	**Lunch**
Session VII	**Chair: Prof. Chau-Jern Cheng**
13:30~14:10	Plenary Talk: Prof. Francis Yu Information Transmission with Quantum Limited Subspace
14:10~14:40	Invited Talk: Prof. Yukitoshi Otani Differential Interference Contrast Microscope and 3D Reconstruction by Pixelated Polarization Camera
14:40~15:10	Invited Talk: Prof. Francis Yu Discovery of Temporal Universe
15:10~15:30	**Coffee Break**
Session VIII	**Chair: Prof. Yukitoshi Otani**
15:30~16:00	Invited Talk: Prof. Chien-Chung Lin Colloidal Quantum Dots and Their Applications to Hybrid Optoelectronic Devices
16:00~16:30	Invited Talk: Prof. Takashige Omatsu Optical Vortices Create Structured Materials
16:30~17:00	Invited Talk: Prof. Tzung-Cheng Chen UAVs in agricultural applications
17:00~17:30	Invited Talk: Prof. Shu-Yi Liaw Deep Learning Applied into the Price Forecasting of Agricultural Products and the Platform of Future Agriculture 4.0
18:30~20:30	**Dinner @ A-Chu's Mess Hall** No. 1, Sec. 2, Baoda Rd., Gueiren Dist., Tainan City 71141

Date: Thursday, 19 April, 2018

Venue: 2F Advantech International Conference Hall, College of Photonics, NCTU (AI_Photonic_Agricultural_Robot@COPNCTU, No. 301, Gaofa 3rd Rd., Guiren Dist., Tainan)

Session IX	**Chair: Dean Ken-Yuh Hsu**
09:00~09:30	Invited Talk: Dr. Setsuko Ishii Holography as Architectural Decoration
09:30~10:00	**Hologram Installation Ceremony**
10:00~12:30	**Chimei Museum (Japanese delegates and invited speakers only)**
12:30~14:00	**Lunch @ 3F Café Message of Chimei Museum**
14:00~	Off-site meeting & visit (Japanese delegates and invited speakers only)

Date: Friday, 20 April, 2018

Venue: Dalukuan Hotel, Pingtung

09:00~12:00	Off-site meeting & visit (Japanese delegates and invited speakers only)
12:00~	**Farewell**

Table of Contents

Session I

Jumpei Tsujiuchi (辻内順平)
Professor Emeritus, Tokyo Institute of Technology
3-7-15 Tsuchihashi, Miyamae-ku, Kawasaki 216-0005, Japan (Home)

1. **Personal Information**
   Birth: August 18, 1927
   Place of Birth: Wakayama, Japan
2. **Education:**
   March 1951 graduated from the Faculty of Science, University of Tokyo
3. **Degree:**
   March 1962 Ph.D. in Applied Physics (University of Tokyo)
4. **Professional Experiences:**
   1951.4~1968.3 Mechanical Engineering Laboratory (Now: National Institute of Advanced Industrial Science and Technology)
   1958.9~1960.4 Institut d'Optique, Paris (first with Scholarship from the French government, and later as Attaché de Recherche of CNRS (Centre National de la Recherche Scientifique, Paris, France)
   1968.4~1988.3 Professor of Applied Optics at Tokyo Institute of Technology
   1988.4 ~ Present Professor Emeritus at Tokyo Institute of Technology
   1988.4~1993.3 Professor of Imaging Science at Chiba University, Faculty of Technology)
5. **Speciality**
   - Applied Optics, (Optical information processing, holography, optical metrology)
6. **Scientific Societies**
   - Honorary member of Japan Society of Applied Physics,
   - Honorary Member of Japanese Society of Medical Imaging Technology,
   - Regular Member of Physical Society of Japan, Optical Society of Japan, Society of Photographic Science and Technology of Japan, Regular Member of Optical Society of Japan,
   - Fellow of Optical Society of America, Fellow of SPIE-International Society of Optical Engineering, Fellow of Institute of Physics (UK), Chartered Physicist
   - President of International Commission for Optics (ICO) (1981-1984)
   - President of Japan Siciety of Applied Physics (1988-1990)
   - President of Japanese Society of Medical Imaging Technology (1994-2004)
7. **Awards**
   - Best Paper of Optics (1962, Japan Society of Applied Physics)
   - Technical Award (1980, Society of Photographic Science and Technology of Japan)
   - President Special Award (1987, SPIE-International Society of Optical Engineering)
   - J. Petzval Award (1988, OAFE Hungary)
   - Blue Ribbon Award (1995, Japanese Government)
   - C.E.K. Mees Medal (1997, Optical Society of America)
   - Distinguished Achievements Award (2011, Japan Society of Applied Physics)
   - Emmett N. Leith Medal (2017 Optical Society of America)
8. **Scientific/Technical Papers**:
   - about 200 papers (English or French languages)
   - Scientific/Technical Books (7 including co-author)
   - Translated Books (6 French and English including co-translation)

Image Restoration by Coherent and Incoherent Optical Methods

Jumpei TSUJIUCHI
Professor Emeritus, Tokyo Institute of Technology, Tokyo, Japan

Photographic images are deteriorated by various reasons such as lens defocus, aberrations, camera movement during an exposure. At present, some of them can be removed by various technologies, but still take place eventually. In such cases, resultant deteriorated images can be restored afterwards. This technique is called image restoration, and we have started to study this problem in 1958 and continued about 10 years. This paper describes basic ideas and some concrete methods for this purpose.

One of pioneering works for this purpose was made by A. Maréchal and P. Croce for improving contrast of photographic images by using a coherent optical method. They put an amplitude spatial filter on the Fraunhofer diffraction pattern of the photographic image so as to make weak the central peak amplitude and obtained higher contrast image. This filter has the effect to improve the contrast of the image and is called often “inverse filter”.

We started the experiment of image restoration by using the same setup as Maréchal-Croce experiment, and started the restoration of image in November 1958 in Institut d’Optique, Paris. First, images obtained by a lens with one dimensional Gaussian curve as point spread function were processed. The inverse filter for this purpose was made manual photographic method, and fairly good results were obtained.

As more general case, restoration of defocused images was made. In this experiment, a π-phase shifting filter was used as inversed filter. Because an automatic vacuum evaporator did not exist at the moment, we made such a phase filter by manual control method. The amplitude filter was made photographically and was combined with the phase filter. The experiment was successfully finished.

These restoration experiments brought fairly good results, but there was a difficult problem in original photograph to be processed. The optical phase disturbance of a film to be processed was removed by liquid immersion, and we had to find new incoherent processing.

Various techniques were studied, and an interesting method among them was incoherent processing realized by a combination of optical and video systems. An image-forming system consisting of conventional and cross-polarized optical systems was used. Two images from this system have different qualities each other, and are recorded by two video cameras. These two images are subtracted each other by video image subtractor, and the resultant image can be used as the final image. Parameters for image restoration can be controlled by parameters of the two image forming systems. Principles of this system were confirmed, but narrow working field is a weak point.

Shean-Jen Chen (陳顯禎)

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1. Personal Information

Birth: Tainan City, Taiwan, 1965.

2. Educations

1997.1	Mechanical Engineering, UCLA, PhD
1992.2	Mechanical Engineering, Columbia University, MS
1987.6	Agricultural Machinery Engineering, National Taiwan University, BS

3. Professional Experiences

2016.8~	College of Photonics, NCTU, Professor & Associate Dean
2012.8~2016.7	Center for Micro/Nano Science and Technology, National Cheng Kung University (NCKU), Director-General Department of Engineering Science & Department of Photonics, NCKU, Distinguished Professor
2011.2~2012.7	Research and Services Headquarter, NCKU, Deputy Director-General Technology Transfer & Business Incubation Center, NCKU, Director
2009.8~2011.1	Center for Micro/Nano Science and Technology, NCKU, Deputy Director-General
2008.6~2008.9	Department of Biological Engineering, Massachusetts Institute of Technology, Visiting Professor
2007.8~2012.7	Department of Engineering Science & Department of Photonics, NCKU, Professor
2004.8~2007.7	Department of Engineering Science & Department of Photonics, NCKU, Associate Professor
2003.8~2004.7	Department of Engineering Science & Department of Photonics, NCKU, Assistant Professor
2000.8~2003.7	Department of Mechanical Engineering & Institute of Photonics, National Central University, Assistant Professor

4. Fields of Specialty

- Advanced Nonlinear Optical Microscopy for Bioimaging
- Three-dimensional Photolithography for Developing Extracellular Matrix

5. Major awards and honors

- "Academic Excellence Award" from College of Engineering, NCKU in 2015.
- "Research Excellence Award" from College of Engineering, NCKU in 2012.
- "Teaching Excellence Award" from NCKU in 2011.
- "Wu Ta You Memorial Award" from National Science Council of Taiwan for research excellence in 2005.

6. Selected Recent Peer-reviewed Publications (* corresponding author)

- C.-Y. Chang, C.-H. Lin, C.-Y. Lin, Y.-D. Sie, Y. Y. Hu, S.-F. Tsai, and **S.-J. Chen***, "Temporal focusing-based widefield multiphoton microscopy with spatially modulated illumination for biotissue imaging," Journal of Biophotonics, vol. 11, no. 1, pp. e201600287, January 2018.
- C.-Y. Lin, H.-Y. Chang, T.-F. Yeh, H. Teng, and **S.-J. Chen***, "Three-dimensional patterned graphene oxide-quantum dot microstructures via two-photon crosslinking," Optics Letters, vol. 42, no. 23, pp. 4970-4973, December 2017.
- V. Hovhannisyan, C.-Y. Dong, and **S.-J. Chen***, "Photodynamic dye adsorption and release performance of natural zeolite," Scientific Reports, vol. 7, no. , 45503, March 2017.
- C.-Y. Chang, Y. Y. Hu, C.-Y. Lin, C.-H. Lin, H.-Y. Chang, S.-F. Tsai, T.-W. Lin, and **S.-J. Chen***, "Fast volumetric imaging with patterned illumination via digital micro-mirror device-based temporal focusing multiphoton microscopy," Biomedical Optics Express, vol. 7, no. 5, pp. 1727-1736, April 2016.
- Y. D. Sie, N.-S. Chang, P. J. Campagnola, and **S.-J. Chen***, "Fabrication of three-dimensional multi-protein microstructures for cell migration and adhesion enhancement," Biomedical Optics Express, vol. 6, no. 2, pp. 480-490, February 2015.

R&D of Unmanned Vehicles with Agri-Photonics in College of Photonics, National Chiao Tung University

Shean-Jen Chen (陳顯禎)

College of Photonics, National Chiao Tung University, 711 Tainan, Taiwan
Email: sheanjen@nctu.edu.tw; Tel.: +886-6-30332121 ext. 57825; Fax: +886-6-3032535.

Intelligent farming robot aims at increasing farming output and decreasing the needs of resources, which can promote farming into another high tech industry and promote agricultural economic development. With the cooperation of unmanned vehicle and agricultural automation equipment, intelligent farming robot can alleviate the needs of agricultural population and enhance the overall production of fruits and vegetables. Though there are many inputs in unmanned aircraft vehicle (UAV) agricultural applications, however, unmanned ground vehicle (UGV) has relatively higher threshold and importance. Therefore, with the advantages of National Chiao Tung University (NCTU) in AI image recognition, solar electricity, and laser system, plus core technology of self-driving platform, electric agricultural vehicle, pest control, and IoT, we can meet the economic needs of Taiwan orchards and develop intelligent-photonic UGV that can be used in pest and quality control. Furthermore, based on the application of this UGV, it can also be used in other orchards or exploration platform of other agricultural crops. In order to achieve the aforementioned objectives, College of Photonics in NCTU will be executed in four research directions.

Direction 1, development of smart functional 3D image recognition system, including high speed image transmission and embedded systems integration, hyperspectral imaging and fruit quality monitoring, embedded intelligent 3D image recognition and IoT networking.

Direction 2, development of laser pest control system, including photonic pest control mechanism, pest control intellectual image recognition, and development of multiple laser beam shaping system.

Direction 3, development of economical orchard UGV, including orchard UGV and autonomous spraying machine system, orchard self-driving control platform, and solar energy autonomous power system.

Direction 4, big data collection of fruit trees and IoT integrated system, including the built building of fruit tress database and AI processing platform, big data cloud and AI pest control, cloud data big data cloud and AI fruits quality analysis.

Session II

Toyohiko Yatagai (谷田貝豊彦)
Center for Optical Research and Education, Utsunomiya University,
Utsunomiya, Tochigi 321-8585, Japan.
Tel & Fax.: +81-28-689-7073, E-mail: yatagai@cc.utsunomiya-u.ac.jp;

1. Personal Information

Birth: Tochigi, Japan, 1946.

2. Educations:

1980.9 Applied Physics, University of Tokyo, DoE.
1969.5 Applied Physics, University of Tokyo, B.S.

3. Professional Experiences

2017.4~ Center for Optical Research and Education, Utsunomiya University, Project Professor
2012.4~2017.3 Center for Optical Research and Education, Utsunomiya University, Director, Distinguished Professor
2007.4~2012.3 Center for Optical Research and Education, Utsunomiya University, Director, Professor
1993.4~2007.3 Institute of Applied Physics, Tsukuba University, Professor
1983.4~1993.3 Institute of Applied Physics, Tsukuba University, Associate Professor
1983.8~1983.3 Institute of Physical and Chemical Research, Researcher

4. Fields of Specialty

- Information Optics, Holography, Optical Measurement, Biomedical Imaging

5. Major awards and honors

- SPIE Dennis Gabor Award, 2017
- OSA Fellow 1999, SPIE Fellow 2000, JSPS Fellow 2007.
- Tochigi Culture Award, Tochigi Prefecture 2015
- Optical Research Award, Japan Society of Applied Physics, 1983.

6. List of Recent Selected Publications

- Yusuke Sando, Boaze Jessie Jackin and **Toyohiko Yatagai***, "Bessel function Expansion to reduce the calculation time and memory usage for cylindrical computer-generated holograms," *Applied Optics* **56** (2017) 5775.
- C.-Yusuke Sando, Daisuke Barada, and **Toyohiko Yatagai***, "Optical rotation compensation for a holographic 3D display with a 360 degree horizontal viewing zone," *Applied Optics* **55** (2016) 8589
- Boaz Jessie Jackin, C. S. Narayanamurthy, **Toyohiko Yatagai***, "Geometric phase shifting digital holography," *Optics Letters* **41** (2016) 2648.
- Percival F. Almoro, Quang Duc Pham, David Ignacio Serrano-Garcia, Satoshi Hasegawa, Yoshio Hayasaki, Mitsuo Takeda, **Toyohiko Yatagai***., "Shape estimation of diffractive optical elements using high-dynamic range scatterometryr," *Optics Letters* **41** (2016) 2161.
- Manabu Hakko, Tomohiro Kiire, Daisuke Barada, **Toyohiko Yatagai*,** and Yoshio Hayasaki*, "Shape estimation of diffractive optical elements using high-dynamic range scatterometry," *Applied Optics* **54** (2015) 4255.
- Fanny Moses Gladys,,* Masaru Matsuda, Yiheng Lim, Boaz Jessie Jackin, Takuto Imai Yukitoshi Otani, **Toyohiko Yatagai***, and Barry Cense, "Developmental and morphological studies in Japanese medaka with ultra-high resolution optical coherence tomography," *Biomedical Optics Express.* **6** (2015) 297.
- Tomohiro Kiire, Tomoyuki Meguriya, Daisuke Barada, Yoshio Hayasaki, and **Toyohiko Yatagai***, "Photon-counting scatterometer with illumination adjusting and intensity stitching," *Jpan J. Applied Physics* **53** (2014) 022505.

Polarization Holography and its Application to Optical Memory

Toyohiko Yatagai(谷田貝豊彦) and Daisuke Barada(茨田大輔)

Center for Optical Research and Education, Utsunomiya University,
Utsunomiya, Tochigi 321-8585, Japan.
yatagai@cc.utsunomiya-u.ac.jp; Tel & Fax.: +81-28-689-7073.

Optical memory systems, such as CD, DVD and Blu-ray Disc, have been recognized as one of the most important memory systems, which are called as cold data storage systems, because their access frequency is very low but their life time is very long and storage cost is very low. The conventional optical data storage systems are based on sequential recording and reading architectures and two-dimensional surface-storage technologies. These optical technologies are approaching to fundamental limits related to optical wavelength, thermal stability and so on. Alternative approach is to store data in three dimensions and to overcome time-sequential recording/reading.

Holographic data storage is one of the candidates of next-generation optical data storage systems. Many techniques on holographic mass storage systems have been developed, which scalar optical data are stored in holographic materials.

In this paper, the use of vector waves for holographic mass storage systems is discussed. Polarization holography using polarization-sensitive photo-polymers has been investigated by many authors. Off-axis volume holographic recording is mainly discussed, and also its polarization multiplexing and phase-level multiplexing techniques are proposed to increase memory capacity.

As one of examples of polarization holographic memory system, a dual channel architecture is shown in Fig.1. A dipole pumped solid state (DPSS) laser with the wavelength of 532 nm was used for recording and reconstruction. The collimated beam was split into signal and reference beams by using a polarizing beam splitter PBS1. The signal beam was further split by using PBS2 and illuminated onto two spatial light modulators (SLMs). In this paper, we consider a signal beam consists of two page data of s- and p- polarization states.

To increase data capacity of the holographic memory, we have developed many techniques, such as, shift multiplexing and angular multiplexing in dual channel off axis holography. For example, in angular multiplexing architecture, PQ-PMMA film of 1mm thickness was placed on the rotating stage and the incident angle of the two beams was changed by rotating the stage. The quality of the recording and reconstructing result, as measured by the symbol error rate (SER), was evaluated. All listed SER values of the s component are higher than those of the p component, because of speckle noise caused by interference of the s component of the reference beam and the reconstructed signal beam.

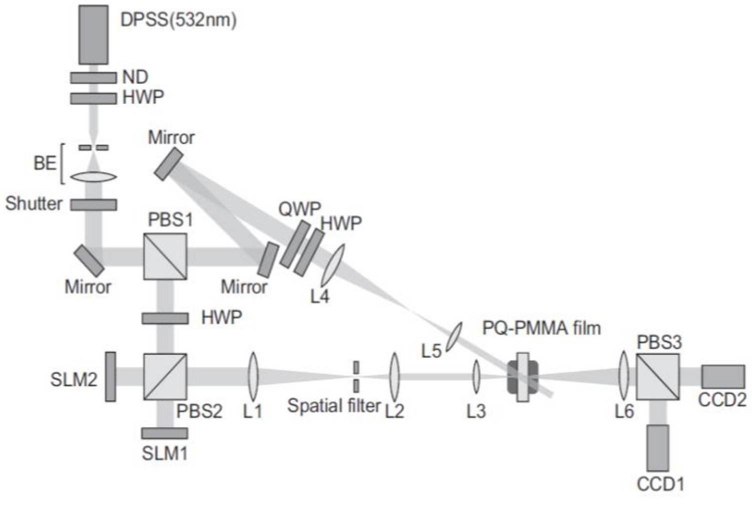

Fig. 1.Optical setup for dual-channel polarization holography. HWP, PBS, and SLM are half-wave plate, polarizing beam splitter, and spatial light modulator, respectively.

Yang, Chih-Chung (C. C.) 楊志忠

Institute of Photonics and Optoelectronics, National Taiwan University
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fax: 886-2-23652637e-mail: ccycc@ntu.edu.tw
websites: http://cc.ee.ntu.edu.tw/~ccy

1. **Personal Information**
   Birth Date: October 12, 1954
2. **Education:**
   October 1972 – June 1976
   Department of Electrical Engineering, National Taiwan University **BS**
   August 1979 – February 1981
   Department of Electrical Engineering, University of Illinois at Urbana-Champaign, USA **MS**
   February 1981 – August 1984
   Department of Electrical Engineering, University of Illinois at Urbana-Champaign, USA **Ph.D.**
3. **Major Experiences:**
   August 1984 – June 1990
   Department of Electrical Engineering, The Pennsylvania State University, USA
   Assistant Professor
   July 1990 – July 1993
   Department of Electrical Engineering, The Pennsylvania State University, USA
   Associate Professor with Tenure
   August 1993 –
   Institute of Photonics and Optoelectronics and Department of Electrical Engineering, National Taiwan University **Professor**
   August 2001 – July 2007
   Institute of Photonics and Optoelectronics, National Taiwan University
   Chairman
   August 2013 –
   Institute of Photonics and Optoelectronics, National Taiwan University
   Distinguished Professor
4. **Research Scopes:**
   Nitride and oxide semiconductor MOCVD and MBE growths, light-emitting diode, nano-photonics and optoelectronics, surface plasmonics, and bio-photonics
5. **Honors:**
   Fellow of Optical Society of America (2002); Fellow of SPIE (2011); Outstanding Research Award of National Science Coucil, Taiwan (2010)
6. **Publications:**
   About 300 SCI journal papers and about 700 conference papers, including over 120 invited talks at international conferences.
7. **Graduate Student These Supervisions:**
   40 Ph.D. these and over 120 MS these supervisions.

Gold Nanoparticles of Specialized Geometries for Photothermal and Photodynamic Therapies

Wei-Hsiang Hua, Yu Lu He, Jen-Hung Hsiao, Po-Hao Tseng, Jian-He Yu, Meng Chun Low, Yu-Hsuan Tsai, Cheng-Jin Cai, Wen-Yen Chang, Yean-Woei Kiang, and C. C. (Chih-Chung) Yang (楊志忠)*

Institute of Photonics and Optoelectronics, National Taiwan University,

臺灣大學光電所

No. 1, Section 4, Roosevelt Road, Taipei, 10617 Taiwan

Surface plasmon (SP) resonance of a gold nanoparticle (NP) can produce enhanced absorption of incident light to generate a local heating effect for damaging cancer cell, i.e., the photothermal (PT) effect. Also, the nearby strong field distribution of a gold NP at SP resonance can increase the single- or two-photon absorption of a photosensitizer for enhancing the photodynamic (PD) effect. A few specially-shaped gold NPs for specifically targeted SP resonance behaviors and their applications to the PT and PD effects for damaging cancer cell are discussed at this presentation. Gold nanorings are fabricated for shifting the SP resonance into the high-penetration spectral range of 1000-1300 nm. Also, rough-surface and porous gold NPs are fabricated for enhancing the SP resonance strength and increasing the linked amount of a photosensitizer. Regarding cancer cell damage application, the effects of cell perforation and preheating on the cell damage efficiency are presented. Also, the cell death pathways under the PT and PD effects are elucidated. Meanwhile, the effects of cell exocytosis after the uptakes of gold NPs and photosensitizers on cell damage efficiency are demonstrated. Besides, the novel methodologies for the aforementioned studies are illustrated.

Ichiro Ishimaru (石丸伊知郎)
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221-20 Hayashi-cyo, Takamatsu Kagawa, Japan
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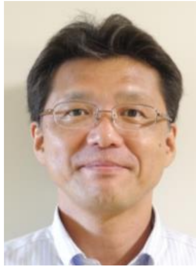

1. Personal Information

Birth: Takamatsu City, Kagawa, 1962.

2. Educations:

1987.3 Mechanical Engineering, Osaka University
1999.1 Doctor of Engineering, the University of Tokyo.

3. Professional Experiences:

1987.4~2000.3 Hitachi, Ltd, Production Engineering Research Laboratory
2000.4~ Faculty of Engineering, Department of intelligent Mechanical Systems Engineering, Kagawa University

4. Fields of Specialty:

- Spectroscopic Imaging for healthcare sensors, environmental measurements and cultural properties

5. Major awards and honors

- 21th century innovation encouraging award of Japan Institute of Invention and Innovation in 2017.

6. List of Recent Selected Publications

- Kosuke Nogo, Wei Qi, Keita Mori, Satoshi Ogawa, Daichi Inohara, Satsuki Hosono, Natsumi Kawashima, Akira Nishiyama, Kenji Wada, and Ichiro Ishimaru, "Ultrasonic Separation of a Suspension for In-situ Spectroscopic Imaging," Optical Review, Vol.23,No.2, pp.360-363, DOI: 10.1007/s10043-016-0186-x, February 2016(2016)
- Shun Sato, Wei Qi, Natsumi Kawashima, Kosuke Nogo, Satsuki Hosono, Akira Nishiyama, Kenji Wada, and Ichiro Ishimaru, "Ultra-miniature one-shot Fourier-spectroscopic tomography," Optical Engineering, Vol.55, pp.025106-1 -025106-8, February 2016(2016)
- Ichiro ISHIMARU, Natsumi KAWASHIMA, Satsuki HOSONO, Built-in hyperspectral camera for smartphone in visible, near-infrared and middle-infrared lights region (1st. report) - Trial products of beans-size Fourier-spectroscopic line-imager and feasibility experimental results of middle infrared spectroscopic imaging -, Proc. of SPIE Defense and Commercial Sensing Conference 2016,April 2016 (2016) in print
- Natsumi KAWASHIMA, Satsuki HOSONO, Ichiro ISHIMARU, Built-in hyperspectral camera for smartphone in visible, near-infrared and middle-infrared lights region (2nd.report) - Sensitivity improvement of Fourier spectroscopic imaging to detect diffuse reflection lights from internal human tissues for healthcare sensors -, Proc. of SPIE Defense and Commercial Sensing Conference 2016,April 2016 (2016) in print
- Satsuki HOSONO, Natsumi KAWASHIMA, Dirk Wollherr and Ichiro ISHIMARU, Built-in hyperspectral camera for smartphone in visible, near-infrared and middle-infrared lights region (3rd. report) - Spectroscopic imaging for broad-area and real-time componential analysis system against local unexpected terrorism and disasters -, Proc. of SPIE Defense and Commercial Sensing Conference 2016,April 2016 (2016) in print
- Naoyuki YAMAMOTO, Tsubasa SAITO, Satoru OGAWA, Ichiro ISHIMARU, Middle infrared (wavelength range: 8[μm]-14[μm]) 2-dimensional spectroscopy (total weight with electrical controller: 1.7[kg], total cost: less than 10,000 USD) so called hyperspectral camera for unmanned air vehicles like drones, Proc. of SPIE Defense and Commercial Sensing Conference 2016,April 2016 (2016) in print
- Tsubasa Saito , Satoshi Ogawa , Wei Qi , Natsumi Kawashima , Pradeep K.W. Abeygunawardhana , Ichiro Ishimaru, "Ultra-compact and lightweight mid-infrared Fourier spectroscopic imager applicable to Unmanned-Air-Vehicle drones", 10th International Conference on Optics-photonics Design & Fabrication, February 28th – March 2nd, (2016)

Mid-infrared Hyperspectral Portable-camera for Healthcare Sensors, Environmental Measurements and Cultural Properties

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Summary: To advance IoT (Internet of Things) technologies, we proposed two kinds of revolutionary compact hyperspectral camera for UAV (Unmanned Aerial Vehicle) such as drones, or smartphones. The palm-size 2-dimensional spectroscopic imager was able to be applied for mid-infrared lights and to be mounted on the multicopter drone.

Introduction: We developed the high-portable palm-size hyperspectral camera (Dimension: W90[mm]×L138[mm]×H60[mm],Weight: optical head 0.78[kg])for mid-infrared lights (Wavelength: 8-14[μm]). Because the proposed method is a near-common path phase-shift interferometer with strong robustness against mechanical vibration, anti-vibration mechanical systems are not required. Thus, the ultra-compact low-price spectroscopic imager was able to be constructed with the simple optical configuration. Furthermore, the proposed method, what is called the imaging-type 2-dimensional Fourier spectroscopy, has high light efficiency. The proposed hyperspectral camera was able to be applied to mid-infrared lights whose photon energy is very low.

Palm-size wide-field hyperspectral camera: As shown in Figure1, we made 2-type trial products of our proposed method. The left-hand side photo in Fig.1 shows the imaging-type 2-dimensional Fourier spectroscopy that is a temporal phase-shift interferometer. And the center photo shows the one-shot-type 1-dimensional Fourier spectroscopy that is a spatial phase-shift interferometer. To secure high time resolution, we developed the imaging-type 2-dimensinal Fourier spectroscopy into spatial phase-shift snapshot method. The 2-dimensional type was able to be mounted on UAV (Unmanned Aerial Vehicle) such as drone to measure environmental conditions for agricultural fields or marines. And the 1-dimensional type, whose dimension was thumb size, will be available for the built-in beans-size hyperspectral camera for smartphones.

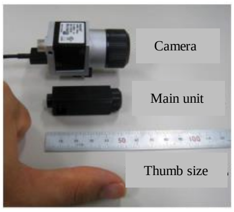
	Trial products by AOI Electronics Co., Ltd.		Conventional method
Hyperspectral camera	 2-dimensional imager	 1-dimensional imager	 2-dimensional imager
Dimension	Business card size	Beans-size(future)	A2 size
Weight	**0.78[kg]**	**0.3[kg]**	29[kg]
Application examples	Environmental measurement with UAV	Healthcare sensor built-in smartphone	Military application (1.5million USD)

Figure 1 Two kind trial products of hyperspectral camera: left-hand photo shows the imaging-type 2-dimensional Fourier spectroscopy, center photo shows the one-shot-type 1-dimensional Fourier spectroscopy.

Session III

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1. Personal Information

Birth: Osaka, Japan, 1972.

2. Educations:

1999.3	Engineering, University of Tsukuba, Ph. D.
1996.3	Applied Physics, University of Tsukuba, M. S.
1994.3	Applied Physics, University of Tsukuba, B. S.

3. Professional Experiences:

2017.4~	Kitami Institute of Technology, Professor
2007.4~2017.3	Kitami Institute of Technology, Associate Professor
2004.4~2007.3	Kitami Institute of Technology, Assistant

4. Fields of Specialty:

- Calculation and application of polarization color
- Hologram recording in glass substrate by corona charging
- Development of optical educational tools

5. Major awards and honors

- "Suzuki-Okada Memorial Award" from Holographic Display Artists and Engineers Club in 2003.

6. List of Recent Selected Publications

- **K. Harada**, T. Matsuzaki, and H. Qin, "Stereoscopic imaging system using interference color of retarder films", *Optik*, **156** (2018) 914.
- **K. Harada**, T. Matsuzaki, "Utilization of two-dimensional code using generic bricks", *Japanese Journal of Applied Physics Education*, **41** (2017) 31. (in Japanese)
- H. Qin, T. Matsusaki, Y. Momoi, and **K. Harada**, "Dual visual cryptography using the interference color of birefringent material", *Journal of Software Engineering and Applications*, **10** (2017) 754.
- D. Sakai, **K. Harada**, Y, Hara, H. Ikeda, S. Funatsu, K. Uraji, T. Suzuki, Y. Yamamoto, K. Yamamoto, N. Ikutame, K. Kawaguchi, H. Kaiju, and J. Nishii, "Selective deposition of SiO2 on ion conductive area of soda-lime glass surface" , *Scientific Reports*, **6** (2016) 27767.
- **K. Harada**, N. Suzuki, T. Tsuji, T. Matsuzaki, and D. Sakai, "Utilization of two-dimensional code using generic bricks", *Japanese Journal of Applied Physics Education*, **40** (2016) 49. (in Japanese)
- S. Sugawara, **K. Harada**, and D. Sakai, "High-chroma visual cryptography using interference color of high-order retarder films", *Optical Review*, **22** (2015) 544.
- K. Kawaguchi, T. Suzuki, H. Ikeda, D. Sakai, S. Funatsu, K. Uraji, K. Yamamoto, **K. Harada**, and J. Nishii, "Alkali ion migration between stacked glass plates by corona dischargetreatment", *Applied Surface Science*, **338** (2015) 120.
- D. Kobayashi, Y. Yamamoto, K. Yamamoto, S. Funatsu, **K. Harada**, and J. Nishii, "Mechanism of hologram formation on glass surface by recording technique with corona discharge", *Journal of Surface Analysis*, **20** (2014) 226.
- K. Kawaguchi, H. Ikeda, D. Sakai, S. Funatsu, K. Uraji, K. Yamamoto, T. Suzuki, **K. Harada**, and J. Nishii, "Accelerated formation of sodium depletion layer on soda lime glass surface by corona discharge treatment in hydrogen atmosphere", *Applied Surface Science*, **300** (2014) 149.
- **K. Harada**, T. Yamaguchi, T. Tsuchida, and D. Sakai, "Visual cryptography using interference color of high-order retarder films", *Japanese Journal of Applied Physics*, **52** (2013) 062501.

Polarization Color and Its Aapplications

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A Retarder film (birefringent cellophane tape or a polymer sheet) exhibits polarization color (interference color) by polarizer. Polarization color is an important source of information for the microscopic observation of birefringent materials. Polarization color is also applied for education, art, security. Figure 1 shows an example of polarization color applied for art. A weak point of conventional polarization color is the quality of the color. High-chroma color cannot be displayed using polarization color. To solve this problem, we propose a technique involving the stacking of retarder films. Our system is composed of up to four transparent retarder films and two polarizers. Each color is controlled by the phase retardation and setting angle of the retarder films. Figure 2(a) shows the conventional optical arrangement. The angle between the transmission axis of a polarizer and the retarder axis of a retarder film is 45° or 135° because the maximum transmittance is obtained at these angles. Figure 2(b) shows the proposed optical arrangement. The angle between the transmission axis of a polarizer and the retarder axis of a retarder film can be varied, and up to four retarder films are stacked. Figure 3 shows the measured chromaticity diagram of polarization color using four retarder films. Figure 4 shows the polarization color chart. In this way, we can display a high-chroma image by using this proposed setup.

Fig. 1. Polarization color art.

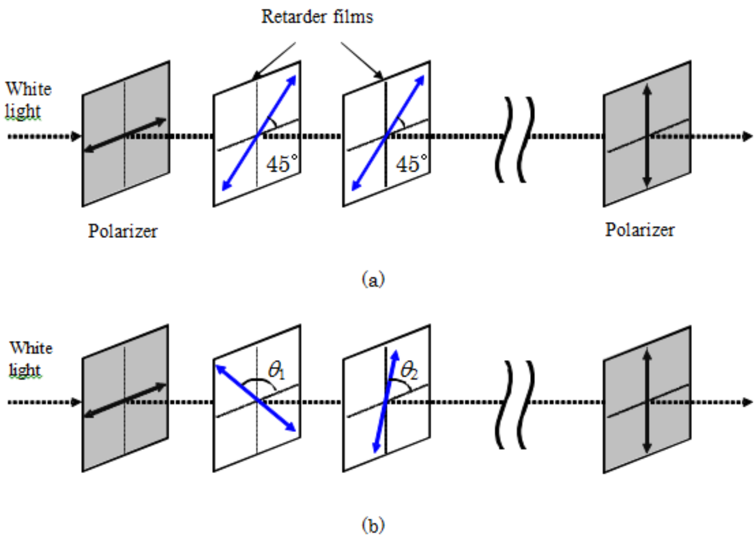

Fig. 2. Optical arrangement of polarizers and retarder films. (a) Conventional method and (b) proposed method.

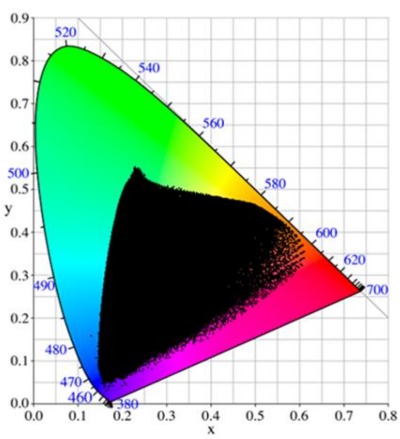

Fig. 3. Measured chromaticity diagram of polarization color using four retarder films.

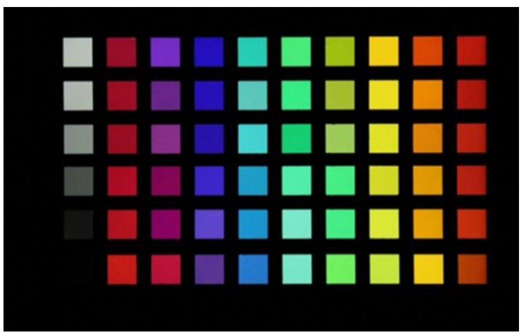

Fig. 4. Polarization color chart.

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1. Personal Information

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2. Educations:

1974.3 Applied Physics, The University of Tokyo, Ph.D.
1971.3 Applied Physics, The University of Tokyo, M.E.
1969.3 Electrical Engineering, the University of Electro-Communications, UEC Tokyo, B.E.

3. Professional Experiences:

2012.4~ Center for Optical Research and Education, Utsunomiya University, 2012.4~2017.3 Specially Appointed Research Professor, 2017.4~ Adjunct Professor
2013.3~2014.9 Institut für Technische Optik, Universität Stuttgart, Humboldt Guest Professor
1977.4~2012.3 The University of Electro-Communications, UEC Tokyo, 1977.4 Lecturer, 1980.5 Associate Professor, 1990.4 Professor, 2012.3 Emeritus Professor
1985.3~1985.12 Information Systems Laboratory, Stanford University, Visiting Scholar
1975.4~1977.3 Central Research Laboratory and Optical Design Section, Canon Inc., R&D Staff
1974.4~1975.3 Institute of Industrial Science, The University of Tokyo, JSPS Post-doctoral Fellow

4. Fields of Specialty:

- Optical metrology, holography and optical information processing
- Statistical optics and imaging theory

5. Major awards and honors

Chandra S. Vikram Award (SPIE, 2017), Humboldt Research Award (Alexander von Humboldt Foundation, 2013), Optics and Quantum Electronics Achievement Award (Hiroshi Takuma Award, JSAP, 2012), Distinguished Alumni Award (UEC, 2011), Dennis Gabor Award (SPIE, 2010), OSA Fellow (2007), JSAP Fellow (2007), SPIE Fellow (1999), Member of International Order of Knights of Holography (1999).

6. List of Recent Selected Publications

- A. K. Singh, G. Pedrini1, **M. Takeda**, W. Osten, "Scatter-plate microscope for lensless microscopy with diffraction limited resolution," Scientific Reports (Nature Publishing Group) (September 2017) 7: 10687 | DOI:10.1038/s41598-017-10767-3.
- A. K. Singh, D. N. Naik, G. Pedrini, **M. Takeda** and W. Osten, "Exploiting scattering media for exploring 3D objects," Light: Science & Applications (Nature Publishing Group) (2017) 6, e16219, pp.1-5; doi:10.1038/lsa.2016.219.
- **M. Takeda**, A. K. Singh, D. N. Naik, G. Pedrini, W. Osten, "Holographic correloscopy - unconventional holographic techniques for imaging a three-dimensional object through an opaque diffuser or via a scattering wall: A review," IEEE Transactions on Industrial Informatics, Vol. 12, No.4 (8, 2016) pp. 1631-1640. DOI: 10.1109/TII.2015.2503641.
- N. Ma, S. G. Hanson, **M. Takeda**, and W. Wang, "Coherence and polarization of polarization speckle generated by a rough-surfaced retardation plate depolarizer," J. Opt. Soc. Am. A, Vol. 32, No.12 (11, 2015) pp.2346-2352. .
- **M. Takeda**, W. Wang, D. N. Naik, and R. K. Singh, "Spatial statistical optics and spatial correlation holography: A review," Optical Review, Vol. 21, No. 6, pp.849–861 (2014).
- A. K. Singh, D. N. Naik, G. Pedrini, **M. Takeda**, and W. Osten, "Looking through a diffuser and around an opaque surface: A holographic approach," Opt. Express, Vol. 22, No 7, pp.7694-7701 (2014,3).
- D. N. Naik, G. Pedrini, **M. Takeda**, and W. Osten,"Spectrally resolved incoherent holography: 3D spatial and spectral imaging using a Mach–Zehnder radial-shearing interferometer," Opt. Lett. Vol. 39, No.7, pp.1857-1860 (2014,3). http://dx.doi.org/10.1364/OL.39.001857

Complex-valued Neural Networks Revisited

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Stimulated by the recent revival of interest in optical neural networks, I will revisit complex-valued neural networks[1] that attracted interest of many researchers in late 1980's to early 1990's. In recollection, this talk reviews our early work[2] on a complex-valued neural network model, with focus on its analogy to self-oscillation of an optical field generated in a phase-conjugate resonator. While today's revived interest is mainly in practical applications of machine learning for a real- valued neural network created on a digital computer, my interest was in basic understanding of the dynamics of neural networks from the viewpoint of its analogy to physical phenomena. At the time, I was enchanted by Haken's assertion "Nature computes," which is found in his book "Synergetic Computing." Our model for a complex neural network permits the state of neurons (represented by complex optical fields) to change both the amplitude and the phase, and evolve with a dynamics similar to that of the optical field building up a self-oscillation mode inside an optical resonator. It is shown that the optical gain medium should have a phase-conjugate property in order for the generated complex fields to have a Hopfield-like energy function that decreases monotonically with the time evolution of the optical fields. In Fig.1, self-oscillation of the field $V(\boldsymbol{r},t)$ is generated inside the cavity formed by a reflector and a degenerate four-wave mixing phase-conjugate mirror (PCM) with gain $g(\cdot)$ provided by pump beams. The equations of dynamics for spatially continuous complex neural fields are modeled as

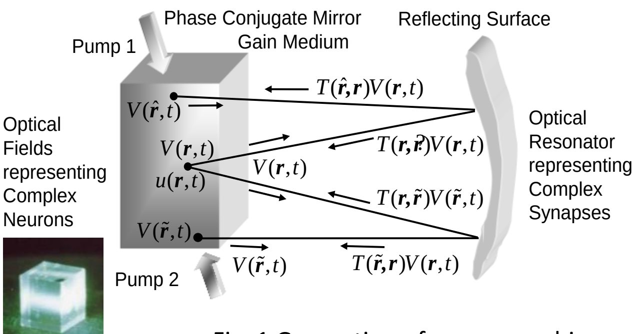

Fig. 1 Generation of neuromorphic

$$\tau\frac{\partial u(\boldsymbol{r},t)}{\partial t}=-\alpha u(\boldsymbol{r},t)+\int_{-\infty}^{\infty}T(\boldsymbol{r},\hat{\boldsymbol{r}})V(\hat{\boldsymbol{r}},t)d\hat{\boldsymbol{r}}\quad(1),\qquad V(\boldsymbol{r},t)=g(|u(\boldsymbol{r},t)|)u^*(\boldsymbol{r},t)/|u(\boldsymbol{r},t)|\quad(2).$$

We can show that these complex neural fields change their states in such a manner that the energy function defined by

$$E=-\frac{1}{2}\mathrm{Re}\left(\int_{-\infty}^{\infty}\int_{-\infty}^{\infty}T(\boldsymbol{r},\hat{\boldsymbol{r}})V(\boldsymbol{r},t)V(\hat{\boldsymbol{r}})d\boldsymbol{r}d\hat{\boldsymbol{r}}\right)+\alpha\int_{-\infty}^{\infty}\int_{0}^{|V(\boldsymbol{r},t)|}g^{-1}(s)dsd\boldsymbol{r}\quad(3)$$

reduces its value monotonically with the time evolution of the system. In the talk, I will review so

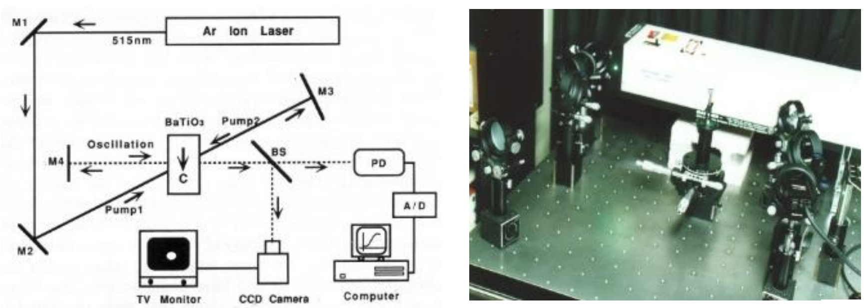

Fig. 2 Experimental setup.

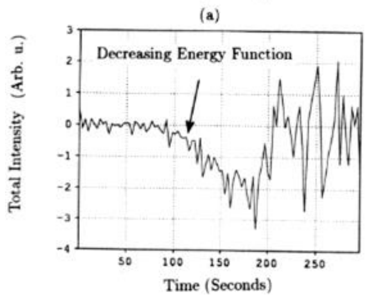

Fig. 3 Energy function decreasing monotonically in the weak-field region

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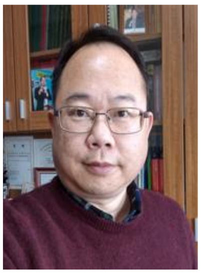

1. Personal Information

Birth: Tainan City, Taiwan, 1965.

2. Educations:

1993.1 Optical Sciences, NCU, Ph.D.
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3. Professional Experiences:

2013.8~2017.4 Optical Sciences Center, NCU, Director
2013.9~2014.1 College of Research, NCU, Deputy Dean
2009.8~2012.7 Department of Optics and Photonics, NCU, Chair
2013~ NCU, Chair Professor in Optics
2002.8~ Department of Optics and Photonics, NCU, Professor
1996.8~2002.7 Institute of Optical Sciences, NCU, Associate Professor

4. Fields of Specialty:

- Holography
- LED solid state lighting
- Optical system

5. Major awards and honors

- Outstanding Research Award, MOST, 2015.
- Outstanding Research Award, NSC, 2010.
- Distinguished Technology Transfer Award, NSC, 2010.
- Distinguished Industrial Technology Award, MOEA, 2009.

6. List of Recent Selected Publications

- R. J. Lin, M. S. Tsai, and C. C. Sun, "Novel optical lens design with a light scattering freeform inner surface for LED down light illumination, "Optics Express **23** (13), 16715-16722 (2015).
- S. C. Chung, P. C. Ho, D. R. Li, T. X. Lee, T. H. Yang, and C. C. Sun, "Effect of chip spacing on light extraction for light-emitting diode array," Optics Express **23** (11), A640-A649 (2015).
- X. F. Li, S. W. Huang, H. Y. Lin, C. Y. Lu, S. F. Yang, C. C. Sun, and C. Y. Liu, "Fabrication of patterned sapphire substrate and effect of light emission pattern on package efficiency," Optical Materials Express **5**, 1784-1791 (2015).
- Y. W. Yu, S. Xiao, C. Y. Cheng, and C. C. Sun, "One-shot and aberration-tolerable homodyne detection for holographic storage readout through double-frequency grating–based lateral shearing interferometry," Optics Express **24** (10), 10412-10423 (2016).
- Y. W. Yu, S. Y. Chen, C. C. Lin, and C. C. Sun, "Inverse focusing inside turbid media by creating an opposite virtual objective," Scientific Reports **6**, 29452 (2016).
- C. C. Sun, X. H. Lee, I. Moreno, C. H. Lee, Y. W. Yu, T. H. Yang, and T. Y. Chung, "Design of LED street lighting adapted for free-form roads," IEEE Photonics Journal **9** (1), 1-13 (2017).
- C. C. Sun, Y. Y. Chang, C. Y. Lu, H. Y. Lin, Z. Y. Ting, T. H. Yang, T. Y. Chung, and Y. W. Yu, "Spatial-coded phosphor coating for high-efficiency white LEDs," IEEE Photonics Journal **9**(3), 1-9 (2017).
- Y. W. Yu, C. S Yang, T. H. Yang, S. H. Lin, and C. C. Sun," Analysis of a lens-array modulated coaxial holographic data storage system with considering recording dynamics of material," Optics Express **25** (19), 22947-22958 (2017).
- T. H. Yang, S. M. Wu, C. C. Sun, B. Glorieux, T. Y. Chung, C. Y. Chen, Y. Y. Chnag, X. H. Lee, Y. W. Yu, and K. Y. Lai, "Stabilization of correlated color temperature with self-compensation in phosphor conversion efficiency for white LEDs," Optics Express **25**(23), 29287-29295 (2017).
- T. H. Yang, H. Y. Huang, C. C. Sun*, B. Glorieux, X. H. Lee, Y. W. Yu, and T. Y. Chung, "Non-contact and instant detection of phosphor temperature in phosphor-converted white LEDs," Scientific Reports **8** (1), 296 (2018).

Smart 3D Indoor Mapping Based on Optical and Artificial Intelligence Technology

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Three-dimensional indoor map has been intensively discussed for its potential impact on modern life style. The applications include virtual/augmented/mixed reality, positioning, navigation, medical care, auto-drive robot, police and firefighters, intelligent transportations, museums, situation awareness, and etc.. Rather than 2D mapping in outdoor application, indoor application needs more precision in 3D information, which enables the application to complex indoor 3D positioning, navigation and internet of things (IoT). In this report, we will start from 3D optical scanning technologies including two cameras, structure light projection and Lidar technology. Then we will discuss the image processing of the point clouds, and the auto-modeling technology, as shown in Fig. 1. Finally the talk will focus on several interesting applications including positioning, navigation and possible new applications.

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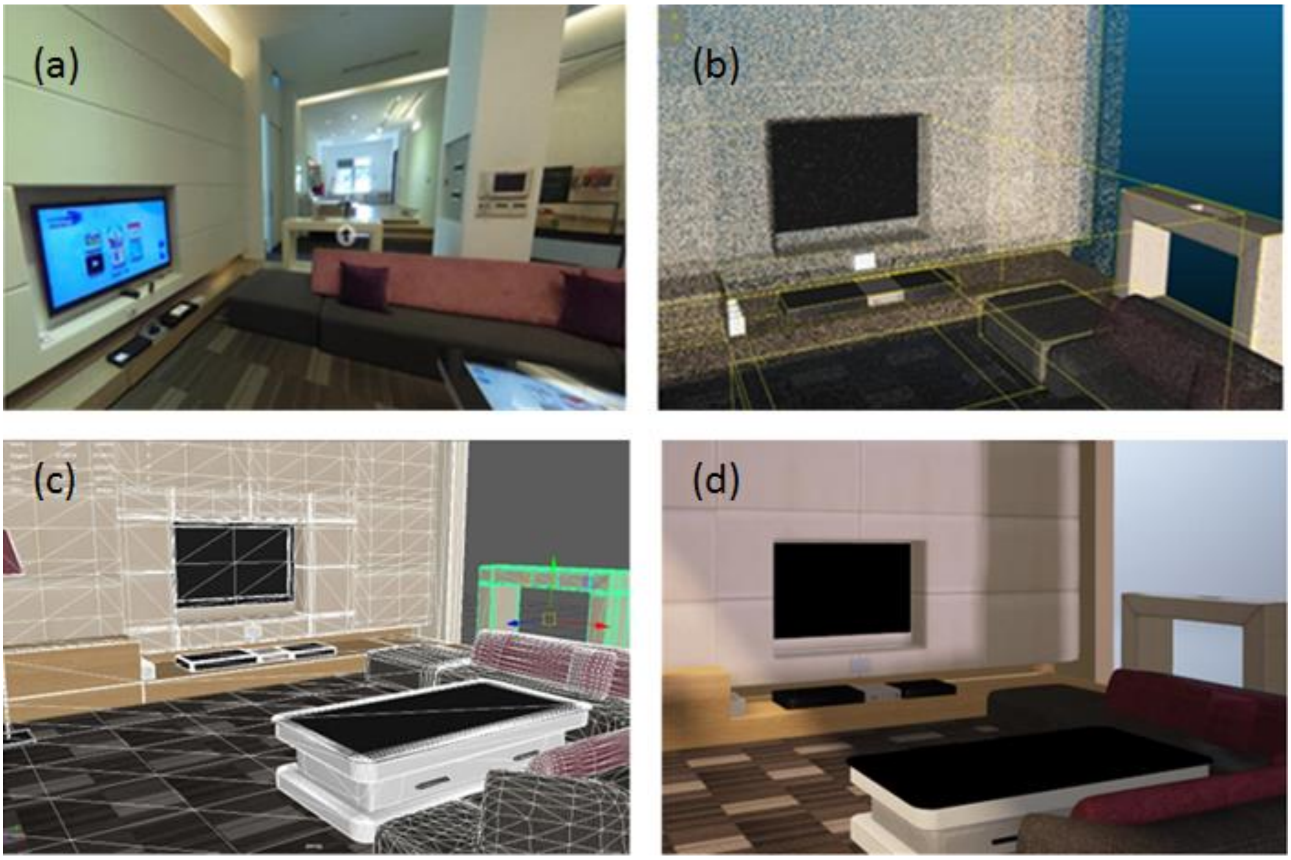

Fig. 1. Image processing for an example of the indoor objects shown in (a), including (b) point clouds, (c) CAD structures, and (d) simulated objects embedded with 3D information.

Experimental results such as those shown in Fig. 2 and 3.

1. See, for example, A. Hirose Ed., *Complex-Valued Neural Networks*, World Scientific Publishing (2003).
2. M. Takeda and T. Kishigami, “Complex neural fields with a Hopfield-like energy function and an analogy to optical fields generated in phase-conjugate resonators,” J. Opt. Soc. Am. A, Vol. 9, No. 12, 2082-2091 (1992).

Session IV

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1981.3	Applied Physics, Osaka University, B.E.

3. Professional Experiences:
2017.4~	Optical Society of Japan, President
2014.9~2017.3	Optical Society of Japan, Vice President
2002.4~	Graduate School of Information Science and Technology, Osaka University, Professor
1996.4~2002.3	Faculty of Engineering, Osaka University, Associate Professor
1993.10~1996.3	Faculty of Engineering, Osaka University, Lecturer
1986.11~1993.9	Faculty of Engineering, Osaka University, Research Associate
1986.4~1986.10	Japan Society for the Promotion of Science, Research Fellow

4. Fields of Specialty:
- Computational Optical Imaging
- Optical computing
- Information Photonics

5. Major awards and honors
- Outstanding Optics Paper Award, Japan Society of Applied Physics, 1986.
- Fellow, The Optical Society, 2015
- Fellow, Japan Society of Applied Physics, 2015

6. List of Recent Selected Publications

- R. Horisaki, R. Takagi, and **J. Tanida**[*], "Learning-based single-shot superresolution in diffractive imaging," *Applied Optics* **56** (2017) 8896.
- T. Nishimura, H. Kimura, Y. Ogura, and **J. Tanida**[*], "Experimental assessment and analysis of super-resolution in fluorescence microscopy based on multiple-point spread function fitting of spectrally demultiplexed images," *Optical Review* (2017). https://doi.org/10.1007/s10043-017-0379-y.
- R. Horisaki, T. Kojima, K. Matsushima, and **J. Tanida**[*], "Subpixel reconstruction for single-shot phase imaging with coded diffraction," *Applied Optics* **56** (2017) 7642.
- **J. Tanida**[*], H. Akiyama, K. Kagawa, C. Ogata, and M. Umeda, "A stick-shaped multi-aperture camera for intra-oral diagnosis," *Proc. SPIE* **10222**, *Computational Imaging II* (2017) 102220L.
- R. Horisaki, R. Takagi, and **J. Tanida**[*], "Learning-based focusing through scattering media," *Applied Optics* **56** (2017) 4358.
- T. Nishimura, K. Kimura, Y. Ogura, and **J. Tanida**[*], "Bayesian based fluorescence coded imaging using quantum dots," *Proc. SPIE* **10251**, *Biomedical Imaging and Sensing Conference* (2017) 102510Z.
- Y. Ogura, M. Aino, and **J. Tanida**[*], "Diffractive fan-out elements for wavelength-maltiplexing subdiffraction-limit spot generation in three dimensions," *Applied Optics* **55** (2016) 6371.
- Y. Ogura, A. Ohishi, T. Nishimura, and **J. Tanida**[*], "Optically controlled release of DNA based on nonradiative relaxation process of quenchers," *Biomedical Optics Express* **7** (2016) 2142.
- H. Horisaki, R. Takagi, and **J. Tanida**[*], "Learning-based imaging through scattering media," *Optics Express* **24** (2016) 13738.
- **J. Tanida**[*], "Multi-aperture optics as a universal platform for computational imaging," *Optical Review* **23** (2016) 859.

Application of Machine Learning for Optical Sensing and Imaging through Scattering Media

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Machine learning is a powerful mathematical tool to explore relations or knowledge hidden in observation data. In the imaging field, superior capability of object recognition comparable to human perception is achieved by machine learning on deep neural network. Our group demonstrated that machine learning is also efficient for imaging applications other than simple object recognition. Namely, we confirmed effectiveness of the machine learning for object recognition, imaging, and focusing through scattering media. The procedure is quite simple. Multiple pairs of the object and observation signal passing through scattering media are prepared and then an appropriate machine learning algorithm is adopted to configure the processing network using the date sets. In the first demonstration, face and non-face objects were illuminated by a laser light and the speckle-wise signals passing through a scattering plate were observed. In the training process, up to 2000 data pairs of the image and the scattered patterns were used to configure the classifier using a support vector machine (SVM). For 200 scattered patterns from 100 face and 100 non-face objects, approximately over 90% of the accuracy rate was obtained in the classification of face and non-face. Then we applied this scheme to imaging through scattering media. In this case, we employed the individual pixel correspondences to the scattered signals considering the fact that a pixel signal of the object spreads and affects to the whole observation signals. To estimate the corespondences, support vector regression (SVR) using a kernel method was used. As shown in Fig.1, relatively good performance was confirmed by the proposed method. As an extension of imaging, we also achieved light control through scattering media. Once the relation between a pixel of the object and the scattered signal is obtained, it is possible to design the object producing a desired pattern after passing through scattering media. As an application of this scheme, light focusing was achieved through scattering media.

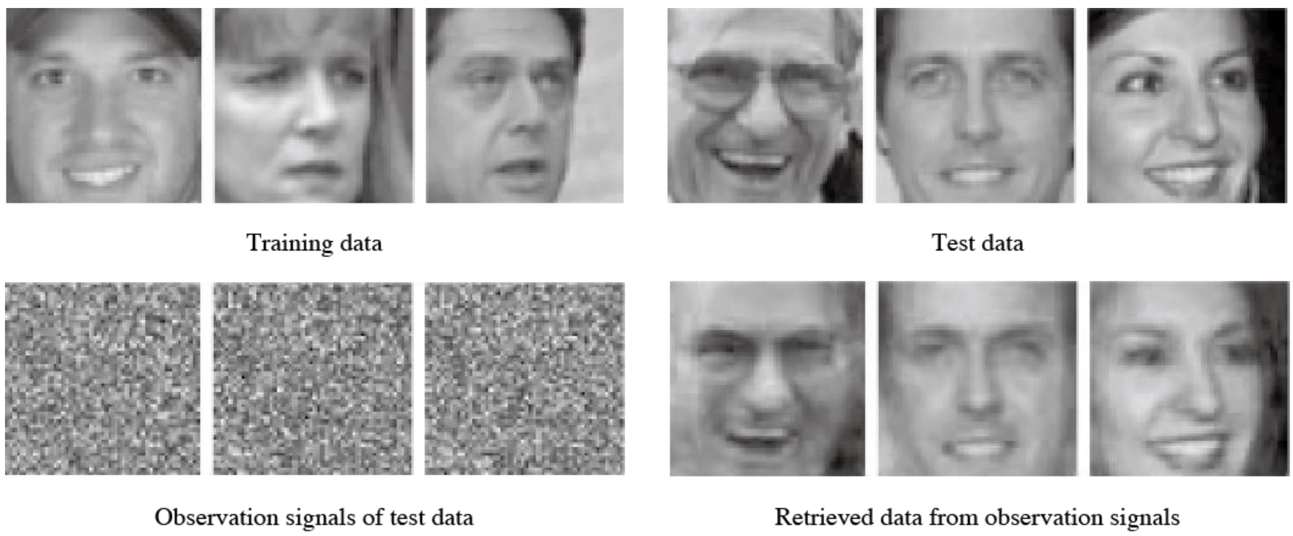

Fig. 1. Experimental result of learning-based imaging through scattering media.

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1. Personal Information

Birth: Taiwan, 1959.

2. Educational history

1985/09~1990/06 Ph.D, University of Cincinnati, Ohio, U.S.A.

3. Work experience

2012~	Director and Distinguished Research Fellow, Research Center for Applied Sciences, Academia Sinica, Taipei, Taiwan.
2008~2012	Director General and Distinguished Research Fellow, National Instrument Technology Research Center, Hsinchu, Taiwan.
1999~2001,2001~,2006~	Associate Professor, Professor, Distinguished Professor, Department of Physics, National Taiwan University, Taipei, Taiwan.
1994~1999	Associate Professor, Department of Physics, National Chung Cheng University, Chia Yi, Taiwan.
1991~1994	Postdoctoral Fellow, Ontario Laser & Lightwave Research Center, Toronto, Ontario, Canada
1990~1991	Research Staff, Microlithography Inc., Sunnyvale, California, U.S.A

4. Major Awards and Honors

- 260 **invited talks** at international conferences, including 10 **plenary talks** and 44 **keynote talks**.
- **Fellow**, **AAAS** (2016), **3M NANO** (2014), **IEEE** (2012), **EMA** (2007), **APS** (2007), **OSA** (2006), and **SPIE** (2005).
- **Corresponding Member**, International Academy of Engineering (IAE), 2015.
- **Academician**, Asia Pacific Academy of Materials (APAM), 2013.
- "**Outstanding Achievement Award in Science and Technology** (2006)", **The Executive Yuan**, Taiwan.
- "**Outstanding Academic Award** (2011)"、"**Excellent Industry-Academy Cooperation Award** (2006)" **Ministry of Education**, Taiwan.
- Two "**Outstanding Research Award** (2013-2016 and 2010-2013)"、"**Science 50 Award** (2008)" **National Science Council**, Taiwan.
- "**Outstanding Research Award** (2010)"、"**Fu Ssu-Nien Award** (2005)"、"**Outstanding Research Contribution Award** (2004)"、"**Senior Excellent Teacher Award** (2004) " **National Taiwan University**.
- "**Distinguished Optical Engineering Award** (2007)"、 "**Outstanding Optical Technology Contribution Award** (2005)" Optical Engineering Society, Taiwan.

5. Selected Publications

- S. Wang, P. C. Wu, V.-C. Su, Y.-C. Lai, M.-K. Chen, H. Y. Kuo, B. H. Chen, Y. H. Chen, T.-T. Huang, J.-H. Wang, R.-M. Lin, C.-H. Kuan, T. Li, Z. Wang, S. Zhu and **D. P. Tsai**, "A broadband achromatic metalens in the visible," **Nat. Nanotechnol.** doi:10.1038/s41565-017-0052-4. (2018) **(IF=38.986)**
- S. M. Wang, P. C. Wu, V.-C. Su, Y.-C. Lai, C. H. Chu, J.-W. Chen, S.-H. Lu, J. Chen, B. B. Xu, C.-H. Kuan, T. Li, S. N. Zhu, and **D. P. Tsai** "Broadband achromatic optical metasurface devices," **Nature Comm.** 8, 187 (2017). **(IF=12.124)**

Meta-device for Photonics in Demand

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Photonic metamaterials composed of artificial structures have attracted a huge number of interests due to their extraordinary optical properties such as optical invisibility [1]. Their single layer configuration, photonic metasurfaces, enable abrupt changes to the electromagnetic phase as well as amplitude within a subwavelength spatial region, which is very promising for the development of flat optics devices in electromagnetic wavefront control [2], nonlinear action [3] and so on. In this talk, I will discuss the unprecedented the scheme of phase modulation through metasurfaces and their applications. The aluminum plasmonic metasurfaces are introduced for the achievement of desired functionalities like versatile polarization generations [4] that working across whole range of visible light. Furthermore, by incorporating with hyperbolic phase profile, one can possess the pixel-level color router, which is capable of guiding individual primary wavelengths into different spatial positions, and a functionality of selectively specific narrow bandwidth for light routing [5]. Finally, a novel design principle for realizing broadband achromatic meta-devices at the visible such as converging metalens will be discussed in this presentation [6, 7].

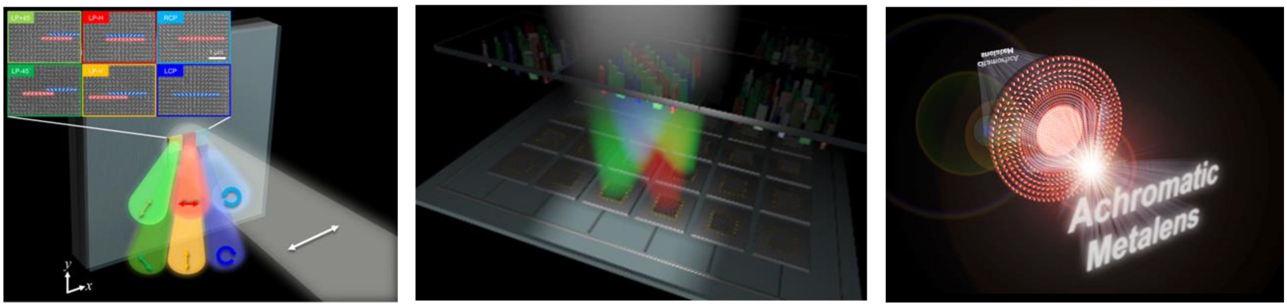

Fig. 1. Schematic of meta-devices for photonics in demand. (a) Versatile polarization generation. (b) Pixel-scale full-color router. (c) Broadband achromatic metalens in the visible

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[2] B. Walther, C. Helgert, C. Rockstuhl, F. Setzpfandt, F. Eilenberger, E.-B. Kley, F. Lederer, A. Tünnermann, and T. Pertsch, "Spatial and spectral light shaping with metamaterials," Adv. Mater. **24**, 6300-6304 (2012).

[3] G. Grinblat, Y. Li, M. P. Nielsen, R. F. Oulton, and S. A. Maier, "Enhanced third harmonic generation in single germanium nanodisks excited at the anapole mode," Nano Lett. **16**, 4635-4640 (2016).

[4] P. C. Wu, W.-Y. Tsai, W. T. Chen, Y.-W. Huang, T.-Y. Chen, J.-W. Chen, C. Y. Liao, C. H. Chu, G. Sun, and D. P. Tsai, "Versatile polarization generation with an aluminum plasmonic metasurface," Nano Lett. **17**, 445-452 (2017).

[5] B. H. Chen, P. C. Wu, V.-C. Su, Y.-C. Lai, C. H. Chu, I. C. Lee, J.-W. Chen, Y. H. Chen, Y.-C. Lan, C.-H. Kuan, and D. P. Tsai, "GaN metalens for pixel-level full-color routing at visible light," Nano Lett. **17**, 6345-6352 (2017).

[6] S. Wang, P. C. Wu, V.-C. Su, et. al., "Broadband achromatic optical metasurface devices," Nat. Commun. **8**, 187 (2017)..

[7] S. Wang, P. C. Wu, V.-C. Su, Y.-C. Lai, M.-K. Chen, H. Y. Kuo, B. H. Chen, Y. H. Chen, T.-T. Huang, J.-H. Wang, R.-M. Lin, C.-H. Kuan, T. Li, Z. Wang, S. Zhu, and D. P. Tsai, "A broadband achromatic metalens in the visible," Nature Nanotechn. (2018)

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EDUCATION

Ph.D., Electrical Engineering, University of Texas, Arlington, May 2007
Master of Science, Electrical Engineering, University of California, Irvine, March 2003
Bachelor of Science, Electrical Engineering, University of California, Irvine, June 2001

DISSERTATION

Specialization: Biomedical Imaging, Integrated and Ultrafast Optics, Microelectromechanical System (MEMS).
Dissertation**:** Electromagnetically Actuated Devices for Optical Coherence Tomography Applications.
Dissertation Advisor: Digant Dave, J.C. Chiao

HONORS ORGANIZATION: Member of Tau Beta Pi (General Engineering Honor Society), 2000-present

WORK EXPERIENCE

Assistant professor, Institute of Photonics, College of Photonics, National Chiao Tung University, Tainan, Taiwan
February 08/01/2014~present

Post-doc, Institute of Physics, Academia Sinica, Taipei, Taiwan
February 01/01/2014~07/31/2014

Post-doc, Department of Physics, National Taiwan University, Taipei, Taiwan
February 2011-October 2013

Technical consultant in MEMS related technologies, Advanced Power Electronics Corp. (富鼎先進電子股份有限公司)
Jan. 2012-October 2013

Post-doc, Pharmacology Department, College of Medicine, Ohio State University, Columbus, OH
October 2009-June 2010

Post-doc, Anesthesiology Department, David Geffen School of Medicine, University of California, Los Angeles, CA
July 2007 – September 2009

SKILLS

Computer: C, C++, Basic, Matlab, Adobe Acrobat, Labview, M.S. Office. Experience in the following software: Optica, Hspice, Pspice.

Laboratory: Near Infrared broadband laser (Titanium Sapphire), Confocal microscopy, Scanning Electron Microscopy, design of interdisciplinary experimental setups in optics, imaging systems, electronics, photonics, magnetics, microfluidics, mechanics. 5 years of clean room experiences: spin coating, photo 2D and 3D lithography, oxidation, thermal evaporation, wet and dry etching.

TEACHING EXPERIENCE

Invited Lecturer, School of Medicine, National Taiwan University November 2012 - June 2013
- Nanophotonics and Nanomedicine

Joined Instructor, School of Medicine, National Taiwan University February 2013 - June 2013
- Principle and Applications of Optical Imaging

Teaching Assistant, Electrical Engineering, UTA, January 2005 - December 2006
- Design and systems in Micro electro mechanical system(MEMS).

Teaching Assistant, Electrical Engineering, UCI, September 2001- January 2003
- C, C++, digital systems, and semiconductor device theory.

RESEARCH EXPERIENCE
Postdoctoral Researcher, Department of Physics, NTU, Feb. 2011-present
- Biological/biomedical studies at tissue and cellular levels using multiphoton microscopy and related techniques.

Postdoctoral Researcher, David Geffen School of Medicine, UCLA, June 2007 – September 2009
- Design, construct 4Pi-STED microscopic system for biomolecular imaging.
- Design and construct tools and instruments for optical measurement and characterization.

Graduate Researcher, Electrical / Biomedical Engineering, UTA, June 2003 – May 2007
- Achieve *in vivo* images of tissues underneath fingers by conducting spectral-domain optical coherence tomography (SD-OCT) imaging using a magnetic scanning probe.
- Design, construct and conduct Time-Domain OCT (TD-OCT) and Spectral-Domain OCT to image cell structure of red onion.
- Invent and fabricate MEMS-based opto-magnetic sensor and RF switch using polymer material.

Graduate Researcher, Electrical Engineering, UCI, September 2001- March 2003
- Develop and characterize scanning endoscopic tools using magnetic actuation for taking OCT images *in vivo*, *in situ*.
- Set up experiments to characterize magnetic materials and optical scanning device.

Undergraduate Researcher, Electrical Engineering, UCI, April 2000-September 2001
- Design optical setup to test performance of optical devices based on polymer materials.
- Acquire experimental data on bio-fluidic chips.
- Performed I-V & C-V measurement on wafer samples and devices.

PUBLICATIONS:
Journal paper *Corresponding author.

Cheng, C.Y., Chen, G.L., **Hu*, P.S.**, $Cs_{0.33}WO_3$ compound nanomaterial-incorporated thin film enhances output of thermoelectric conversion in ambient temperature environment. *Appl Nanosci* (2018). https://doi.org/10.1007/s13204-018-0718-8. **SCI IF: 3.325**

Hu*, P.S., Wu, C.E., Chen, G.L., ZnO micro/nanostructures grown on sapphire substrates using low-temperature vapor-trapped thermal chemical vapor deposition: structural and optical properties. *Materials.* 11(3), ma11010003 (2018) **SCI IF: 2.654**

Tomasovicova, N., **Hu*, P.S.**, Zeng, C.L., Hurakova, M., Csach, K., Majorosova, J., Kubovcikova, M., Kopcansky, P. Dynamic morphogenesis of dendritic structures formation in hen egg white lysozyme fibrils doped with magnetic nanoparticles. *Colloids and Surfaces B: Biointerfaces* 161, 457-463. (2018) **SCI IF: 3.88**

Hovhannisyan, V., **Hu, P.S.**, Chen, S.J., Kim, T.H., Dong, C.Y. Elucidation of the mechanism of optical clearing in collagen tissue with multiphoton imaging. *Journal of Biomedical Optics*. 18(4), 046004, (2013) **SCI IF: 3.188, 8/78 in Optics**

Hu, P.S., Ghazaryan, A.A., Hovhannisyan, V., Chen, S.J., Chen, Y.F., Kim, C.S., Tsai, T.H., Dong, C.Y. Imaging of biological tissues with pixel-level analysis of second-order susceptibility. *Journal of Biomedical Optics*. 18(3), 31102, (2013) **SCI IF: 3.188, 8/78 in Optics**

Tan, H.Y., Chang, Y.L., Lo, W., Hsueh, C.M., Chen, W.L., Ghazaryan, A.A., **Hu, P.S.**, Young, T.H., Chen, S.J., Dong, C.Y. Characterizing the morphologic changes in collagen crosslinked-treated corneas by Fourier transform-second harmonic generation imaging. *Journal of Cataract and Refractive Surgery*. 39(5), 779-788, (2013).
SCI IF: 4.24, 17/73 in Biophysics

Chen, W.L., **Hu, P.S.,** Ghazaryan, A.A., Chen, S.J., Tsai, T. H., Dong, C. Y. Quantitative Analysis of Two-Photon Excitation Fluorescence Imaging for Medical Diagonosis. *Computerized Medical Imaging and Graphics*. 36(7), 519-526, (2012) **SCI IF: 1.110, Rank: 87.36%**

Lo, W., Ghazaryan, A., Tso, C.H., **Hu, P.S.**, Tso, Chien-Hsin, Chen, W.L., Kuo, T.R., Lin, S.J., Chen, S.J., Chen, C.C., Dong, C.Y. Oleic acid-enhanced transdermal delivery pathways of fluorescent nanoparticles. *Applied Physics Letter.* 100(21), 213701, (2012)
SCI IF: 3.841, 15/118 in Physics, Applied.

Vladimir, V., **Hu, P.S.**, Tan, H.Y., Chen, S.J., Dong, C.Y. Spatial orientation mapping of fibers using polarization-sensitive second harmonic generation microscopy. *Journal of Biophotonics*. 5(10), 768-776, (2012).
SCI IF: 4.24, 17/73 in Biophysics

Ghazaryan, A.A., **Hu, P.S.**, Chen S.J., Tan H.Y., Dong, C.Y. Spatial and temporal analysis of skin glycation by the use of multiphoton microscopy and spectroscopy. *Journal of Dermatological Science.* 65(3),189-95, (2012)
SCI IF: 3.712, 7/55 in Dermatology

Hu, P.S., Hsueh, C.M., Su, P.J., Chen, W.L., Hovhannisyan, V., Chen, S. J., Tsai, T.H., Dong, C.Y. The use of second order susceptibility as contrast mechanism for label-free imaging of biological tissue. *IEEE Journal of Selected Topics in Quantum Electronics*. 18(4), 1326-1334, (2012)
SCI IF: 3.466, 9/247 in Engineering, Electrical & Electric.

Technical Report

"Breaking the Diffraction Limit Using Stimulated Emission Depletion Microscopy," Hans Hu, Pedro Felipe G. Rodriguez, Mansoureh Eghbali, Ligia Toro, and Enrico Stefani, ASA 2009 Annual Meeting.

Conference Proceedings

"A Compact Optical Fiber Scanner for Medical Imaging," Naresh Dhaubanjar, Hans Hu, Digent Dave, Pratibha Phuyal, Jeongsik Sin, Harry Stephanou and J.-C. Chiao, Proc. of SPIE Vol. 6414, 64141Z, (2007).

"Characterization of Nonlinear Optical Polymers Fabricated with Dye-doped UV Curing Epoxy," Kevin Le, Ping Zhang, Hans Hu, and J.-C. Chiao, Proc. of SPIE Vol. 6109, 61090N, (2006.)

"A compact fiber optic scanner using electromagnetic actuation," Hans Hu, Kevin Le and J.C. Chiao, Proc. of SPIE Vol. 6038, 60381N, (2006).

"An Optical Scanner Based on Electromagnetically Actuated Optical Fiber," Hans Hu, Kevin Le, and J.-C. Chiao, Photonics West Symposium, Micromachining and Microfabrication Process Technology Conference, San Jose, Jan. 21-26, 2006.

"Polymeric electro-optical channel waveguide fabricated by lithography and wet chemical etching," Kevin Le, Ping Zhang, Hans Hu, and J.C. Chiao, *Microelectronics, MEMS, and Nanotechnology Symposium, Photonics: Design, Technology, and Packaging Conference*, Brisbane Australia, Dec. 11-14, 2005.

Key capability on MPM project

1. Setting up an entire multiphoton microscopy for imaging.
2. Developing tools for manipulating optical pulse and measuring pulse-width.
3. Designing and constructing an miniaturized probe for small animal imaging such as mice, rat and zebrafish.
4. Applying these tools and technique to biological and biomedical experiment.

$Cs_{0.33}WO_3$ compound nanomaterial-incorporated thin film enhances output of thermoelectric conversion in ambient temperature environment

Cs0.33WO3 nanomaterial absorbs a range of near-infrared (NIR) wavelength spanning 900 nm to 2400 nm, of which the main contributor of heat energy may be utilized for electrical generation. In this research Cs0.33WO3 nanomaterial is synthesized through a combination of the processes of co-precipitation and wet nanogrinding, and characterization of structural and optical properties of the nanomaterial were carried out using x-ray diffraction, scanning electron microscopy, transmission electron microscopy and visible-near-infrared absorption spectroscopy. The concept of improving the efficiency of thermoelectric conversion by the trapping of heat at the hotside surface of a TE device was implemented. Specifically, the photothermal property of Cs0.33WO3 nanomaterial is assessed to investigate its effects on the electrical output of a thermoelectric (TE) device, utilizing a laser with wavelength of 808 nm, a solar simulator, and sunlight in ambient environment. Moreover, four typical weather condition, sunny, sunny with partly cloudy, cloudy, rainy, were assessed, and our results indicate that Cs0.33WO3 nanomaterial is capable of increasing the output of thermoelectric conversion in an ambient environment. In a complete sunny day, when compared with a bare thermoelectric device, approximately 13.1% of rise in maximal attainable temperature and the corresponding 291% of increase in maximal output voltage were demonstrated employing Cs0.33WO3 nanomaterial with concentration of 0.66 wt%.

Session V

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1. Personal Information

Date of Birth: 16/1/1947

2. Educations:

1976-1983	Applied Physics, California Institute of Technology, USA, Ph.D.
1970-1972	Physics, National Taiwan University, Taiwan, M.S.
1964-1968	Physics, Rangoon Arts & Science University, Burma, B.S.

3. Professional Experiences:

2008.1~date	Director, Biophotonics and Molecular Image Research Center, NYMU, Taipei, Taiwan
2003.8~date	Professor, Institute of Biophotonics, NYMU
2011.2~2013.07	Dean, Office of International Affairs
2003.8~2009.7	Dean, School of Bio-Medical Science and Engineering, NYMU
2001.8~2003.7	Dean, School of Science & Engineering, NDHU, Hualien, Taiwan
1997.8~2001.7	Professor and Head, EE Department, NDHU
1997.2~1997.7	Visiting Chair Professor, NCTU, Hsinchu, Taiwan
1984.9~1997.1	MTS, Project Manager, & Senior Scientist, Rcokwell International Science Center, Thousand Oaks, California
1982.10~1984.8	Post-Doctoral Research Fellow, San Jose Research Lab, IBM, San Jose, California
1980.10~1982.9	Part-Time Engineer, Jet Propulsion Lab (JPL), NASA, Pasadena, California

4. Fields of Specialty:

- Optics & Photonics, Laser Spectroscopy & Microscopy, Optical Image Processor
- Biophotonics & Nano-Biophotonics, Optical Manipulation & Sensing for Biomedical Applications
- Optical Cellular Mechano-Biology

5. Professional Awards and Honors

- NASA “Recognition of Innovative Technical Achievement” Award (1982)
- SPIE’s 1989 Rudolph Kingslake Medal & Award (1990)
- Senior Member, IEEE (since 1992), and Life Senior Member IEEE (2015)
- Fellow, Optical Society of America（OSA）(since 1993)
- Fellow, SPIE (since 1993)
- Fellow, Photonics Society of Chinese Americans (since 1997)
- Taiwan ROC Optical Engineering Society 2008 Optoelectronics Achievement Award, the highest achievement award from the society.
- 2012 NYMU Outstanding Students’ Advisor Award (100學年度：陽明大學優良導師獎)
- 2016 NYMU Outstanding Teaching Award (104學年度：陽明大學優良教師獎)
- 2016 NYMU Outstanding Students’ Advisor Award (104學年度：陽明大學良師益友獎)

Bio- Physical and Chemical Properties of Head and Neck Cancer Cell Lines with Distinct EMT (Epithelial-Mesenchymal Transition) Phenotypes in 2D and 3D Environments

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Epithelial-mesenchymal transition (EMT) is a process via which the epithelial cells lose their polarity and acquire the mesenchymal phenotype. EMT has been shown to be crucial in development, organ fibrosis, and cancer metastasis. In cancer cells, the key features of EMT include a remodeling of cytoskeletons and a reduction in the intercellular adhesion between epithelial cells; concomitantly, the cellular morphology changes from cuboidal epithelial to elongated mesenchymal, which leads to enhanced migration & invasiveness, and elevated resistance to apoptosis. To date, most of the studies of EMT focus on its molecular and cellular biological aspects, including the signal transduction and the changes in biological behavior. However, the corresponding changes in biophysical properties during EMT have attracted much less attention, and many important questions in the mechanobiology of EMT remain unanswered.

In this talk, we report our studies, via video particle tracking microrheology, the intracellular stiffness of head and neck cancer cell lines with distinct EMT phenotypes. We also examined cells migration and invasiveness in different extracellular matrix architectures and EMT-related signaling in these cell lines. Our results show that when cells were cultivated in three-dimensional (3D) environments, the differences in cell morphology, migration speed, invasion capability, and intracellular stiffness were more pronounced among different head and neck cancer cell lines with distinct EMT phenotypes than those cultivated in traditional plastic dishes and/or seated on top of a thick layer of collagen. The significance of the key results will be highlighted.

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1. Personal Information

Birth: Tokyo, Japan, 1947.

2. Educations:

1976.3	Applied Physics, University of Tokyo, Ph.D.
1973.3	Applied Physics, University of Tokyo, M.S.
1971.6	Applied Physics, University of Tokyo, B.S.

3. Professional Experiences:

2012.4~	Center for Optical Research and Education, Utsunomiya University, Professor
1993.1~2012.3	Institute of Industrial Science, University of Tokyo, Professor
1883.8~1992.12	Institute of Industrial Science, University of Tokyo, Associate Professor
1976.4~1983.7	Institute of Industrial Science, University of Tokyo, Research Assistant

4. Fields of Specialty:

- Laser Physics, Nonlinear Optics
- Polarization Holography, Speckle in Laser Display

5. Major awards and honors

- JSAP Fellow (2007), SPIE Fellow (2008), OSA Fellow (2009).

6. List of Recent Selected Publications

- J. Kinoshita, K. Yamamoto, K. Kuroda, "Color speckle measurement errors using system with XYZ filters" *Opt. Rev.* **25** (2018) 123.
- T. Satoh, R. Iida, T. Higuchi, Y. Fujii, A. Koreeda, H. Ueda, T.Shimura, K. Kuroda, V. I. Butrim, B. A. Ivanov, "Excitation of Coupled spin-orbit dynamics in cobalt oxide by femtosecond laser pilse. *Nature Commun.,* **8** (2017) #638.
- Y. Liu, Z. Li, J. Zang, A. Wu, J. Wang, X. Lin, X. Tan, D. Barada, T. Shimura, and K. Kuroda, "The optical polarization properties of phenanthrenequinone-doped Poly(methyl methacrylate) photopolymer materials for volume holographic storage", *Opt. Rev*., **22** (2015) 837.
- J. Zang, A. Wu, Y. Liu, J. Wang, X. Lin, X. Tan, T. Shimura, and K. Kuroda, "Characteristics of volume polarization holography with linear polarization light", *Opt. Rev.* **22** (2015) 829.
- A. Wu, G. Kang, J. Zang, Y. Liu, X. Tan, T. Shimura, and K. Kuroda, "Null reconstruction of orthogonal circular polarization holography with large recording angle", *Opt. Express* **23** (2015) 8880.
- K. Kuroda, T. Ishikawa, M. Ayama, S. Kubota, "Color speckle" *Opt. Rev.* **21** (2014) 83.
- T. Satoh, Y. Terui, R. Moriya, B. A. Ivanov, K. Ando, E. Saitoh, T. Shimura, and K. Kuroda, "Directional control of spin wave emission by spatially shaped light" *Nature Photon.,* **6** (2012) 662.
- Y.L. Liu, R. Fujimura, K. Ishida, N. Oya, N. Yoshie, T. Shimura, and K. Kuroda, "Synthesis of organic phenothiazine-based molecular glasses and effect of racemic/homochiral aliphatic chain on near-infrared photorefractive property," *J. Phys. Chem. Solids* **73** (2012) 1136.
- K. Kuroda, Y. Matsuhashi, R. Fujimura, and T. Shimura, "Theory of polarization holography" *Opt. Rev.,* **18** (2011) 374.
- T. Nagai, R. Fujimura, T. Shimura, and K. Kuroda, "Photorefractive effect in undoped aluminum nitride" *Opt. Lett*., **35** (2010) 2136.
- N. Fujioka, S. Ashihara, H. Ono, T. Shimura, and K. Kuroda, "Cascaded third-harmonic generation of ultrashort optical pulses in two-dimensional quasi-phase-matching gratings" *J. Opt. Soc. Am. B,* **24** (2007) 2394.
- X. L. Zeng, S. Ashihara, N. Fujioka, T. Shimura, and K. Kuroda, "Adiabatic compression of quadratic temporal solitons in aperiodic quasi-phase-matching gratings" *Optics Express*, **14** (2006) 9358.

Measurement of Color Speckle in Laser Display

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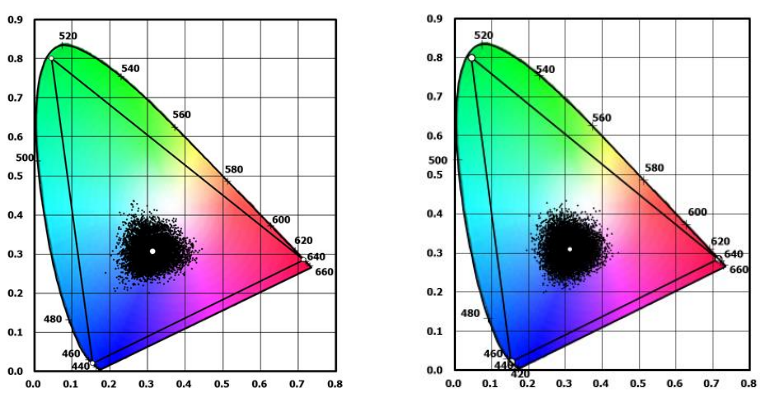
Speckle is a random distribution of the irradiance on the observation plane caused by the interference of randomly phase-modulated wavefronts. In the laser displays, three primary-color lasers form independent speckle patterns with each other. Since the color is synthesized by the superposition of three primary colors, independent primary-color speckles result in the distribution of colors on the observation plane which is called color speckle[1]. In this presentation, I will review briefly the recent development of laser display. Then, I will discuss the simulation of color speckle based on the standard speckle theory, and the measurement using 2-dimensional colorimeter.

For a monochromatic laser, the speckle is measured by the contrast ratio C_s, defined by the ratio of the standard deviation to the mean value of the irradiance distribution. On the contrary, the color speckle is the distribution of chromaticity in the color space, such as, *xy* chromaticity or *u'v'* chromaticity. There are several measuring methods of color speckle.

1) Monte Carlo simulation
   If we know the speckle contrast of primary color lasers, we can simulate the distribution of chromaticity.
2) Indirect measurement of color speckle
   First we turn on one of primary-color lasers and measure the monochromatic speckle pattern. Then we synthesize the chromaticity pixel by pixel. Although the monochromatic speckles for the primary colors are not measured simultaneously, the distribution of chromaticity is statistically the same as the direct measurement.
3) Direct measurement of color speckle
   We measure the distribution of chromaticity directly by using the 2D luminance colorimeter.

We conducted the experiment on the direct measurement of color speckle using 2D luminance colorimeter (UA-200T, Topcon). The primary-color laser source is made of the red (λ_R 638.1 nm), green (λ_G 514.5 nm), and blue (λ_B 453.3 nm) semiconductor lasers which are coupled to the single mode fiber through dichroic mirrors. The experimental results and the simulation are shown in Fig.1. Agreement between two data is satisfactory.

1) K. Kuroda, T. Ishikawa, M. Ayama, S. Kubota, "Color speckle" *Opt. Rev.* **21** (2014) 83.



(a) (b)

Fig. 1. Measurement of color speckle: (a) direct measurement and (b) simulation.

CURRICULUM VITAE

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Research Areas and Interests

Focusing on the research area of metamaterials, plasmonics, bio-photonics, nanofabrication, nonlinear optics, green energy, and bio-sensors.

Educations:

2011.5 **Purdue University**, School of Electrical and Computer Engineering, West Lafayette
Doctor of Philosophy (Ph.D.) in Electrical and Computer Engineering

2004.6 **National Taiwan University**, Institute of Biomedical Engineering**,** Taipei, Taiwan
Master of Science (M.S.) in Biomedical Engineering

2002.6 **National Chiao-Tung University**, Department of Electrical and Control Engineering, Taiwan
Bachelor of Science (B.S.) in Electrical and Control Engineering

PROFESSIONAL EXPERIENCE

Associate Professor, Institute of Imaging and Biomedical Photonics, College of Photonics
Aug. 2017 - present
National Chiao-Tung University, Taiwan
Assistant Professor, Institute of Imaging and Biomedical Photonics, College of Photonics
Aug. 2012 – Jul. 2017
National Chiao-Tung University, Taiwan
Process TD engineer, Intel Corporation, Portland Logic Technology Development, OR, USA
Jun. 2011 - Jul. 2012

AWARDS

- Best student paper award in 2016 ICNP international conference.
- Mo-Ching Wu Scholarship. (2014, 2015, 2016, 2017)
- Student Paper Award in Optics and Photonics Taiwan, the International Conference (OPTIC 2016, 2017)
- Student Paper Award in the Asia-Pacific Conference on Near-field Optics (APNFO), 2017

SELECTIVED PUBLICATIONS

- Yang, Chi-Yin, Jhen-Hong Yang, Zih-Ying Yang, Zhong-Xing Zhou, Mao-Guo Sun, Viktoriia E. Babicheva, and Kuo-Ping Chen. "Nonradiating Silicon Nanoantenna Metasurfaces as Narrow-band Absorbers." ACS Photonics (2018).
- Chou, Yu Hsun, Kuo-Bin Hong, Chun-Tse Chang, Tsu-Chi Chang, Zhen-Ting Huang, Pi Ju Cheng, Jhen-Hong Yang et al. "Ultra-compact pseudowedge plasmonic lasers and laser arrays." Nano letters (2018).
- Yang, Zih-Ying, Chen-Wei Su, and Kuo-Ping Chen. "Optimization of effective absorption enhancement of paired-strips gold nanoantennas arrays in organic thin-films." Applied Physics A 124, no. 1 (2018): 68.
- Xie, Zu-Wen, Jhen-Hong Yang, Vishal Vashistha, Wei Lee, and Kuo-Ping Chen*. "Liquid-crystal tunable color filters based on aluminum metasurfaces." Optics express 25, no. 24 (2017): 30764-30770.
- Yang, Zih-Ying, Satoshi Ishii, Y. O. K. O. Y. A. M. A. Takahiro, Thang Duy Dao, Mao-Guo Sun, Pavel S. Pankin, Ivan V. Timofeev, Tadaaki Nagao, and Kuo-Ping Chen. "Narrowband Wavelength Selective Thermal Emitters by Confined Tamm Plasmon Polaritons." ACS Photonics (2017).
- Kuo, Yu-Lun, Shih-Yi Chuang, Shiuan-Yeh Chen, and Kuo-Ping Chen*. "Enhancing the Interaction between High-Refractive Index Nanoparticles and Gold Film Substrates Based on Oblique Incidence Excitation." *ACS Omega* 1, no. 4 (2016): 613-619.

Narrow-band Optical Absorber by Metasurface and Tamm Plasmon

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This study experimentally demonstrates infrared wavelength selective thermal emission based on Tamm plasmon polaritons (TPPs). Unlike conventional TPP structures that have a thin metal layer on a distributed Bragg reflector (DBR), the proposed structure has a thick metal under a DBR that is more robust for thermal radiation. The number of DBR pairs is a critical factor in maximizing the narrowband emission needed to satisfy the impedance matching condition, which varies with the choice of metal film. The proposed structure can achieve twice higher Q-factor for the measured emissivity compared to typical plasmonic thermal emitters. The structure is one dimensional, consisting of only multilayers and free from nano-patterning, offering a practical design in applications such as gas sensing, narrowband IR sources and thermophotovoltaics. In addition, we also proposed the high-refractive-index (HRI) nanostructures as narrowband absorber, which supports optically induced electric dipole (ED) and magnetic dipole (MD) modes that can be used to control scattering and absorption. In this work, a high absorptance device is realized by using amorphous silicon nanoantenna arrays (a-Si NA arrays) that suppress backward and forward scattering with engineered structures and in particular periods. The overlap of ED and MD resonances, by designing an array with a specific period and exciting lattice resonances, is experimentally demonstrated. The absorptance of a-Si NA arrays increases 3-fold in the near-infrared (NIR) range in comparison to unpatterned silicon films. Nonradiating a-Si NA arrays can achieve high absorptance with a small resonance bandwidth (Q = 11.89) at wavelength 785 nm. The effect is observed not only due to the intrinsic loss of material but by overlapping the ED and MD resonances.

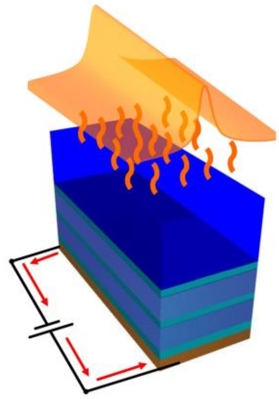

Fig. 1. Narrowband wavelength selective thermal emitters by Tamm Plasmon Polaritons

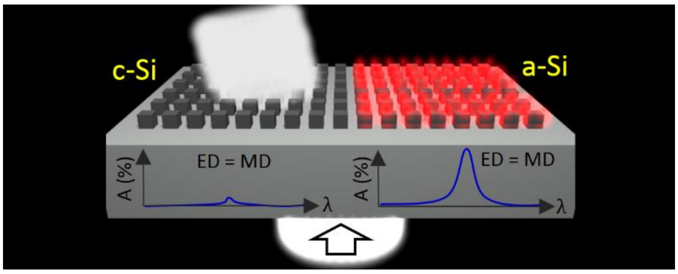

Fig. 2. Silicon metasurfaces narrowband absorbers by Kerker effects

Session VI

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1. Personal Information

Birth: Japan, 1962.

2. Educations:

1992.12 Applied Physics, Hokkaido University, Ph.D.
1987.3 Mathematical Engineering and Information Physics, University of Tokyo, M.S.
1985.3 Mathematical Engineering and Information Physics, University of Tokyo, B.S.

3. Professional Experiences:

2017.4~	Faculty of Science and Technology, Hirosaki University, Professor
2007.1~	College of Optical Sciences, University of Arizona, Adjunct Professor
2003.3~2003.12	Optical Sciences Center, University of Arizona, Visiting Scholar
1996.4~2017.3	Division of Applied Physics, Faculty of Engineering, Hokkaido University, Associate Professor
1993.4~1996.3	Department of Engineering Science, Faculty of Engineering, Hokkaido University, Lecturer
1987.4~1993.3	Department of Engineering Science, Faculty of Engineering, Hokkaido University, Research Associate

4. Fields of Specialty:

Polarimetry, optical polarization science and engineering, interferometry, singular optics, optical coherence, and optical fiber sensors.

5. Major awards and honors

- OSA Senior Member, 2012
- SPIE Fellow, 2009
- G. G. Stokes Award from SPIE, 2006
- Best Paper Award from SICE, 1990

6. List of Recent Selected Publications

- K. Yamane, M. Sakamoto, N. Murakami, R. Morita, and **K. Oka**, “Picosecond rotation of a ring-shaped optical lattice by using a chirped vortex-pulse pair,” Opt. Lett. **41** (2016) 4597.
- M. Suzuki, K. Yamane, **K. Oka**, Y. Toda, and R. Morita, “Analysis of the Pancharatnam-Berry phase of vector vortex states using the Hamiltonian based on the Maxwell-Schrödinger equation,” Phys. Rev. A **94** (2016) 043851.
- M. Suzuki, K. Yamane, **K. Oka**, Y. Toda, and R. Morita, “Full quantitative analysis of arbitrary cylindrically polarized pulses by using extended Stokes parameters,” Scientific Reports **5** (2015) 17797.
- M. Suzuki, K. Yamane, **K. Oka**, Y. Toda, and R. Morita, “Nonlinear coupling between axisymmetrically-polarized ultrashort optical pulses in a uniaxial crystal,” Opt. Express **22** (2014) 16903.
- M. Sakamoto, **K. Oka**, R. Morita, and N. Murakami, “Stable and flexible ring-shaped optical-lattice generation by use of axially symmetric polarization elements,” Opt. Lett. **38** (2013) 3661.
- N. Murakami, S. Hamaguchi, M. Sakamoto, R. Fukumoto, A. Ise, K. Oka, N. Baba, and M. Tamura, “Design and laboratory demonstration of an achromatic vector vortex coronagraph,” Opt. Express **21** (2013) 7400.
- M. Kudenov, M. Escuti, N. Hagen, E. L. Dereniak, and **K. Oka**, “Snapshot imaging Mueller matrix polarimeter using polarization gratings,” Opt. Lett. **37** (2012) 1367.
- E. DeHoog, H. Luo, **K. Oka**, E. Dereniak, and J. Schwiegerling, “Snapshot polarimeter fundus camera,” Appl. Opt. **48** (2009) 1663.
- M. W. Kudenov, M. J. Escuti, E. L. Dereniak, and **K. Oka**, “White-light channeled imaging polarimeter using broadband polarization gratings,” Appl. Opt. **50** (2011) 2283.

Channeled Polarimetry — Snapshot and Compact Method for Polarization Measurement

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Although polarimetry is a field with a long history, its application areas are rapidly expanding in recent years. Such new applications demand various new functions and higher performances of polarimeters, but standard methods, such as the rotating element polarimetry and the polarization-modulation polarimetry, can satisfy only part of these requirements. In these circumstances, several alternative principles for polarimetry have been developed. Among them, channeled polarimetry is a method with several remarkable features, such as its capability for the snapshot (one-shot) measurement.

A channeled polarimeter for the spectroscopic polarization measurement of polychromatic broadband light utilizes high-order birefringent retarders. Since the retardations of the high-order birefringent retarders have strong dispersion and are almost linearly related to wavenumber, the spectrum obtained from the channeled spectropolarimeter is finely modulated with wavenumber. The obtained spectrum includes several quasi-cosinusoidal components carrying the information of the spectrally-resolved Stokes parameters of the light under measurement. Fourier analysis of the spectrum enables us to separate the respective components from which we can determine the four Stokes parameters independently and simultaneously. The same concept was also applied for the imaging polarimetry so that the spatially-resolved polarization distribution can be measured. For the generation of the fringes carrying the information of spatially-resolved Stokes parameters, we can use several kinds of polarization optics, such as birefringent retarders, Savart plates, Sagnac interferometers, and polarization gratings. The polarimeter based on this method is made of all static elements whose polarization characteristics, such as the azimuth directions and the retardations, are not changed during the measurement. This implies that the method requires no mechanical or active elements for polarization variation, such as a rotating compensator and a photoelastic modulator, which have been indispensable in the standard polarimeters for spectral- or spatial-distribution measurement of polarization. The method also has a feature that all the distributions of Stokes parameters can be determined from a single spectrum or image, and hence the snapshot measurement can be made by use of this method.

In view of the advantageous features of the channeled polarimetry, the method is now used in many application areas. For example, a miniaturized spectropolarimeter with a pencil-size sensing head and the spectroscopic ellipsometer with a palm-size sensing head were developed. Since the optical configuration of the channeled spectropolarimeter is simple and includes neither mechanical nor active elements for polarization modulation, it is suited for the miniaturization of the polarization optics. In addition, they have a feature of its high-speed response of the order of 10 ms.

Fig. 1. Miniaturized channeled spectropolarimeter.

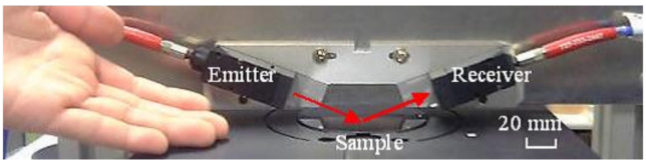

Fig. 2. Channeled spectroscopic ellipsometer.

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1. **Current:**
   Professor, Electro-Optical Science and Technology, National Taiwan Normal University
2. **Professional Experiences:**
   2015 Visiting Professor, University of Cambridge, United Kingdom
   2011-2014 Director, Institute of Electro-Optical Science and Technology, National Taiwan Normal University, Taiwan
   Professor, Department of Electro-Optical Engineering, National Taipei University of Technology, Taiwan
   Chairman, Department of Electronic Engineering, St. John's University, Taiwan
   1986-1988 Engineer & Task Leader, Industrial Technology Research Institute (ITRI), Taiwan
3. **Specialized fields:**
   Electro-Optical Engineering, Information Optics,
   Digital Holography, Computer-generated Holography
4. **Education:**
   PhD (1994), Institute of Electro-Optical Engineering, National Chiao-Tung University, Taiwan
5. **Selected papers:**
   - XJ Lai, HY Tu, YC Lin, and CJ Cheng*, "Coded aperture structured illumination digital holographic microscopy for superresolution imaging," Optics Letters 43(5), 1143-1146, 2018.
   - YC Lin, CJ Cheng*, and LC Lin, "Tunable time-resolved tick-tock pulsed digital holographic microscopy for ultrafast events, " Optics Letters 42 (11), 2082-2085, 2017.
   - HY Tu, WJ Hsiao, XJ Lai, YC Lin, and CJ Cheng*, "Synthetic aperture common-path digital holographic microscopy with spiral phase filter," Journal of Optics 19, 065604, 2017.
   - YC Lin, HC Chen, HY Tu, CY Liu, and CJ Cheng*, " Optically driven full-angle sample rotation for tomographic imaging in digital holographic microscopy," Optics Letters 42 (7), 1321-1324, 2017.
   - XJ Lai, HY Tu, CH Wu, YC Lin, and CJ Cheng*,"Resolution enhancement of spectrum normalization in synthetic aperture digital holographic microscopy," Applied Optics 54(1), A51-A58, 2015.
   - YC Lin and CJ Cheng*, "Sectional imaging of spatially refractive index distribution using coaxial rotation digital holographic microtomography," Journal of Optics 16(6), 065401, 2014.
   - YL Lee, YC Lin, HY Tu, and CJ Cheng*, "Phase measurement accuracy in digital holographic microscopy using a wavelength-stabilized laser diode," Journal of Optics 15(2), 025403, 2013.

Digital Holographic Microscopy: From Ultrafast to Superresolution Imaging

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Digital holographic microscopy (DHM) with full-field quantitative complex imaging (amplitude and phase) has been widely used in optical metrology for measuring optical micro-/nano- devices and biological living cells with high phase accuracy and *in situ* observation. These push the quantitative amplitude/phase imaging and optical metrology of DHM becoming an attractive tool for various fields of scientific work and industrial applications. This talk will describe state-of-the-art technology and recent progress in DHM from various superresolution and tomographic image techniques in spatial domain to ultrafast imaging with spatio-temporal multiplexing scheme for studying the dynamic phenomena of laser and matter interaction from nanoseconds to femtoseconds time scale.

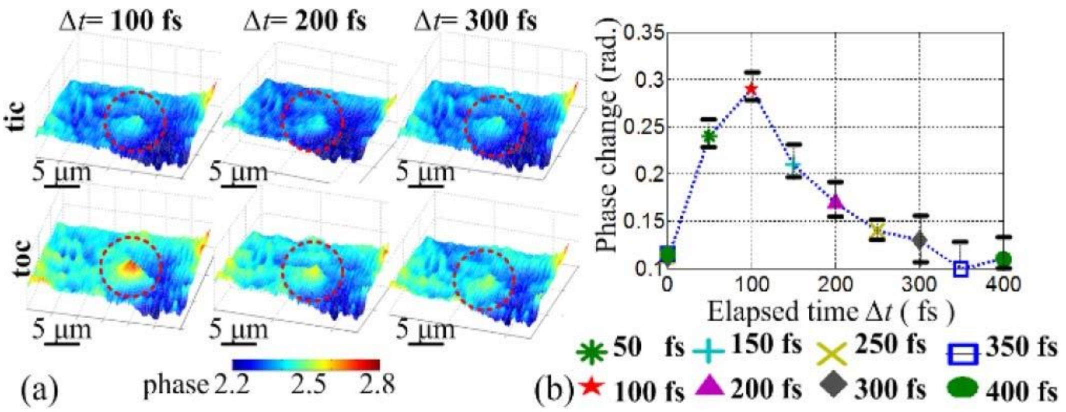

Fig. 1. Experimental results of the photoexcited carrier effect in graphene (a) phase maps at the elapsed times of 100, 200, and 300 fs and (b) phase change at different elapsed times.

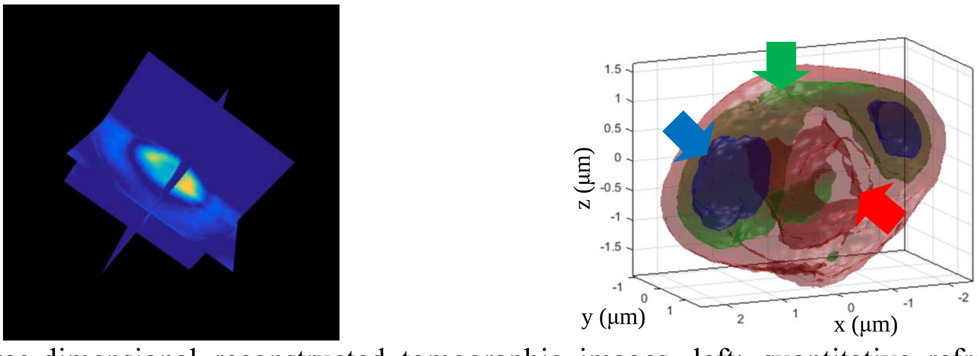

Fig. 2. Three-dimensional reconstructed tomographic images, left: quantitative refractive index distribution of the yeast in the x, y, and z planes; right: internal organelles of the yeast. Red arrow: vacuole, blue arrow: nucleus, and green arrow: cytoplasm

Yoshio Hayasaki, (早崎芳夫) Professor, PhD (Eng.)
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1. **Personal Information**
   Birth: 1965
2. **Educations:**
   1988.03, BS, Fundamental Engineering, The University of Tsukuba, Japan
   1990.03, MS, Applied Physices, The University of Tsukuba, Japan
   1993.03, Ph.D, Applied Physices, The University of Tsukuba, Japan (Supervisor: Prof. T. Yatagai)
3. **Professional experiences**
   1993.04, Researcher, Photodynamic Research Center, RIKEN, Japan
   1995.04, Assoc. Prof., Department of Optical Science & Technolgy, The University of Tokushima, Japan
   2008.04, Assoc. Prof., Center for Optical Research & Education, Utsunomiya University, Japan
   2011.08, Professor, Center for Optical Research & Education, Utsunomiya University, Japan
4. **Abroad experineces**
   - Sep.1998 - Mar. 1999, Visiting scholar, University of Colorado (6 months)
   - Feb. 2015 - Mar. 2015, Visiting scholar, University of Arizona (1 month)
5. **Society membership**
   - Japanease Society of Applied Physics, Student member (1988~1993), Member (1994~)
   - Optical Society of Japan, Member (1995 ~)
   - Optical Society of America (OSA), Member (2000~), Senior member (2017~)
   - SPIE, Member (2000~), Senior member (2013~2017), Fellow member (2018~),
   - Laser Society of Japan, Member (2004~)
   - Japan Laser Processing Society, Member (2010~)
6. **Technical Accomplishments**
   Hayasaki achieved novel and useful uses of holographic technologies including computer-generated holography and digital holography for optical tweezers, super-resolution microscopy, scatterometry, three-dimensional displays, material laser processing, two-photon polymerization, pump-probe time-resolved imaging, and optical frequency comb profilometry. The acheivements described as
   - Holographic optical tweezers (Proc. SPIE **2778**, (1996))
   - Large stereoscopic full-color LED display (AO **41**, 6907 (2002)).
   - Holographic femtosecond laser processing (APL **87**, 031101 (2005), Light **5**, e16133 (2016))
   - Fingernail memory (Jpn. J. Appl. Phys. **43**, 168 (2004). OE **13**, 4560 (2005))
   - Photon-counting digital holography (OL**34**, 1081-1083 (2009)).
   - Digital super-resolution interference microscope (DiSRIM) (OE **21**, 18424 (2013))
   - Optical frequency comb profilometry (OE **21**, 19003 (2013), OL **41**, 2016 (2017))
   - Photon-counting scatterometry (OL **38**, 3862 (2013)).
   - Volumetric displays (OL **40**, 3356 (2015), ACM TOG **35** No. 17 (2016), Optica **4** (2017))
7. **Publication summary**
   - **100** peer-reviewed papers in English, **8** peer-reviewed papers in Japanese, **4** book chapters in English
   - **6** book chapters in Japanese, **27** Review papers in Japanease
   - **289** talks in international meetings (including **61** invited talks) and **16** seminar talks in universities
   - **694** talks in Japanese domestic meetings (including **100** invited and seminar talks)

Two-color Pump-probe Digital Holography

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Time-resolved observation in the femtosecond (fs) region has been actively performed to know the interaction between a material and laser pulses. The analysis is helpful for searching better pulse parameters for desired laser processing. The fs laser processing has very short interaction time with materials, the energy deposition time is sufficiently higher than the thermal diffusion time of the materials. Therefore, it is capable of the non-thermal and clear micro fabrications.

In our previous studies, we have demonstrated an holographic pump-probe time-resolved imaging technique capable to characterize modifications in glass induced by fs laser pulses in the lateral [1] and axial [2] cross sections of the pulse propagation at the conditions close to the threshold. Generation and recombination of carriers, a local heating and pressure waves separately occur one after the other, because photoexcitation by fs laser pulse was similar to the delta function in time. However, in practice, the carrier generations and local heating occurred in the same time domain and was obtained as their mixed decrease of the refractive index. In this study, the pump-pulse digital holography with two colors at 400 nm and 800 nm separated them [3].

The optical setup is shown in Fig. 1. A laser pulse emitted from an amplified Ti:sapphire fs laser with a center wavelength of 800 nm was divided into a pump pulse and a probe pulse. The pump pulse was irradiated inside a superwhite crown glass (B270, Schott) using an oil-immersion objective lens (OL) (NA 1.25). Both 400 nm and 800 nm probe pulses adjusted by an optical delay line, and illuminated a sample. After passing through the sample, the probe pulses were expanded by an OL (NA 0.55) and a lens of f = 500mm, and was introduced into the interferometer.
The interference fringes were detected by the CCD image sensor, as shown in Fig. 2(a). The complex amplitude of the laser-induced phenomena was obtained by the Fourier filtering method. Figure 2(b) shows the fast Fourier transform (FFT) of the interference image. The complex amplitude distribution for each wavelength was obtained by the inverse FFT of the image extracted by a spatial filtering technique for signals around each 1st order light. The resolution decided by the filter size was set to 0.89 μm. The defocusing was corrected by the digital focusing that was the diffraction calculation to eliminate the chromatic aberration between 800 nm and 400 nm.

When $t < 0.2$ ps, the difference in the profile of the respective wavelengths was not observed. The difference was appeared particularly large when $0.2 < t < 1.0$ ps and the maximum was at 0.4 ps. In this time region, a decrease in transmittance was notably observed at each wavelength. The difference was larger at a position close to the light source side was observed. The local heating was dominant when $t > 100$ ps, and the difference between wavelengths was small. Therefore, the difference was considered to be due to local heating. The temperature become the highest immediately after irradiation of the pump pulse. After that, the temperature reduction process was observed.

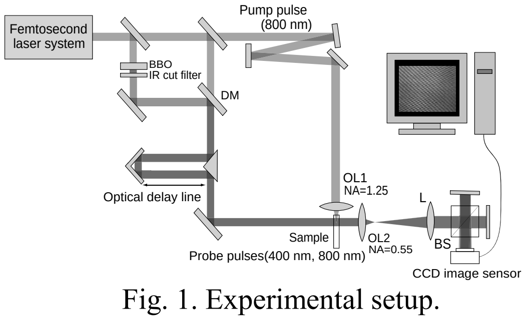

Fig. 1. Experimental setup.

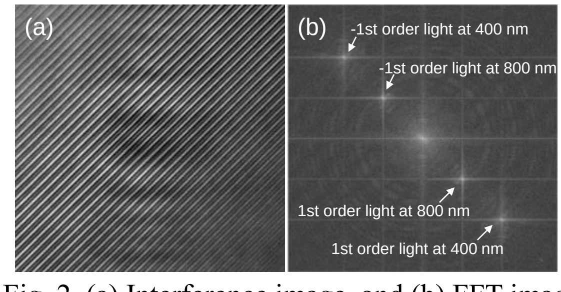

Fig. 2. (a) Interference image, and (b) FFT image.

[1] Y. Hayasaki, M. Isaka, A. Takita, and S. Juodkazis, "Time-resolved interferometry of femtosecond-laser-induced processes under tight focusing and close-to- optical breakdown inside borosilicate glass," Opt. Express **19**, 5725–5734 (2011).
[2] Y. Hayasaki, K. Iwata, S. Hasegawa, A. Takita, and S. Juodkazis, "Time-resolved axial-view of the dielectric breakdown under tight focusing in glass," Opt. Mater. Express **1**, 1399–1408 (2011).
[3] Y. Hayasaki, S. Fukuda, S. Hasegawa, and S. Juodkazis, "Two-color pump-probe interferometry of ultra-fast light-matter interaction," Sci. Rep. **7**, 10405 (2017).

Session VII

Professor Francis T. S. Yu (楊振寰教授)

Evan Pugh Emeritus Professor of Electrical Engineering
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Vitae

Francis T. S. Yu received his B.S.E.E. degree from Mapua Institute of Technology, Manila, Philippines, and his M.S. and Ph.D. degrees in Electrical Engineering from the University of Michigan.

During the period from 1958 to 1965, he was a teaching fellow, an instructor, and a lecturer in the Electrical Engineering Department at the University of Michigan, and a research associate with the Communication Sciences Laboratory at the same University. From 1966 to 1980 he was on the faculty of the Electrical and Computer Engineering Department at Wayne State University. He was a Visiting Professor in the Electrical and Computer Engineering Department at the University of Michigan from 1978-1979. Since 1980, he has been a Professor in the Electrical Engineering Department at The Pennsylvania State University. He has been a consultant to several industrial and government laboratories. He is an active researcher in the fields of optical signal processing, holography, optics and information theory, and optical computing. He has published over 300 refereed papers in these areas. He is a recipient of the 1983 Faculty Scholar Medal for Outstanding Achievement in Physical Sciences and Engineering, a recipient of the 1984 Outstanding Researcher in the College of Engineering, was named Evan Pugh Professor of Electrical Engineering and Director of Center for Electro-Optics Research at The Pennsylvania State University in 1985, a recipient of the 1993 Premier Research Award from the Penn State Engineering Society, was named Honorary Professor in Nankai University in 1995, Honorary Professor in National Chiao Tung University in Taiwan in 2004, and is the co-recipient of the 1998 IEEE Donald G. Fink Prize Paper Award.

Dr. Yu is a life fellow of IEEE, and a fellow of OSA, SPIE, and PSC.

HONORS AND AWARDS

- IEEE Life Fellow
- OSA Fellow
- SPIE Fellow
- PSOC (Photonic Society of Chinese Americans) Fellow
- OSA Emmett N. Leith Medal, 2016
- SPIE Dennis Gabor Award, 2004
- Recipient of the 1998 IEEE Donald G. Fink Prize Paper Award (with D.A. Gregory)
- Recognition for Creative Development of Technical Innovation, NASA (JPL), 1995
- Honorary Professor, Nankai University, Tianjin, China, 1995
- Chairman, Gordon Research Conference on "Optical Signal Processing and Holography," June27-July 2, 1993
- Recipient of the 1993 Penn State Engineering Society Premier Research Award
- Commencement Speaker, 92nd Commencement Exercises at the Mapua institute of Technology, November 12, 1991
- The 1991 Outstanding Alumnus Award from Mapua Institute of Technology
- Distinguished lecturer, Department of Electrical Engineering, Texas A&M University, March 1991
- Recognition Award Plaque, Philippines Engineers and Scientists Organization, Chicago, September l3, l986
- Named Evan Pugh Professor of Electrical Engineering at The Pennsylvania State University, 1985
- Recipient of the 1984 Outstanding Researcher in the College of Engineering at The Pennsylvania State University
- Recipient of the 1983 Faculty Scholar Medal for Outstanding Achievement in Physical Sciences and Engineering at The Pennsylvania State University

- Recipient of the Presidential Gold Medal Award at the Mapua Institute of Technology, 1956, for outstanding scholastic performance during four year college term
- Eta Sigma Mu (The Honor Society of Mapua Institute of Technology)

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EDITORIAL ADVISOR

- Editorial Board - Journal of Optics
- Editorial Board - The Proceedings of the IEEE Editorial Board, November 1996-present
- Associate Editor - Optical Memory and Neural Networks
- Editorial Board - Microwave and Optical Technology Letters
- Associate Editor - Journal of Wave-Material Interaction
- Editorial Advisor - "Series of Optics and Photonics," World Scientific Publishing Co., Inc.
- Associate Editor - IEEE Photonics Technology Letters, January 1, 1994-December 31, 1996
- SPIE Fellow Committee, 1996-1997

GUEST EDITOR FOR SPECIAL ISSUES

- “Architectures, Design, Algorithms, and Devices for Optical Neural Networks,” Optical Memory to Neural Networks, Vo. 1 and 2, No. 2 and 3, 1993.
- “Application of Neural Networks in Optics,” Optical Engineering, Vol. 35, No. 8, 1996.
- “Photorefractive Optics,” IEEE Proceedings, Vol. 87, 1999.

Information Transmission with Quantum Limited Subspace

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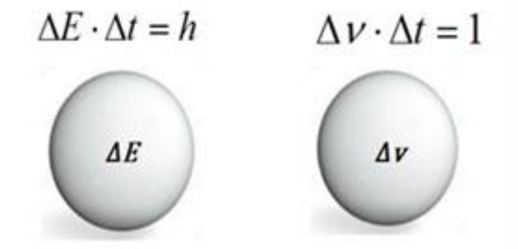
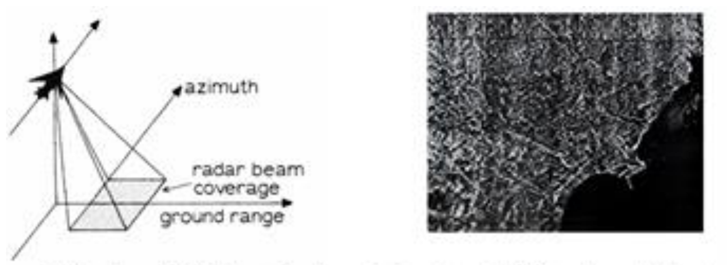
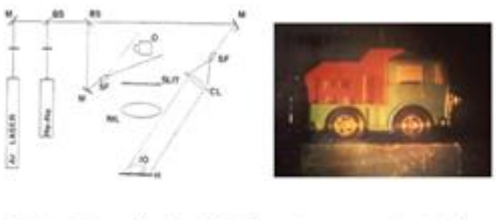
One important aspect of our universe is that one cannot get something from nothing; there is always a price to pay. In this article we show that every bit of information is limited by a quantum unit [1]. Since we are communicating within a temporal subspace [2], this unit can be equivalently described as a quantum limited subspace (QLS)[3], as imposed by the Heisenberg Principle. We show that communication can be exploited within and outside the QLS. The size of a QLS is determined by carrier signal bandwidth; that is narrower the bandwidth the larger the size of the QLS. By manipulating the size of a QLS, more efficient information transmission strategies can be developed. Examples for inside and outside QLS communication are given [4,5]. Extension to relativistic communication has also demonstrated. We remark that, a new era of communication is anticipated to immerge and it will **change** our way in communicating, observation and computing, we used to employ, forever!



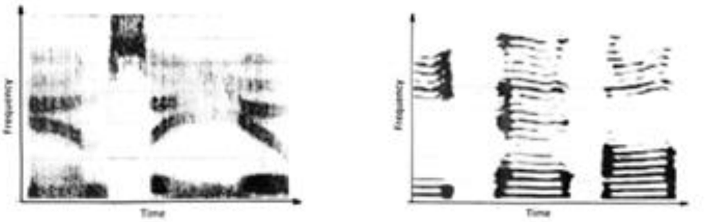
Quantum Limited Subspace QLS.



SAR Imaging w/in QLS information-transmission. The synthetic format was obtained within the **size of QLS over 60,000 feet.** Coherence length of microwave antenna can be designed **over hundreds of thousand feet, which** is equivalence the size of its QLS.



3-D imaging **w/in** the QLS information-transmission.The one-step rainbow hologram was made with a set of Argonne & He-Ne lasers of about **6 inches** coherence length, which is about the **size** of the QLS.



(a) Wide-band sound spectrogram. (b) Narrow-band sound spectrogram.

Imaging **outside QLS** (or w/in the uncertainty regime).
They show that Δt & $\Delta \nu$ cannot be resolved simultaneously.

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Discovery of Temporal Universe

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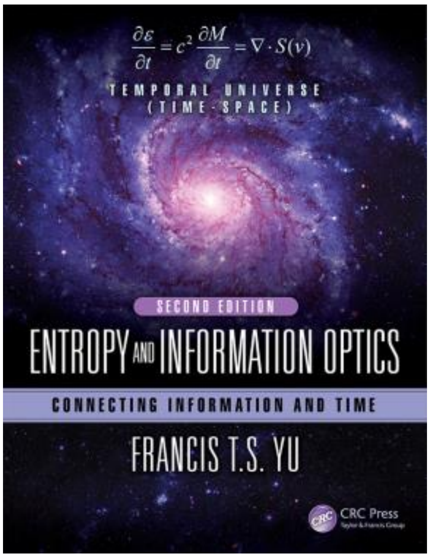
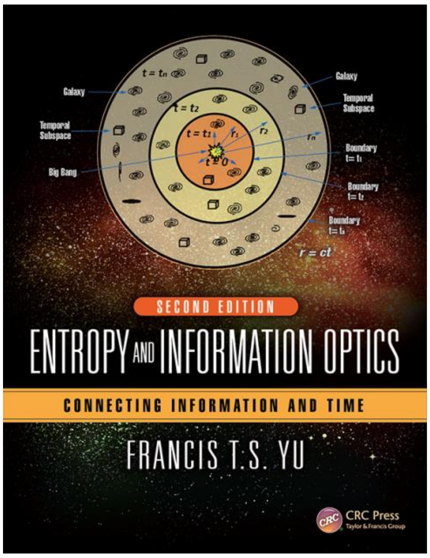
In this talk, I will base on the laws of physics to illustrate the enigma time as creating our physical space (i.e., the universe). I will show that, without time there would be no physical substance and no life. In reference to Einstein's energy equation, we see that energy and mass can be traded, and every mass can be treated as an Energy Reservoir. I will further show that, physical space cannot be embedded in absolute empty space and cannot have any absolute empty subspace in it. Since all physical substances existed with time, our cosmos is created by time and every substance including our universe is coexisted with time. Although time initiated the creation, it is the created physical substances presented to us the existence of time. We are not alone with almost absolute certainty. Someday we may find a right planet, once upon a time, had harbored a civilization for a short period of light years.

One of the important aspects of understanding the temporal universe (i.e., our home) is that a valuable criterion can be set: Any science that can be shown existed within our temporal subspace is physically real, otherwise it is fictitious unless it can be repeated by experiments.





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1995.7	Department of Precision Engineering, University of Tokyo, Dr.Eng.
1990.3	Department of Industrial Mechanical Engineering, Tokyo University of Agriculture and Technology, M.S.
1987.3	Department of Mechanical Systems Engineering, Tokyo University of Agriculture and Technology, B.S.

3. Professional Experiences:

2015.4~	Department of Optical Engineering / Center for Optical Research and Education（CORE）, Utsunomiya University, Professor
2010.4~2015.3	Center for Optical Research and Education（CORE）, Utsunomiya University, Professor
1999.8~2010.3	Department of Mechanical Systems Engineering, Tokyo University of Agriculture and Technology, Associate Professor
1991.5~1999.8	Department of Mechanical Systems Engineering, Tokyo University of Agriculture and Technology, Research Associate
1990.4~1991.5	Center for Optronics, HOYA corporation, Engineer

4. Fields of Specialty:
- Polarization Science and Engineering
- Optical measurement for surface topography
- Optomechatoronics : optical actuator and manipulator

5. Major awards and honors
- SPIE, the international society for optics and photonics, Fellow in 2010.

6. List of Recent Selected Publications
- Joel Cervantes-L David I.Serrano-Garcia,**Yukitoshi Otani,** Barry Cense : Mueller-matrix modeling and characterization of a dual-crystal electro-optic modulator,Optics Express 24(21) (2016) pp. 24213-24224.
- Toshitaka Wakayama, Takeshi Higashiguchi, Hiroki Oikawa, Kazuyuki Sakaue, Masakazu Washio, Motoki Yonemura, Toru Yoshizawa, J. Scott Tyo, and **Yukitoshi Otani** : Determination of the polarization states of an arbitrary polarized terahertz beam: Vectorial vortex analysis, Scientific Reports 5, 9416 (2015).
- David Ignacio Serrano-García, Amalia Martínez-García, Noel-Ivan Toto-Arellano, **Yukitoshi Otani**: Dynamic temperature field measurements using a polarization phase-shifting technique, Optical Engineering, 53, 11 (2014) 112202-1 -112202-5.
- Toshitaka Wakayama,Oscar G. Rodríguez-Herrera, J. Scott Tyo, **Yukitoshi Otani**, Motoki Yonemura, and Toru Yoshizawa : Generation of achromatic, uniform-phase, radially polarized beams,Optics Express 22, 1 (2014) pp.3306-3315.
- Takashi Onuma, **Yukitoshi Otani** : A development of two-dimensional birefringence distribution measurement system with a sampling rate of 1.3 MHz, Optics Communications, 315,15(2014).
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- **Yukitoshi Otani** : Chapter 11　Uniaxial 3D Shape Measurement, Handbook of 3D Machine Vision, 275-284 (Song Zhang (Ed.) , CRC press, 2013,3).
- George K. Knopf, **Yukitoshi Otani** (Ed.) : Optical Nano and Micro Actuator Technology (CRC Press, 2012, 12) 639 Pages.

Differential Interference Contrast Microscope and 3D Reconstruction by Pixelated Polarization Camera

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A method for measuring phase distribution of a small sample is proposed using a differential interference contrast (DIC) microscope attached pixelated polarization camera. It is possible to measure real-time phase distribution of an alive fish and its egg as bio-samples. In the field of biology, it is important to analyze inside structures of a bio-sample. The DIC microscope has a capability of analyzing detailed structures, capability of observing small steps on the surfaces, high sensitivity in detecting sample height information of optical sectioning [1-3]. In this report, we propose a snap shot measurement of 3D reconstruction of inside structure by the DIC microscope using pixelated polarization camera. We also try to 3D structure analysis by optical sectioning whose sensitivity reaches to as same as for an OCT and a confocal microscope. Figure 1 shows an optical configuration for a DIC microscopy utilizes the interference between two orthogonal polarized beams that pass through slightly different areas (amount of the shear: Δ) of a specimen. It visualizes the optical path difference between two beams of light. After passing through a sample, phase of two wave fronts change independently according to thickness (optical path) of sample. They combine two wave fronts again in the Nomarski prism. We can capture an interferogram by polarization camera. By using polarization camera, we can capture two images with ±45degrees of azimuthal angle of polarizer and after applying deconvolution algorism, such as FFT decopose with MTF and inverse FFT, we can obtain real phase data. It is possible to determine a 3D reconstruction when we moved a sample along to z-direction by z motor stage as a optical sectioning. Figure 2 shows a blood flow in an egg of Medaka fish with 10msec per flame. Figure 3 shows a 3D sectioning of a head of transparent Medaka. In conclusions, a DIC microscope with polarization camera is proposed to analyze a dynamic measurement without staining method. It is also possible to detect with snapshot. A 3D reconstruction is demonstrated by optical sectioning.

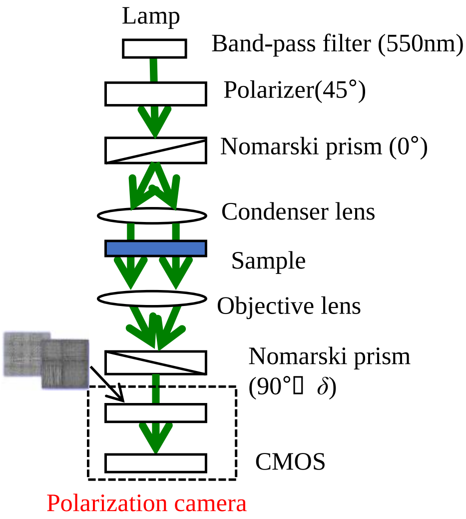

Fig. 1 Optical configuration DIC microscope.

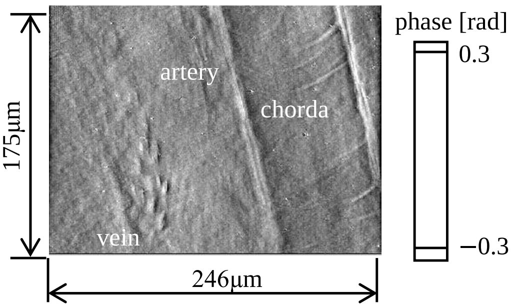

Fig. 2 Sectioning of blood flow in an egg of Medaka.

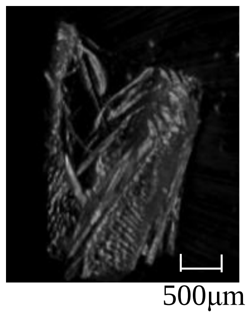

Fig. 3 3D reconstruction of a head of transparent Medaka.

Acknowledgements

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Session VIII

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1. Personal Information

Birth: Taipei City, Taiwan, 1970.

2. Educations:

2002.6	Electrical Engineering, Stanford University, Ph.D.
1997.6	Electrical Engineering, Stanford University, M.S.
1993.6	Electrical Engineering, National Taiwan University, B.S.

3. Professional Experiences:

Aug, 15—Aug, 16	Director, Institute of Photonic System, College of Photonics, National Chiao Tung University, Tainan, Taiwan.
Aug, 15—now	Professor, Institute of Photonic System, College of Photonics, National Chiao Tung University, Tainan, Taiwan
Aug, 12—Jul, 15	Associate Professor, Institute of Photonic System, College of Photonics, National Chiao Tung University, Tainan, Taiwan
Aug, 09—Jul, 12	Assistant Professor, Institute of Photonic System, College of Photonics, National Chiao Tung University, Tainan, Taiwan
Jun, 04—Aug, 09	Member of Technical Staff/Manager, Santur Corporation (Now NeoPhotonics)
Jun, 02—Jun, 04	Senior Optoelectronic Engineer, E2O Communications, Inc., CA

4. Fields of Specialty:

- Nano-scale particles for highly efficient hybrid light emitting diodes.
- Microwave photonics via semiconductor lasers.
- Novel technology for solar spectrum management.

5. Major awards and honors

- 2017 ITRI EOSRL (傑出研究獎銀牌)
- 2017 NCTU's Student Mentor's awards (績優導師獎)
- 2015 Young Investigator Research Grant by Ministry of Science and Technology of Taiwan
- 2015 NCTU's Teaching awards (優良教學獎)
- 2014 NCTU's Teaching awards (優良教學獎)
- 2014 NCTU's Student Mentor's awards (績優導師獎)
- 2011 NCTU's Student Mentor's awards (績優導師獎)
- 1998 Gerald L. Pearson Memorial Fellowship of Stanford University

Recent Selected Publications

- **Chien-Chung Lin***, Ming-Hsuan Tan, Che-Pin Tsai, Kuei-Ya Chuang, T.S. Lay, "Numerical Study of Quantum-Dot-Embedded Solar Cells", IEEE, JSTQE, 19, pp.4000110, Sept.-Oct. 2013
- K. J. Chen, H. C. Chen, K. A. Tsai, **Chien-Chung Lin**,* H. H. Tsai, S. H. Chien, Y. J. Hsu, M. H. Shih, C. H. Tsai, H. H. Shih, and Hao-Chung Kuo,* "Resonant-Enhanced Full-Color Emission of Quantum-Dot-Based Display Technology by Pulsed Spray Method," Advanced Functional materials, 22, pp. 5138-5143, 2012
- Hsin-Chu Chen, **Chien-Chung Lin**,* Hao-Wei Han, Yu-Lin Tsai, Chia-Hua Chang, Hsun-Wen Wang, Min-An Tsai, Hao-Chung Kuo, and Peichen Yu, "Enhanced efficiency for c-Si solar cell with nanopillar array via quantum dots layers", Optics Express, 19, pp.A1141-A1147, 2011.
- Yen-Hua Lo, Yu-Chang Wu, Shun-Chieh Hsu, Yi-Chia Hwang, Bai-Ci Chen, **Chien-Chung Lin***, "Tunable microwave generation of a monolithic dual-wavelength distributed feedback laser", Optics Express, 22, 13125-13137, 2014
- Lung-Hsing Hsu, **Chien-Chung Lin***, Hau-Vei Han, Da-Wei Lin, Yen-Hua Lo, Yi-Chia Hwang, Hao-Chung Kuo, "Enhanced photocurrent of a nitride–based photodetector with InN dot-like structures", Optical Materials Express, 4, pp.2565-2573, 2014
- Hau-Vei Han, **Chien-Chung Lin***, Yu-Lin Tsai, Hsin-Chu Chen, Kuo-Ju Chen, Yun-Ling Yeh, Wen-Yi Lin, Hao-Chung Kuo & Peichen Yu, "A Highly Efficient Hybrid GaAs Solar Cell Based on Colloidal-Quantum-Dot-Sensitization", Scientific Reports, 4, 5734, 2014

Colloidal Quantum Dots and Their Applications to Hybrid Optoelectronic Devices

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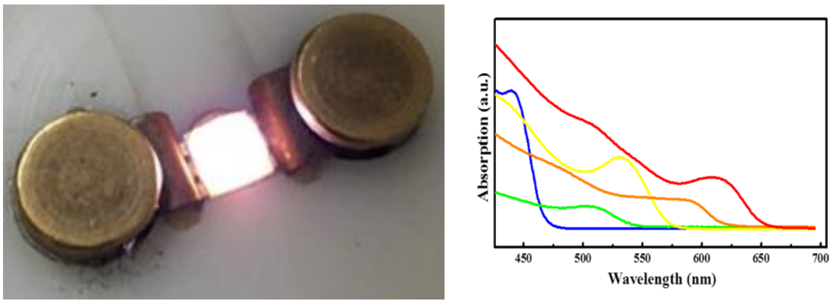
In this talk, we will review the past and updated efforts in our lab on the colloidal quantum dot hybrid optoelectronic devices. The colloidal quantum dots (CQDs) are nano-meter scale particles made of semiconductors. The size of the particle provides good quantum confinement and also improved quantum transitions for optical emission or absorption. Thus there has been a long history to apply these CQDs for the optoelectronic devices. However, most of the past research use the scheme of electrically pumped structure, which needs to align the band edge of the different materials (including CQDs and electron/hole transport layers), and this is not very advantageous for the prevalence of the CQD devices. The electrical currents that are running through the CQD layer can also be detrimental to the lifetime and reliability of the devices because the CQD is too small and fragile. We proposed and demonstrated the hybrid design of the CQD layer and the traditional optoelectronic devices. The combination of the two things can bring the enhancement in both absorption and emission. Highly efficient light emitting diodes (LEDs) can be shown in Fig. 1. The luminescent down-shifting (LDS) effect brought by the CQD layer can effectively improve the solar cell quantum efficiency in the short wavelength (such as ultraviolet region), as can be seen in Fig. 2. Most important of all is that these designs do not require the alignment of the band edge and the CQD layer are passively pumped by the external photons, in which we believe the reliability of such devices can be greatly improved.



(a) (b)

Fig. 1.(a) The hybrid CQD LED under electrical injection. (b) The absorption spectra of various CQDs.

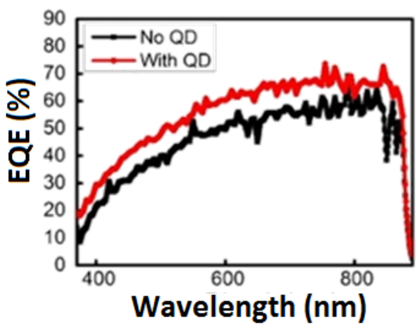


Fig. 2. The external quantum efficiency (EQE) spectrum of the CQD enhanced solar cell.

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3. Professional Experiences:

2017.4~	Director, Molecular Chirality Research Center, Chiba University
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2014.4~2017.3	Dean, Graduate School of Advanced Integration Science, Chiba University
2007.4~2017.3	Graduate School of Advanced Integration Science, Chiba University, Professor
1996.12~2007.3	Department of Image Engineering, Chiba University, Associate Professor
1992.6~1996.11	Department of Image Engineering, Chiba University, Research Associate

4. Fields of Specialty:

- Singular Optics, Optical Angular Momentum
- Laser Physics & Nonlinear Optics

5. Major awards and honors

- Visiting Professor, Macquarie University, Australia (2017)
- Futaba electronics memorial foundation award, (2016)
- Prize (Reaserch Category) for Science and Technology, The Minister of Education, Culture, Sports, Science and Technology (2016)
- Fellow, The Optical Society (2016)
- Visiting Professor, Ajou University, Korea (2014)
- Fellow, Japan Society of Applied Physics (2013)
- Visiting Professor, Xinjiang Normal University, China (2012)

6. List of Recent Selected Publications

- S. Araki, K. Ando, K. Miyamoto, **T. Omatsu**, "Ultra-widely tunable mid-infrared (6–18μm) optical vortex source," *Appl. Opt.*, **57**, 620-624 (2018). (Editor's pick)
- J. C. Tung, Y. H. Hsieh, **T. Omatsu**, K. F. Huang, and Y. F. Chen, "Generating laser transverse modes analogous to quantum Green's functions of two-dimensional harmonic oscillators," *Photon. Res.*, **5**, 733-739 (2017).
- **T. Omatsu**, K. Miyamoto, A. J. Lee, "Wavelength-versatile vortex lasers," *J. Opt.*, **19**, 123002/1-17 (2017). (Invited review article)
- K. Masuda, S. Nakano, D. Barada, M. Kumakura, K. Miyamoto, **T. Omatsu**, "Azo-polymer film twisted to form a helical surface relief by illumination with a circularly polarized Gaussian beam," *Opt. Express*, **25**, 12499-12507 (2017).
- K. Miyamoto, B. J. Kang, W. T. Kim, F. Rotermund, Y. Sasaki, H. Niinomi, K. Suizu, **T. Omatsu,** "Highly intense monocycle terahertz vortex generation by utilizing a Tsurupica spiral phase plate," *Sci. Rep.*, **6**, 38880/1-7 (2016).
- F. Takahashi, K. Miyamoto, H. Hidai, K. Yamane, R. Morita, **T. Omatsu**, "Picosecond optical vortex pulse illumination forms a monocrystalline silicon needle," *Sci. Rep.*, **6**, 21738/1-10 (2016).
- A. Abulikemu, T. Yusfu, R. Mamuti, K. Miyamoto, **T. Omatsu**, "Widely-tunable optical vortex output from a singly resonant optical parametric oscillator," *Opt. Express*, **23**, 18338-18344 (2015).
- M. Watabe, G. Juman, K. Miyamoto, **T. Omatsu**, "Light induced conch-shaped relief in an azo-polymer film," *Sci. Rep.*, **4**, 4281 (2014).
- K. Toyoda, F. Takahashi, S. Takizawa, Y. Tokizane, K. Miyamoto, R. Morita, **T. Omatsu**, "Transfer of light helicity to nanostructures," *Phys. Rev. Lett.*, **110**, 143603 (2013).
- K. Toyoda, K. Miyamoto, N. Aoki, R. Morita, **T. Omatsu**, "Using optical vortex to control the chirality of twisted metal nanostructures," *Nano Lett.*, **12**, 3645−3649 (2012).

Optical Vortices Create Structured Materials

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Structured light beams, such as optical vortices [1-3], possess various unique physical properties, for instance, annular intensity profile, helical wavefront, and orbital angular momentum, thereby providing many new fundamental light-matter interactions. In fact, structured beams have been intensely investigated in diverse applications, for instance, optical manipulation and tweezer, optical telecommunication, quantum information, and high spatial resolution fluorescence microscope.

In recent years, we and our co-workers have discovered that optical vortices with orbital angular momentum twist melted or softened materials to establish a variety of chiral structured materials, including chiral metal needles, chiral polymeric surface reliefs, chiral monocrystalline silicon microstructures, and twisted photo-polymerized fibers on a nano-/micro-scale [4-6]. We term this ‘optical vortex materials processing’.

Such optical vortex materials processing will open potentially the path to develop chiral optical devices, for instance, chiral meta-surfaces, sensitive detectors of the chiral chemical composites, and chiral chemical reactors at high time and cost efficiencies.

In this presentation, I review the state-of-art of the chiral nano-/micro-structures formed by optical vortex materials processing. I also address recent progress of wavelength-versatile optical vortex sources to create further chiral structured materials [7-9].

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Bachelor's Degree Program of UAV Application
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Personal Details：

Date of Birth： Kaohsiung, Taiwan, 1965

Education： Ph.D., Mechanical and Aerospace Engineering, September 2004
State University of New York at Buffalo, U.S.A.
M.S., Mechanical and Aerospace Engineering, June 1998
State University of New York at Buffalo, U.S.A.
B.S., Aeronautic and Astronautic Engineering, June 1993
National Cheng Kung University, Taiwan.

Professional Experiences:：

2017~ UAV Applied Development Research Center, Director.

2017~ Bachelor's Degree Program of UAV Application, Chairman.

2016~2017 College of Information and Design, Executive Secrerary.

2014~ Department of Engineering & Management of Advanced Technology, Chung Jung Christian University, Associate Professor.

2005~2014 Department of Engineering & Management of Advanced Technology, Chung Jung Christian University, Assistant Professor.

2004~2005 Post Doctoral Fellow
Mechanical and Aerospace Engineering
State University of New York at Buffalo

Fields of specialty：

- Stability Analysis of Hypersonic Boundary Layer
- Neural Network and Artificial Intelligent
- Data mining and Machine Learning
- Embedded System and control system

Major awards and honors：

Best paper award, T. C. Chen, T. S. Chen, and P. W. Wu ,'Data Collection in Wireless Sensor Networks Assisted by Mobile Collector', 1st IFIP Wireless Days Conference 2008 , Nov. 2008 ,Dubai, United Arab Emirates.

Best student paper award, T. C. Chen and Y. C. Su ,'High Performance Algorithm Realization on FPGA for Stepper Motor Controller', SICE Annual Conference 2008 , Aug. 2008, Chofu, Tokyo, Japan.

Innovative Object Oriented Design and Application of Unmanned Aircraft System

Tzung-Cheng Chen (陳宗正)

Unmanned Aircraft System (UAS) has caught the most of attention by the public, especially, for the researchers who have devoted themselves for solving labor problem in various industries which need a tremendous amount of manpower. During this talk, three topics will be included. First, the precision agriculture with the aid of UAS, which has been demonstrated for the ability and capability of saving manpower for agriculture industries in the application of agriculture fertilizer/pesticide spray. The main design purpose of UAS design is to carry the large amount of payload for a designed spraying area. However, for the application of ortho-photography, the aerial photographing is the most popular activity used by the UAS, also the images taken from the bird view are the most widespread used in various application, such as land survey, security monitoring, and cargo delivery. The design rule of the UAS for this application, mainly, on the duration time of flight, and distance also. Last, the application of bridge inspection and power line inspection, who requires the UAS get closer to the target in order to acquire the high quality image for detail information for further decision making.

Fig. 1. UAS Agriculture Application, Land Inspection.

Fig. 2. UAS Power Line Inspection.

Shu-Yi Liaw (廖世義)

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Ping-Tung 912, Taiwan

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1. Personal Information

Birth: Kaohsiung City, Taiwan, 1961.

2. Educations:

Doctor of Philosophy (PhD), Industrial and Information Management, National Cheng Kung University, Taiwan

Master of Management Science, Department of Management Science, Nati**onal Louis University, Chicago,** USA

Master of Engineering, Department of Mechanical Aerospace, Illinois In**stitute of Technology, Chicago,** USA

Bachelor of Engineering, Department of Mechanical Engineering, **National Cheng Kung University,** Taiwan.

3. Professional Experiences:

2014/08 ~ present, Director of Computing Centre, NPUST

2009/08-2010/07, CEO of EBMA Program, College of Management, NPUST

2006/08-2009/07, Chairman, Department of Business Administration, NPUST

4. Project Leader

2015-2017 Promotion Project of Big Data Analytics and Data Mining Application, StatSoft Holdings, Inc., Taiwan Branch, ID: B10500378

2012-2017 Internet Marketing and E-commerce License Promotion, Prowin Net Technology, ID: B10400417

5. Research Fields:

- Big Data Analysis and Application / Data Mining in Marketing
- Electronic Commerce / Online Consumer's Behavior

6. Publications:

- Thi Mai Le, & **Shu-Yi Liaw** (2017). Effects of Pros and Cons of Applying Big Data Analytics to Consumers' Responses in an E-Commerce Context. *Sustainability, 9*(5), 798.– SSCI, ISSN 2071-1050)
- Chung –Yi Li, **Shu-Yi Liaw,** Chao-Chun Chen, Mao-Yuan Pai, Yuh-Mi Chen (2017). A computer-based Approach for Annalyxing Consumer Demands in Electronic World of Mouth. *Journal of Electronic Markets,* 27: 225-242. – SSCI.
- **Shu-Yi Liaw** & Thi Mai Le (2017). Comparing Mediation Effect of Functional and Emotional Value in the Relationship between Pros of Applying Big Data Analytics and Consumers' Responses. *International Journal of Marketing Studies, 9*(4) - ISSN: 1918-7203
- Nong Thi Hong Lam & **Shu-Yi Liaw** (2017). Comparing Mediation Role of Cultural Intelligence and Self-Efficacy on the Performance of International Business Negotiation. *International Business Research*, *10*(7), 22. –ISSN: 1913-9012.

Deep Learning Applied into the Price Forecasting of Agricultural Products and the Platform of Future Agriculture 4.0

Shu-Yi Liaw (廖世義)

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Ahead of crops production, farmers are unable to accurately predict prices at harvest, and they are unaware whether the current scale of cultivation of the same crops has exceeded market demand. Therefore, most of the agricultural products harvested can only be delivered to the traditional wholesale market. They are sold under asymmetric information condition leading wholesalers to be slaughtered. The highlight of this project is the forecasted analysis of fruit and vegetable markets. Although the Agriculture and Food Agency, council of agriculture of Taiwan (AFA) provides daily market information for fruits and vegetables, the data is hardly used by units for further research. The present project provides an on-line in depth analysis and forecasting through machine learning (Deep Learning) technology with integration of an early warning system displaying imbalances between supply and demand for the general public and related research units.

We compiled a web crawler program that automatically captures the latest trading quotes every day, collects historical trading prices for fruits and vegetables since 2011, and automatically retrieves the latest quotes every day. We used FB Prophet's price forecasting algorithm to predict models for years. Extreme events such as holidays, typhoons, and rains are forecasted weekly. Finally, the data is converted into visual graphics for the characteristics of various crops to be described, accompanied by visual interactive charts to help producers and consumers quickly understand the volatility of the market.

The contributions of this project are as follow:

(1) Provides the same visualization of the stock market analysis and forecast charts, the first in the country.
(2) Although, the forecast result is affected by the data set completely, it clearly shows the market cycles and trends and is sufficient for reference before planting.
(3) Important holidays and the impact of typhoon on the market have been able to join the external variables of forecast (typhoon, heavy rain, Spring Festival, consecutive holidays).
(4) Complete and flexible automatic data collection and forecasting framework, and provide the general public with a more readable and complete agro-market information platform.

Fig 1、收錄210萬筆之近六年交易記錄

Fig 2、蔬果花卉列表與近10日交易統計

Session IX

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EDUCATION

1970 B.S. Applied physics, Tokyo Institute of Technology, Tokyo, Japan.
1974 Sokei Academy of Fine Arts, Tokyo, Japan.
1974~75 Ecole National Superieur des Beaux-Arts, Paris, France.
1978~81 Research Student, Image Science and Engineering Laboratory, Tokyo Institute of Technology, Tokyo, Japan.
2001~04 Graduate school of Information Science and Engineering, Tokyo Institute of Technology, Tokyo 2005 Ph.D. Tokyo Institute of Technology

PROFESSIONAL ACTIVITIES

Fellowship

1981 Fellowship of Japanese Government for Artists and Musicians.
Fellow, Center for Advanced Visual Studies, Massachusetts Institute of Technology, .

Teaching

2000 Visiting Artist, Critical Studies, California Institute of Arts, California, USA.
2003 Visiting Artist, School of Visual Arts, The Korean National University of Arts.
2007 Lecturer for intensive course of art holography, National Taiwan Normal University.
2006-2011 Adjunct Professor, Tokyo Institute of Technology, Japan.
1997-2015 Lecturer, Aichi University of the Arts, Japan
2008-2017 Lecturer, Tokyo Polytechnic University, Japan
2007-2017 Lecturer, Saitama Institute of Technology, Japan

AWARD

1980/82/85 Artist-in-Residence, Museum of Holography, New York, USA.
1987 Artist-in-Residence, Cite International des Arts, Paris, France.
1985 Shearwater Foundation Award for creative holography, USA.
1993 European Holography Prize, City of Pulheim, Germany.
2000 Artist-in-Residence, 3rd Holocenter Award, New York, USA.
2007 HODIC Suzuki-Okada Award
2013 Artist-in-Residence, Holocenter awards 2013, OSU, Ohio, USA 2016
Holographic Art Grant awarded from the Hologram Foundation, France.

PUBLICATIONS

* Setsuko Ishii, Jumpei Tsujiuchi, Where are We Going in Art Holography?, **New Directions in HOLOGRAPHY and SPECKLE**, Chapter 6, pp95-113, American Scientific Publishers, 2008
* Setsuko Ishii**, Artistic Representation with Holography**, paper in the Journal of the Society for Science on Form, Forma, 21, pp.81-92. 2006
http://www.scipress.org/journals/forma/pdf/2101/21010081.pdf
* Setsuko Ishii, Art, Interia and Decoration, **Holography Material & Application Handbook**, Part II, Sec.1.1, pp.205-213, NTS, 2007
* Setsuko Ishii, Holography Art, **３D（three dimensional）Image Handbook,** PartII , 4.1, pp257-265, Asakura Publishing Co.Ltd, 2006

ART ACTIVITIES

Solo exhibition (selected)

1982 Museum of Holography, Paris, France. Palazzo Fortuny, Venice, Italy.
1986 **New Experiences in Perception**, Museum of Holography, New York, USA.
1987 Museum of Holography, Pulheim, Germany. Walker Hill Art Center, Seoul, Korea.
Cite International des Arts, Paris, France.
1989 **Forum'89, 100 One-Man Show**, Hamburg Messe, Germany.
1993 **Spinning Thread of Light-World of Setsuko Ishii-**, Utsikushi-ga-hara Open-Air Museum, Japan.
1995 **Photon Weaving Nature**, Takasaki Museum of Art, Japan.

2000 **Holography, Light Time Space,** California Institute of Art, Los Angeles, USA.
World of Setsuko Ishii-Holography, Ikeda Museum of Art, Nagano, Japan.
2003 -04 **Holography Art Exhibition Featuring/Setsuko Ishii,** Huis ten bosch Art Museum, Japan.
2006 **Spinning Thread of Light-World of Setsuko Ishii Holography·Art**, Tsuruoka Art Forum, Japan.
Spinning Thread of Light, National Taiwan Normal University, Taiwan
2007 **Percorsi Di Luce Nel Tempo**, Villa dei Quintili-Roma, Italy

Group exhibition (selected)

1979 **15th Sao Paulo Biennial**, Sao Paulo, Brazil.
New Spaces, The Holographer's Vision, The Franklin Institute, Philadelphia, USA.
1980 **Photokina '80,** Cologne Messe, Cologne Germany.
1981 **Laser Artland Taipei'81**, Taipei, Taiwan.
A Scene of Contemporary Japanese Art, Museum of Fine Art Miyagi, Japan.
1982 **1st International Exhibition of Display Holography**, Durand Art Institute, Lake
Forest 1983 **Light Dimensions**, The Royal Photographic Society, Bath , UK.
Art & Technology, Museum of Modern Art, Toyama, Japan.
Realism Now, Museum of modern Art, Saitama, Japan.
1984 **Lichit-Blicke**, Deutsches Filmmuseum, Frankfurt/Main, Germany.
1985 **Japan.Avant-Garde of the Future**, Geniva, Italy.
Decouverez l'Holographie, Palais de la Decouverie, Paris, France.
1986 **Holomedia'86**, **Faszination in Licht und Ton**, Staditsch Galerie, Karlsrue, Germany.
1987 **Images in Time and Space**, National Museum of Science and Technology, Montreal, Canada.
1988 **Artware-Fest Kunst und Elektronik**, Hannover Messe, Germany.
Japan High Technology Art Exhibition, Taiwan Museum of Art, Taizhon, Taiwan.
1989 **Artec '89, World Design Expo.** Aichi, Japan.
Another Light, Thomas Gallery, Munich, Germany.
1990 **International Congress on Art in Holography**, Saint Mary's College, Notre Dame, USA.
1991 **Raume aus Licht**, Akademie, Galerie, Berlin, Germany.
Fiat Lux!, Feria International de Muestras de Astrius, Gijon, Spain.
1992 **World Expo.'92, Seville**, Spain.
1994 **Point of View**, Retretti Art Center, Finland.
Techno Art, Ontario Science Center, Canada.
1995 **Premonition on Future**, Museum of Art Chongjiu, Korea.
4th International de Tecnologias de Imagen, SESC Pompeia, Sao Paulo, Brazil.
1996 **Science-Art**, Museum of Art Tsukuba, Japan.
1997~00 **Unfolding Light,** Tour Exhibition starts from MIT Museum, USA.
1999~00 **Holography**, Tour Exhibition starts from Museum of Art Rauma , Finland.
2000 **New Age of Holography**, Museum of Art Canton, USA.
Holography, Tokyo Metropolitan Film Museum, Tokyo, Japan.
2001 **Light and it's Representation**, Nerima Art Museum, Tokyo, Japan.
2002 **Image-Media-Museum**, Kurashiki City Art Museum, Tokyo, Japan.
2003 **Leading Light,** St. Mary's College, Notre Dome, Indiana, U.S.A.
Balls for Meditation, Kawagoe City Art Museum, Saitama, Japan.
2006 **Egg of Möbius**, 21st Century Museum of Contemporary Art, Kanazawa, Japan.
Holography- From the Science to the Art, Tokyo Institute of Technology, Japan
2007-8 **DOMANI,** National Art Center ,Tokyo Japan
2011 **GARDEN OF LIGHT** , Gallery 175, Insadon, Seoul, Korea
2012-15 **The Jewel Net – Views of Contemporary Holography**, MIT Museum, Cambridge, USA
2015 **MAGIC OF LIGHT,** Elisseev Palace, St Petersburg, Russia
2017 **IRIDESCENCE** Espace 24B, Paris, France,
IRIDESCENCE, Center for the Holographic Art, Holocenter, Governers iland

HOLOGRAPHY AS ARCHITECTURAL DECORATION

Setsuko Ishii
Independent artist

This presents an application for holography as an architectural decoration. It describes the attempt to bring the attractive decorative applications of holography into a building's everyday living space.

There are various different methods for using a hologram as a raw material, for example, sculptural decoration as a three-dimensional object, atrium decoration, a holography chandelier, wall decoration such as a mural painting, and staging the prismatic display of sunlight indoors by using holography grating.

In these cases, the reflection type of hologram is mainly utilized because the reflection holograms are much easier to handle than using transmission holograms as a raw material. One of the reasons is that the transmission holograms require a large space behind the holograms for a light to shine through and reproduce the holographic images.

Lastly, recent practices are described, weaknesses of recent practices are resolved, and multicolor rainbow transmission holograms are installed as a wall decoration.

Transportation between airport and hotel, please see the details as below:

TW Kaohsiung International Airport to Shangri-La's Far Eastern Plaza Hotel			
From – To	Transport tool	Time	Website linkage
TW Kaohsiung International Airport station(R4) – Zuoying HSR station(R16)	Take Red line of Kaohsiung Rapid Transit Corp.	35mins	http://www.krtco.com.tw/en/StationGuide_map.aspx
Zuoying HSR station – Tainan HSR station	Take TW High-Speed Rail(HSR)	15mins	https://www.thsrc.com.tw/tw/StationInfo/Prospect/f2519629-5973-4d08-913b-479cce78a356
Tainan HSR station –台南市東區大學路西段 89 號 / 89 Section West, University Road, Tainan 70146, Taiwan Tel：(886 6) 702 8888	Taxi	30mins	http://www.shangri-la.com/tainan/fareasternplazashangrila/about/map-directions/
TW Taoyuan International Airport to Shangri-La's Far Eastern Plaza Hotel			
From – To	Transport tool	Time	Website linkage
TW Taoyuan International Airport station(A12/A13) – Taoyuan HSR station(A18)	Taoyuan Metro	17mins	https://www.tymetro.com.tw/tymetro-new/tw/_pages/travel-guide/road.html
Taoyuan HSR station – Tainan HSR station	Take TW High-Speed Rail(HSR)	At least 1hr22mins	http://www.thsrc.com.tw/jp/StationInfo/Prospect/8f896846-8d78-4e2d-96fa-1ed6fd2dbf9e
Tainan HSR station–台南市東區大學路西段 89 號 / 89 Section West, University Road, Tainan 70146, Taiwan Tel：(886 6) 702 8888	Taxi	30mins	http://www.shangri-la.com/tainan/fareasternplazashangrila/about/map-directions/
TW Songshan International Airport to Shangri-La's Far Eastern Plaza Hotel			
From – To	Transport tool	Time	Website linkage
TW Songshan International Airport - Taipei HSR station	Taxi	25mins	
Taipei HSR station – Tainan HSR station	Take TW High-Speed Rail(HSR)	At least 1hr46mins	http://www.thsrc.com.tw/jp/StationInfo/Prospect/4a61506f-70d6-470e-804d-82291b466560
Tainan HSR station –台南市東區大學路西段 89 號 / 89 Section West, University Road, Tainan 70146, Taiwan Tel：(886 6) 702 8888	Taxi	30mins	http://www.shangri-la.com/tainan/fareasternplazashangrila/about/map-directions/

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