台灣國立交通大學理學院應用化學系
雷射生物奈米科學研究室
研究成果活動報告書
民國 97 年 4 月 ～ 107 年 3 月

Laser Bio/Nano Science Laboratory
Department of Applied Chemistry, National Chiao Tung University
(NCTU)

Activity Report
(2008 April - 2018 March)

Increasing Visibility of NCTU in Science and in Japan

Preface

In the autumn of 2007 I was invited by Prof. Yuan-Pern Lee to visit NCTU (National Chiao Tung University) and exchanged our opinions on some topics of mutual interest with him and prominent scientists of Department of Applied Chemistry (DAC). Also we discussed on how to develop our science, university, and academic exchange internationally, and consequently I shifted from Osaka to Hsinchu on April 2018. Our Laser Bio/Nano Science Laboratory started smoothly and now ten years have passed away. I chose laser trapping as a central subject among my topics in the past, considering various situations and conditions about NCTU, fund, staff, my age, and of course my interest, I believed that originality and uniqueness of laser trapping dynamics and chemistry were enough high, international competitiveness was expected, and unconventional and seminal study would evolve from our laboratory.

Laser Bio/Nano Science Laboratory has been developing supported by Aiming-Top-University (ATU) project of NCTU and Ministry of Education (MOE). Now my contract of 5 years-2 terms with our presidents is ending, and we are happy to summarize our activity in this small booklet. Due to our systematic scientific contribution, we are now regarded as one of the world-level centers studying laser trapping dynamics and chemistry. Additionally we have devoted our efforts for academic exchange between Taiwan and foreign countries particularly Japan, so that not only professors and researchers but also many people including even high school students have visited to NCTU, DAC, and our Laser Bio/Nano Science. Our past ten years activity is well summarized with a concluding word “Increasing Visibility of NCTU in Science and in Japan”.

Here I would like to express my sincere thanks to my colleagues, friends, assistants, students and funding, and most importantly to President Drs. Peter Chung-Yu Wu, Yan-Hua Wu Lee, and Mau-Chung Frank Chang, Deans of College of Science Drs. Jenh-Yih Juang, Henry Horng-Shing Lu, Yaw-Kuen Li, and Yung-Fu Chen, and DAC Chairs Drs. Weng-Sheng Chung, Niann-Shiah Wang, and Chi-Shen Lee for their kind understanding and strong supports. Finally, my most sincere

thanks are dedicated to Prof. Yuan-Pern Lee for his kind and fair management based on his wonderful scientific project.

March 29, 2018

Hiroshi MASUHARA

Research Activity

98 Published Papers

96 Invited lectures

Education Activity

8 PhD Students

1 1 PhD student promoted as Professor of Japanese University

41 Master Students

4 Dual Degree Students (3 with Japanese University and 1 with Belgian University)

27 Japanese Graduate Students staying in Our Laboratory for 1~3 months

11 Our Students Studying Abroad for 1 – 2 years

Academic Exchange Activity

5 Staffs Promoted to Japanese and Brunei Universities

2 Japanese Staffs married with Taiwanese ladies

4 Japanese Postdoctoral Fellows supported by JSPS (Japan Society for Promotion of Science)

48 Japanese Professors we invited to Department Seminar

86 Japanese Professors we invited to Laboratory Seminar

723 Participants to Hsinchu Summer Course and Workshop on Single Molecule/Nanoparticle Spectroscopy and Imaging

228 Japanese Super Science High School students we received


台湾国立交通大学 竹湖
2014.6.17

Present Members

Hiroshi MASUHARA

増原 宏

Painted by
Prof. Toshitsune MIYAKE
Mathematician,
Prof. Emeritus of
Hokkaido University

Dr. Hiroshi Masuhara graduated from Tohoku University (1966) in Sendai and obtained Ph.D. degree from Osaka University (1971). He is a physical chemist working in multidisciplinary areas in departments of chemistry (Tohoku University), synthetic chemistry (Osaka University), polymer science and engineering (Kyoto Institute of Technology), applied physics (Osaka University), frontier bioscience (Osaka University), life science (Hamano Foundation), and materials science (Nara Institute of Science and Technology). In 2008 he joined Department of Applied Chemistry of National Chiao Tung University as Chair Professor. He has published about 600 papers, 160 reviews and 19 books. In Laser Bio/Nano Science Laboratory he has extended seminal researches on (1) laser trapping dynamics of nanoparticles, (2) laser trapping crystallization of molecules and proteins, and (3) application of femtosecond laser and chemical surface modification for fabricating individual cell-based devices.

Academy Member

(1) Foreign Fellow of National Academy of Sciences, India (2010 - present)
(2) Foreign Member, Flemish Academy of The Art and Sciences, Belgium (1998 - present)

Honor, Award, and Prize

(1) 2017 The Order of the Sacred Treasure, Gold Rays with Neck Ribbon (The Emperor of Japan)
(2) 2010 Mukai Prize
(3) 2010 Mizushima-Raman Lectureship (JSPS-India DST)
(4) 2010 Asian Photochemistry Association Award
(5) 2008 Outstanding Scholar Award (Foundation for the Advancement of Outstanding Scholarship, Taiwan)
(6) 2008 The Purple Ribbon Medal (The Emperor of Japan)
(7) 2006-2013 Doctor Honoris Causa de Ecole Normale Superier de Cachan, France

Society Fellow

(1) JPA (Japanese Photochemistry Association) Emeritus Member (2017~present)
(2) CSJ (Chemical Society of Japan) Fellow (2010 - present)

Journal Editor

(1) Advisory board (2008 - present)
The Chemical Record
(2) Advisory board (2005 - present)
Bulletin of the Chemical Society of Japan
(3) Editorial board (2000 - present)
ChemPhysChem
(4) Editorial board (1997 - present)
Journal of Photochemistry and Photobiology C: Photochemistry Review
(5) Asian Editor (1997 - 2011), Editorial Board (2012 - present)
Journal of Photochemistry and Photobiology A: Chemistry

President, Advisor, and Councilor

(1) Advisor (2016 - present)
Center for Excellence in Exciton Science, Australian Research Council, Australia
(2) Advisor (2016 - present)
Japan Society for Promotion of Science Project, Grant-in-Aid for Scientific Research on Innovative Area on “Nano-Material Manipulation and Structural Order Control with Photon Forces”

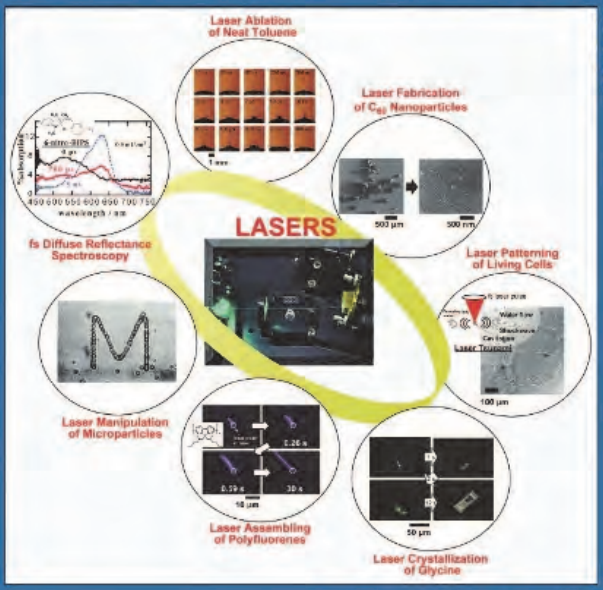
(3) Advisor (2014 - present)
Japan Society for Promotion of Science Project, Grant-in-Aid for Scientific Research on Innovative Area on “Application of Cooperative Excitation into Innovative Molecular Systems with High Order Photofunctions”
(4) Advisor (2013 - 2018)
Japan Society for Promotion of Science Project, Grant-in-Aid for Scientific Research on Innovative Area on “Dynamical ordering of biomolecular systems for creation of integrated functions”
(5) Review Committee member (2013 - 2016)
Research Center of Applied Sciences, Academia Sinica
(6) Executive Advisor (2013 - 2016)
Institute for Molecular Science, Japan
(7) President (2002 - 2004), Advisor (2005 - present)
The Asian and Oceanian Photochemistry Association
(8) International Advisor (2002 - 2016)
Interuniversity Attraction Pole Project on Supramolecular Chemistry and Catalysis, Belgian Federal Science Policy Office, Belgium
(9) Councilor and Advisor (2001 - present)
The Laser Society of Japan
(10) President (2000-2001), Advisor (2003-present)
Japanese Photochemistry Association

Masuhara Lectureship Award
Asian and Oceanian Photochemistry Conference started this award in 2012.

HIROSHI MASUHARA FESTSCHRIFT (Special Issue)
2009 Journal of Physical Chemistry C, America Chemical Society

JULY 9, 2009
VOLUME 113
NUMBER 27
pubs.acs.org/JPCC

THE JOURNAL OF PHYSICAL CHEMISTRY C



Exploration with Lasers into New Areas of Molecular Photoscience (see page XXX)

Hiroshi Masuhara Festschrift

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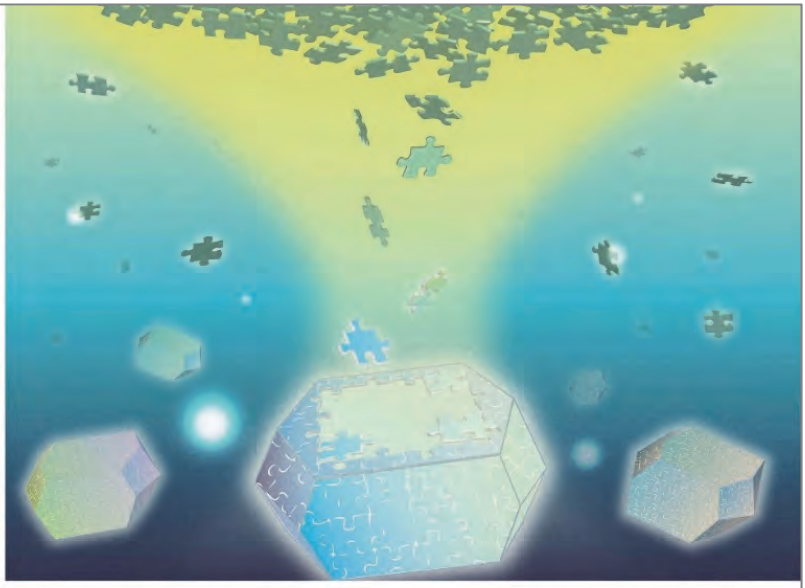
Teruki SUGIYAMA

杉山 輝樹

Dr. Teruki Sugiyama received B. Eng. degree from Shinshu University in 1994 and Ph.D. from Nankai University, P. R. China in 2002. He was Designated Instructor, Specially-Appointed Instructor, and Specially-Appointed Fellow in Department of Applied Physics at Osaka University from 2002-2007. In Osaka University, he studied the fabrication of organic and pharmaceutical nanoparticles utilizing laser ablation in solution, and succeeded in tailoring the smallest organic dye nanoparticles by the top-down method using ultrashort laser. In 2007, he became Researcher at Hamano Life Science Research Foundation, where he started his current research topic on the development of laser trapping method to crystal chemistry. From 2008 to 2011, he worked at Nara Institute of Science and Technology as Associate Professor and at Instrument Technology Research Center, National Applied Research Laboratories as Associate Researcher and Research Fellow from 2011 to 2015, when he extended his research on laser trapping chemistry. He moved to National Chiao Tung University as Associate Professor of Applied Physics in 2007. His main areas of research interest are laser nano chemistry of molecular/cluster systems for two research topics: “Laser trapping chemistry” and “Laser bio/nano application”.

Physical Chemistry Chemical Physics (Back cover)
20, 6034–6039 (2018)
“Rapid localized crystallization of lysozyme by laser trapping”



Highlighting research from Laser Bio/Nano Science Laboratory, National Chiao Tung University, Hsinchu, Taiwan

Rapid localized crystallization of lysozyme by laser trapping

This paper reports laser trapping-induced crystallization of hen egg-white lysozyme (HEWL) showing high temporal and spatial controllability. The crystallization is inhibited during laser trapping, while initiated by stopping the laser irradiation. The generation time is much shortened by 20 times compared to spontaneous nucleation. The resultant HEWL crystals are densely localized in a circle area with the diameter of a few millimetres around the focal spot. The present rapid localized crystallization method will be widely applied to many proteins.

As featured in:

See Teruki Sugiyama *et al.*, *Phys. Chem. Chem. Phys.*, 2018, **20**, 6034.

ROYAL SOCIETY OF CHEMISTRY

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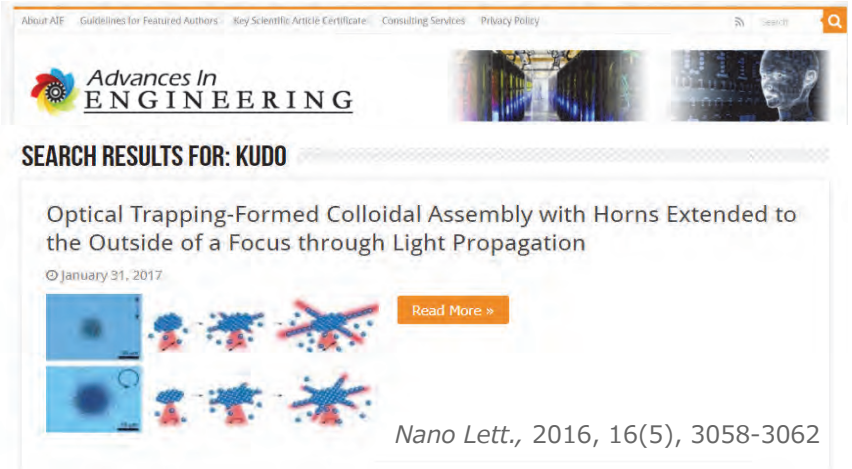
Tetsuhiro KUDO

工藤 哲弘

Dr. Tetsuhiro Kudo obtained the Ph.D. degree from Department of Physics and Electronics, Osaka Prefecture University, Japan (2014). He has worked in Department of Applied Chemistry, National Chiao Tung University in Taiwan as JSPS (Japan Society for the Promotion of Science) Overseas Research Fellow and Post-doc (2014-2016). He is currently working as Assistant Research Fellow from 2017. He is a theoretical and experimental physicist starting academic career in Taiwan, and recently discovering and investigating the novel laser trapping phenomena of nanoparticles based on light propagation and scattering at an interface. He has received 2016 Inoue Research Award for Young Scientists in Japan, EXCON2012 Young Scientist Award in Netherlands, and Poster award at 2017 Spring Symposium of The Asian and Oceanian Photochemistry Association in Taiwan.

Our *Nono Letters* is cited as a key scientific article in Advances in Engineering. (https://advanceseng.com/)



Laboratory Staffs

Hiroshi Masuhara 増原宏	Chair Professor	2008.04 - present
Teruki Sugiyama 杉山輝樹	Associate Professor	2015.08 - present
Atsushi Miura	Assistant Professor	2009.09 - 2014.04
三浦篤士	Associate Researcher	2008.04 - 2009.08
Takayuki Uwada	Assistant Researcher	2008.04 - 2012.03
宇和田貴之		
Anwar Usman	Post Doctoral fellow	2009.06 - 2013.06
吳安華		
Kenichi Yuyama	Assistant Researcher	2014.01 - 2016.09
柚山建一	Post Doctoral Fellow	2011.04 - 2013.12
Kazunori Okano	Assistant Researcher	2013.06 - 2015.12
岡野和宣	Post Doctoral Fellow	2012.08 - 2013.05
Masayasu Muramatsu	Post Doctoral Fellow	2014.04 - 2015.10
村松正康	JSPS Overseas Research Fellow	
		2012.04 - 2013.03
Tetsuhiro Kudo	Assistant Researcher	2017.01 - present
工藤哲弘	Post Doctoral Fellow	2016.04 - 2016.12
	JSPS Overseas Research Fellow	
		2014.04 - 2016.03
Shun-Fa Wang	Post Doctoral Fellow	2017.02 - 2017.07
王順発		
Yugo Hayashi	JSPS Overseas Research Fellow	
林有吾		2015.06 - 2015.08
		2016.02 - 2016.03
Morihiko Hamada	JSPS Overseas Research Fellow	
濱田守彦		2015.04 - 2016.03
Wen-Yu Lee	Assistant	2008.04 - present
李文郁		
Yi-Chun Lee	Assistant for Research	2009.08 - 2010.0
李依純		

JSPS Overseas Research Fellows

1.	Masayasu Muramatsu	村松正康	2012.04 - 2013.03
2.	Tetsuhiro Kudo	工藤哲弘	2014.04 - 2016.03
3.	Morihiko Hamada	濱田守彦	2015.04 - 2016.03
4.	Yugo Hayashi	林有吾	2015.06 - 2015.08 2016.02 - 2016.03

Students

1.	Ping-Yu Hsu	許平諭	(PhD)	2009.08 - 2015.01
2.	Jing-Ru Tu	杜靜如	(PhD)	2009.08 - 2016.01
3.	Tsung-Han Liu	劉宗翰	(MS, PhD)	2009.08 - 2017.08
4.	Chun-Wei Huang	黃重維	(MS)	2010.02 - 2011.11
5.	Wei-Yi Chiang	江威逸	(MS, PhD)	2010.08 - 2017.11
6.	Shun-Fa Wang	王順發	(MS, PhD)	2010.08 - 2017.01
7.	Ching-Shu Tseng	曾綮續	(MS)	2010.08 - 2013.08
8.	Zu-Wei Hsu	許孜瑋	(MS)	2010.08 - 2013.08
9.	Yen-Hwa Huang	黃彥樺	(MS)	2010.08 - 2013.08
10.	Ling-Ting Huang	黃鈴婷	(MS)	2010.08 - 2013.08
11.	Chi-Shuen Wu	吳奇勳	(MS, PhD)	2011.08 - present
12.	Chun-Shen Wu	吳峻陞	(MS)	2012.08 - 2015.02
13.	Po-Yu Lin	林柏宇	(MS)	2012.08 - 2014.07
14.	Ding-Wen Jian	簡鼎文	(MS)	2013.07 - 2015.07
15.	Chun-Han Wang	王崇翰	(MS)	2013.07 - 2015.07
16.	Pei-Yun Hseh	謝沛芸	(MS)	2013.07 - 2015.07
17.	Jen-Lian Shu	徐禎蓮	(MS)	2013.07 - 2015.09
18.	Po-Ren Chen	陳伯任	(MS)	2013.08 - 2015.07
19.	Kai-Di Chang	張凱迪	(MS)	2013.08 - 2015.07
20.	Lin-Li Liu	劉林禮	(MS)	2013.08 - 2016.01
21.	Tse-Fu Hsen	沈則甫	(MS)	2013.09 - 2015.07
22.	Yuan-Lin Yi	易宛霖	(MS)	2014.04 - 2015.12
23.	Ping-Shun Peng	彭炳順	(MS)	2014.08 - 2016.10
24.	Mong-Wei Chou	卓孟瑋	(MS)	2014.08 - 2015.07
25.	Ray-Kai Chen	陳睿凱	(BS, MS)	2014.08 - present
26.	Yung-Lun Lin	林詠倫	(MS)	2015.02 - 2017.08
27.	Shang-Wei Lou	劉上瑋	(MS)	2015.08 - 2016.09

28.	Chi-Lung Wu	吳奇隆	(MS)	2015.08 - 2017.08
29.	Shang-Jan yang	楊尚展	(MS)	2015.08 - 2017.10
30.	An-Chieh Cheng	鄭安婕	(MS, PhD)	2015.08 - present
31.	Tsung-Wei Shieh	施宗緯	(MS, PhD)	2015.08 - present
32.	Chieh-Ju Chang	張傑茹	(MS)	2015.09 - 2017.08
33.	Ting-Shiang Chiou	邱鼎翔	(BS, MS)	2015.03 - present
34.	Ching-Shiang Tseng	曾靖翔	(MS)	2016.07 - present
35.	Yang-Hsin Shieh	施仰欣	(MS)	2016.02 - present
36.	Jhao-Rong Lin	林昭容	(MS)	2016.06 - present
37.	Pei-Hua Lo	羅珮華	(MS)	2016.07 - present
38.	Jia-Syun Lu	呂佳勳	(MS)	2017.07 - present
39.	Hao-Tse Su	蘇浩澤	(MS)	2017.07 - present
40.	Zhi-Hao Huang	黃之灝	(MS)	2017.07 - present
41.	Yu-Ming Wang	王裕明	(MS)	2017.07 - present
42.	Chia-Ying Tsai	蔡佳穎	(MS)	2017.09 - present
43.	Abdullah Kamit	卡蜜濤	(MS)	2018.02 - present
44.	Yen-Ling Chiou	邱彥苓	(BS)	2013.08 - 2015.06
45.	Yen-En Liu	劉言恩	(BS)	2015.07 - 2017.08
46.	Yi-Ju Wu	吳奕儒	(BS)	2016.07 - present
47.	Hsuan-Yin Wang	王暄尹	(BS)	2017.07 - present
48.	Wen-Chi Wang	王玟淇	(BS)	2017.07 - present

Dual Degree Program Students

1. Shinpei Nishimura (Saitama University - NCTU)
   西村晋平 2012.08 - 2015.09
2. Kazuki Okano (Saitama University - NCTU)
   岡野和希 2017.10 - 2018.03
3. Chiang Wei.-Yi. (NCTU - Katholieke Universiteit Leuven)
   江威逸 2014.09 - 2017.11
4. Chi-Shuen Wu (NCTU - Saitama University)
   吳奇勳 2016.10 - 2017.09

Financial Support by NCTU, NSC (National Science Council) and MOST (Ministry of Science and Technology)

1. Hiroshi Masuhara, 2008, ATU Project of NCTU
   Title: 雷射生物奈米科學研究室
2. Hiroshi Masuhara, 2009, ATU Project of NCTU
   Title: 雷射生物奈米科學研究室
3. Hiroshi Masuhara, 2010, ATU Project of NCTU
   Title: 雷射生物奈米科學研究室
4. Hiroshi Masuhara, 2011, ATU Project of NCTU
   Title: 雷射生物奈米科學研究室
5. Hiroshi Masuhara, 2011, President of NCTU
   Title: 雷射生物奈米科學研究室
6. Hiroshi Masuhara, 2012, President of NCTU
   Title: 雷射生物奈米科學研究室
7. Hiroshi Masuhara, 2012, ATU Project of NCTU
   Title: 雷射生物奈米科學研究室
8. Hiroshi Masuhara, 2013, ATU Project of NCTU
   Title: 雷射生物奈米科學研究室
9. Hiroshi Masuhara, 2014, ATU Project of NCTU
   Title: 雷射生物奈米科學研究室
10. Hiroshi Masuhara, 2015, ATU Project of NCTU
    Title: 雷射生物奈米科學研究室
11. Hiroshi Masuhara, 2016, ATU Project of NCTU
    Title: 雷射生物奈米科學研究室
12. Hiroshi Masuhara, 2017, ATU Project of NCTU
    Title: 雷射生物奈米科學研究室
13. Hiroshi Masuhara, 2018, President of NCTU
    Title: 雷射生物奈米科學研究室
14. Hiroshi Masuhara, 2008.04 ~ 2009.03, NSC
    Title: 雷射補陷結晶法之研究(1/3)

15. Hiroshi Masuhara, 2009.04 ~ 2010.03, NSC
    Title: 雷射補陷結晶法之研究(2/3)
16. Takayuki Uwada, 2009.08 ~ 2011.07, NSC
    Title: 開發廣場雷利散射顯微影像技術用於探討蛋白質結晶的基本過程
17. Hiroshi Masuhara, 2010.04 ~ 2011.03, NSC
    Title: 雷射補陷結晶法之研究(3/3)
18. Hiroshi Masuhara, 2011.04 ~ 2012.03, NSC
    Title: 純有機化合物液體中的雷射捕捉及結構組成(1/3)
19. Hiroshi Masuhara, 2012.04 ~ 2013.03, NSC
    Title: 純有機化合物液體中的雷射捕捉及結構組成(2/3)
20. Atsushi Miura, 2012.08 ~ 2014.07, NSC
    Title: 螢光蛋白雷射捕陷結晶化動力學：藉由非線性顯微成像研究光壓誘發相分離及晶核形成
21. Hiroshi Masuhara, 2013.04 ~ 2014.03, NSC
    Title: 純有機化合物液體中的雷射捕捉及結構組成(3/3)
22. Hiroshi Masuhara, 2014.05 ~ 2015.11, NSC
    Title: 藉由三維觀測分析闡明奈米糰簇和奈米粒子的雷射捕捉, 散射及緊合動力學
23. Kazuhiro Okano, 2014.01 ~ 2015.12, NSC
    Title: 藉由在培養基片上的局部設計固定誘導分化因子達成細胞分化在時空上的控制
24. Kenichi Yuyama, 2014.08 ~ 2016.07, NSC
    Title: 雷射捕陷誘發分子與膠體晶體動態成長機制之反射影像光譜解析
25. Teruki Sugiyama, 2015.08 ~ 2016.07, MOST
    Title: 雷射捕陷誘發叢集聚合區域之蛋白質結晶調控
26. Hiroshi Masuhara, 2016.04 ~ 2017.03, MOST
    Title: 雷射捕陷與雷射燒蝕誘發類澱粉蛋白之纖維化
27. Teruki Sugiyama, 2017.08 ~ 2018.07, MOST
    Title: 藉由雷射捕陷技術控制結晶之對映現象(1/2)
28. Hiroshi Masuhara, 2017.08 ~ 2018.07, MOST

Title: 雷射捕陷與雷射燒蝕誘發類澱粉蛋白之纖維化

29. Tetsuhiro Kudo, 2017.10 ~ 2019.07, MOST
Title: 光傳遞及光散射促成之光捕陷誘發聚集

Academic Exchange Activity

Collaborative Publication with Taiwanese Professors

LANGMUIR

Article

pubs.acs.org/Langmuir

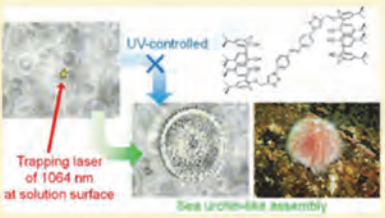
Photocontrolled Supramolecular Assembling of Azobenzene-Based Biscalix[4]arenes upon Starting and Stopping Laser Trapping

Ken-ichi Yuyama,† Lionel Marcelis, Pei-Mei Su, Wen-Sheng Chung,* and Hiroshi Masuhara*

Department of Applied Chemistry and Institute of Molecular Science, National Chiao Tung University, Hsinchu 30010, Taiwan

Supporting Information

ABSTRACT: Laser trapping in chemistry covers various studies ranging from single molecules, nanoparticles, and quantum dots to crystallization and liquid−liquid phase separation of amino acids. In this work, a supramolecular assembly of azobenzene-based biscalix[4]arene is generated in ethyl acetate using laser trapping; its nucleation and growth are elucidated. No trapping behavior was observed when a 1064 nm laser beam was focused inside of the solution; however, interesting assembling phenomena were induced when it was shined at the air/solution interface. A single disk having two layers was first prepared at the focal point of ~1 μm and then expanded to the size of a few tens of micrometers, although no optical force was exerted outside of the focal volume. Upon switching the trapping laser off, needles were generated at the outer layer of the assembly, giving a stable sea urchin-like morphology to the generated assembly. At a 30−50% dilution of the initial solution in ethyl acetate, a mushroom-like morphology was also observed. Laser trapping-induced assembly of azobenzene-based biscalix[4]arene was quite different from the sharp-ellipsoidal aggregates obtained by the spontaneous evaporation of the solution. These trapping phenomena were specifically observed for biscalix[4]arene in the *trans* conformation of azo-benzene moiety but not for the *cis*-form, suggesting that the laser trapping of this azobenzene-based biscalix[4]arene is photocontrollable. Dynamics and mechanism of the supramolecular assembling are considered, referring to laser trapping-induced nucleation and liquid−liquid phase separation of amino acids.



Langmuir, 2017, 33, 755-763

RSC Advances

PAPER

View Article Online
View Journal | View Issue

Cite this: RSC Adv., 2017, 7, 42606

Enhanced optical confinement of dielectric nanoparticles by two-photon resonance transition†

Aungtinee Kittiravechote, Anwar Usman,‡ Hiroshi Masuhara* and Ian Liau *

Despite a tremendous success in the optical manipulation of microscopic particles, it remains a challenge to manipulate nanoparticles especially as the polarizability of the particles is small. With a picosecond-pulsed near-infrared laser, we demonstrated recently that the confinement of dye-doped polystyrene nanobeads is significantly enhanced relative to bare nanobeads of the same dimension. We attributed the enhancement to an additional term of the refractive index, which results from two-photon resonance between the dopant and the optical field. The optical confinement is profoundly enhanced as the half-wavelength of the laser falls either on the red side, or slightly away from the blue side, of the absorption band of the dopant. In contrast, the ability to confine the nanobeads is significantly diminished as the half-wavelength of the laser locates either at the peak, or on the blue side, of the absorption band. We suggest that the dispersively shaped polarizability of the dopant near the resonance is responsible to the distinctive spectral dependence of the optical confinement of nanobeads. This work advances our understanding of the underlying mechanism of the enhanced optical confinement of doped nanoparticles with a near-infrared pulsed laser, and might facilitate future research that benefits from effective sorting of selected nanoparticles beyond the limitations of previous approaches.

Received 30th May 2017
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DOI: 10.1039/c7ra06031a

rsc.li/rsc-advances

Journal of Materials Chemistry C

PAPER

View Article Online
View Journal | View Issue

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Highly-integrated, laser manipulable aqueous metal carbonyl vesicles (MCsomes) with aggregation-induced emission (AIE) and aggregation-enhanced IR absorption (AEIRA)†

Nimer Murshid,[a] Ken-ichi Yuyama,[b] San-Lien Wu,[c] Kuan-Yi Wu,[c] Hiroshi Masuhara,[b] Chien-Lung Wang[c] and Xiaosong Wang*[a]

A highly-integrated, laser manipulable multi-functional metal carbonyl nanovesicle (MCsome) with aggregation-induced emission (AIE) and aggregation-enhanced IR absorption (AEIRA) is created via the self-assembly of a bithiophene tethered-Fp acyl derivative (Fp: $CpFe(CO)_2$) (**1**). Although **1** is hydrophobic and non-surface-active, the molecule can self-assemble in water into vesicles without detectable critical aggregation concentration (CAC). The water–carbonyl interaction (WCI) is responsible for the colloidal stability. The bilayer membrane structure with the bithiophene moieties associated within the inner wall and the iron-carbonyl units exposed to water is confirmed by transmission electron microscopy (TEM), atomic force microscopy (AFM), and cyclic voltammetry (CV) experiments. The synchrotron small-angle X-ray scattering (SAXS) experiment suggests that the bithiophene groups are interdigitated within the membrane. The spatial segregation of the AIE-active bithiophene domain from the iron-carbonyl units by the butanoyl spacers prevents the quenching effect of the iron and renders the MCsome photoluminescent. The polarizable iron-carbonyl groups on the surface of the MCsome create an enhanced optical field upon infrared (IR) irradiation, resulting in an enhancement (ca. 100-fold) in IR absorption for the carbonyl groups as compared to the same concentration of molecule **1** in THF. When the MCsome interacts with a focused continuous-wave near-IR (NIR) laser beam, a strong gradient (trapping) force is generated allowing the laser trapping of the MCsome without using additives. A sharp contrast in the refractive index (RI) of **1** (RI = 1.71) with water (RI = 1.33) accounts for this laser manipulability that is difficult to be achieved for nanosized liposomes (RI = 1.46). As illustrated, the MCsome of **1** represents a novel group of vesicular colloids, which is amenable to functional materials complementary to extensively studied liposomes and polymersomes.

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Review

In situ patterning and controlling living cells by utilizing femtosecond laser

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Cell-cell interaction
Cell migration

ABSTRACT

Photo-induced processes have high potential in *in situ* patterning and controlling living cells, whose developments are introduced and recent progresses by utilizing femtosecond laser are described. Photochemical and photothermal surface modification performed by conventional light and nanosecond laser irradiation is summarized and their applicability is considered. Femtosecond laser ablation has superior features due to its photomechanical mechanism, which is confirmed by ultrafast spectroscopy and imaging of a model film under laser ablation. Femtosecond laser ablation of physiological solutions generates shockwave and cavitation bubbles, which is employed for patterning and manipulating living cells. Femtosecond laser ablation fabricating cytophobic and cytophilic domains enable us to form living cell patterns and to study cell migration and cell–cell interaction. Finally summary and perspective are presented.

Enhanced optical confinement of dye-doped dielectric nanoparticles using a picosecond-pulsed near-infrared laser

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Abstract

We demonstrate a novel strategy to increase the capability of confining numerous dye-doped polymeric nanobeads (diameter 100 nm) with laser trapping. Unlike most classical works of optical trapping that address mainly the stiffness of the optical trap, our work concerns an increase in the number of particles confined near the laser focus. We developed an imaging system of light scattering in which a condenser lamp was employed to illuminate the focal plane of the objective lens, and the scattering of the incoherent light was specifically measured to determine the number of confined nanobeads. In contrast to preceding work that used mainly continuous-wave or femtosecond-pulsed lasers, we employed a picosecond-pulsed laser with the half-wavelength of the laser particularly falling within the absorption band of the dopant. Our results show that the number of doped nanobeads held by the laser is significantly greater than that of the bare nanobeads of the same dimension. In striking contrast, the confinement of the nanobeads of the two types was comparable when a continuous-wave laser of the same wavelength and power was employed. The number of confined dye-doped nanobeads increased nonlinearly with the power of the pulsed laser; this dependence was fitted satisfactorily with a second-order polynomial. Supported by theoretical analysis, we attribute the enhanced confinement of doped nanobeads in part to an increased effective refractive index resulting from two-photon resonance between the optical field of the laser and the dopant of the nanobead. We envisage that our findings would evoke applications that benefit from controlled confinement or aggregation of nanomaterials with the employment of near-infrared pulsed lasers.

Laser Phys. Lett., 2014, 11, 076001

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Metabolic variation of HeLa cells migrating on microfabricated cytophilic channels studied by the fluorescence lifetime of NADH†

Gitanjal Deka,‡[a] Kazunori Okano,‡*[b] Hiroshi Masuhara,[c] Yaw-Kuen Li[c] and Fu-Jen Kao*[a]

We report a novel method for studying cellular migration *in vitro*. Cytophilic microdomains were formed on a cytophobic substrate by laser ablation. HeLa cells were grown on those domains until confluence, and then channels were formed to guide cellular migration. Two-photon excitation fluorescence-lifetime imaging of NADH revealed metabolic variation among migrating and nonmigrating cells.

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Single femtosecond laser pulse-single crystal formation of glycine at the solution surface

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[b] Graduate School of Materials Science, Nara Institute of Science and Technology, Ikoma, Nara 630-0192, Japan
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A1. Single crystal
A1. Femtosecond laser
B1. Glycine

ABSTRACT

We demonstrate femtosecond laser-induced crystallization of glycine from its supersaturated solution depending on laser tunable parameters (pulse energy and repetition rate) and focal position, and examine the crystallization probability, crystal morphology, and crystal polymorph. The generation of cavitation bubble through multiphoton absorption of water depends on input laser pulse energy and repetition rate, which strongly determine morphology and number of the obtained crystals. Significant increase in the crystallization probability is observed by irradiating the femtosecond laser pulses to the air/solution interface, and single pulse-induced single crystal formation is successfully achieved. The crystallization mechanism is discussed in view of inhomogeneous mechanical stress induced by cavitation bubble generation and molecular assembly characteristics of the surface.

Lab on a Chip

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PAPER

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In situ laser micropatterning of proteins for dynamically arranging living cells

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Kazunori Okano,*[abcde] Ai Matsui,[b] Yasuyo Maezawa,[b] Ping-Yu Hee,[f] Mie Matsubara,[b] Hideaki Yamamoto,[g] Yoichiroh Hosokawa,[b] Hiroshi Tsubokawa,[d] Yaw-Kuen Li,[f] Fu-Jen Kao*[c] and Hiroshi Masuhara*[f]

This study shows the modification of the surface of polymer-layered glass substrates to form biofunctional micropatterns through femtosecond laser ablation in an aqueous solution. Domains of micrometer size on a substrate can be selectively converted from proteinphobic (resistant to protein adsorption) to proteinphilic, allowing patterning of protein features under physiological aqueous conditions. When femtosecond laser pulses (800 nm, 1 kHz, 200–500 nJ per pulse) were focused on and scanned on the substrate, which was glass covered with the proteinphobic polymer 2-methacryloyloxyethylphosphorylcholine (MPC), the surface became proteinphilic. Surface analysis by X-ray photoelectron spectroscopy (XPS) and scanning electron microscopy (SEM) reveals that the laser ablates the MPC polymer. Extracellular matrix (ECM) proteins were bound to the laser-ablated surface by physisorption. Since femtosecond laser ablation is induced under physiological aqueous conditions, this approach can form micropatterns of functional ECM proteins with minimal damage. This method was applied to pattern collagen, laminin, and gelatin on the substrate. Removal of an ECM protein from the substrate followed by replacement with another ECM protein was achieved on demand at a specific location and time by the same laser ablation method. Living cells adhered to the fabricated domains where ECM proteins were arranged. The modification of patterning during cell culture was used to control cell migration and form arrays of different cells.

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ChemBioChem **2011**, *12*, 795 – 801

FULL PAPERS

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Induction of Cell–Cell Connections by Using in situ Laser Lithography on a Perfluoroalkyl-Coated Cultivation Platform

Kazunori Okano,*[a, b] David Yu,[c] Ai Matsui,[a] Yasuyo Maezawa,[a] Yoichiroh Hosokawa,[a] Atsushi Kira,[d] Mie Matsubara,[a] Ian Liau,[c] Hiroshi Tsubokawa,[b] and Hiroshi Masuhara[a, c]

This article describes a novel laser-directed microfabrication method carried out in aqueous solution for the organization of cell networks on a platform. A femtosecond (fs) laser was applied to a platform culturing PC12, HeLa, or normal human astrocyte (NHA) cells to manipulate them and to facilitate mutual connections. By applying an fs-laser-induced impulsive force, cells were detached from their original location on the plate, and translocated onto microfabricated cell-adhesive domains that were surrounded with a cell-repellent perfluoroalkyl (R_f) polymer. Then the fs-laser pulse-train was applied to the R_f polymer surface to modify the cell-repellent surface, and to make cell-adhesive channels of several μm in width between each cell-adhesive domain. PC12 cells elongated along the channels and made contact with others cells. HeLa and NHA cells also migrated along the channels and connected to the other cells. Surface analysis by X-ray photoelectron spectroscopy (XPS) and atomic force microscopy (AFM) confirmed that the R_f polymer was partially decomposed. The method presented here could contribute not only to the study of developing networks of neuronal, glial, and capillary cells, but also to the quantitative analysis of nerve function.

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Applied Physics A
Materials Science & Processin

Local stimulation of cultured myocyte cells by femtosecond laser-induced stress wave

Yung-En Kuo · Cheng-Chi Wu · Yoichiroh Hosokawa · Yasuyo Maezawa · Kazunori Okano · Hiroshi Masuhara · Fu-Jen Kao

Received: 22 November 2009 / Accepted: 15 June 2010 / Published online: 17 July 2010

Abstract When an 800 nm femtosecond laser is tightly focused into cell culture medium a stress wave is generated at the laser focal point. Since the stress wave localizes in a few tens of μm, it is possible to locally stimulate single cells in vitro. In this work, several kinds of cultured mammalian cells, HeLa, PC12, P19CL6, and C2C12, were stimulated by the stress wave and the cell growth after the stress loading with the laser irradiation was investigated. In comparison with the control conditions, cell growth after the laser irradiation was enhanced for the cells of C2C12 and P19CL6, which can differentiate into myocytes, and suppressed for PC12 and HeLa cell lines. These results suggest a possibility of cell growth enhancement due to myogenic cells response to the femtosecond laser-induced stress.

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1. Title: 雷射結晶化日台共同研究補助金
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Promotion of PhD Student to Professor in Japanese University

Tsung-Han Liu (李宗翰) will be promoted as Assistant Professor of Kwansei Gakuin University in Japan on April 1, 2018. He was a PhD student, got PhD degree on August 2017, and now is working in Osaka University as a postdoctoral fellow.

Dual Degree Program Students

1.	Shinpei Nishimura 西村晋平	(Saitama University - NCTU)	2012.08-2015.09
2.	Kazuki Okano 岡野和希	(Saitama University - NCTU)	2017.10-2018.03
3.	Chiang Wei.-Yi. 江威逸	(NCTU - Katholieke Universiteit Leuven)	2014.09-2017.11
4.	Chi-Shuen Wu 吳奇勳	(NCTU - Saitama University)	2016.10-2017.09

JSPS Overseas Research Fellows

1.	Masayasu Muramatsu	村松正康	2012.04-2013.03
2.	Tetsuhiro Kudo	工藤哲弘	2014.04-2016.03
3.	Morihiko Hamada	濱田守彦	2015.04-2016.03
4.	Yugo Hayashi	林有吾	2015.06-2015.08 2016.02-2016.03

Japanese Students Studying with Us

(1)	Sho Fujii (Chuo University)	2010.01.24-2010.02.11
(2)	Sho Fujii (Chuo University)	2010.08.14-2010.09.04

(3) Hayato Inoue (Chuo University) 2010.07.01-2010.08.25
(4) Hayato Inoue (Chuo University) 2011.01.16-2011.01.20
(5) Jino George (National Institute for Interdisciplinary and Technology, Trivandrum, India) 2011.10.15-2011.12.14
(6) Daiki Kimura (Saitama University) 2012.08.21-2012.11.28
(7) Shimpei Nishimura (Saitama University) 2012.08.21-2012.11.28
(8) Shimpei Nishimura (Saitama University) 2012.12.25-2013.02.23
(9) Shimpei Nishimura (Saitama University) 2013.06.20-2013.09.16
(10) Shimpei Nishimura (Saitama University) 2013.11.11-2014.01.25
(11) Shimpei Nishimura (Saitama University) 2014.02.11-2015.09.30
(12) Tetsuhiro Kudo (Osaka Prefecture University) 2012.11.09-2013.02.01
(13) Tetsuhiro Kudo (Osaka Prefecture University) 2013.09.06-2013.11.08
(14) Mizuki Sato (Yamagata University) 2014.08.01-2014.09.30
(15) Fuyuto Takahashi (Chiba University) 2014.12.15-2015.01.05
(16) Wakana Nishiyama (Yamagata University) 2015.08.01-2015.09.30
(17) Ryo Kihara (Ehime University) 2015.11.02-2015.11.30
(18) Jun Hyung Lee (Chiba University) 2015.12.01-2016.01.31
(19) Kazuki Okano (Saitama University) 2016.10.14-2016.12.13
(20) Daiki Suzuki (Saitama University) 2016.10.14-2016.12.13
(21) Masamichi Nisogi (Ehime University) 2016.11.05-2016.12.06
(22) Keisuke Masuda (Ehime University) 2016.11.05-2016.12.06
(23) Takuya Takeshige (Saitama University) 2017.11.01-2018.01.09
(24) Keisuke Meguriya (Saitama University) 2017.11.01-2018.01.09
(25) Taisei Himeda (Ehime University) 2017.11.06-2017.12.10
(26) Hiroki Omoda (Ehime University) 2017.11.06-2017.12.10
(27) Kazuki Okano (Saitama University) 2017.09.09-2018.01.31

Our Students Studying Abroad

(1) Wei-Yi Chiang at KU Leuven, Belgium 2014.09.01-2015.08.31
(2) Wei-Yi Chiang at KU Leuven, Belgium 2016.10.20-2017.09.28
(3) Tsung-Han Liu at Osaka University, Japan 2014.04.02-2014.08.29
(4) Tsung-Han Liu at Osaka University, Japan 2014.11.03-2014.12.09
(5) Tsung-Han Liu at Osaka University, Japan 2015.11.30-2016.06.30

(6) Po-Jen Chen at Hokkaido University, Japan
2014.07.12-2015.05.31
(7) Ting-Wen Chien at Hokkaido University, Japan
2014.07.12-2015.05.31
(8) Ding-Shiang Chiu at Hokkaido University, Japan
2016.03.27-2016.09.20
(9) Chi-Shiun Wu at Saitama University, Japan
2016.10.01-2017.09.08
(10) Yen-En Liu at Hokkaido University, Japan 2016.03.31-2016.08.12
(11) Yi-Ju Wu at Ehime University, Japan 2017.07.31-2017.09.01

Organizing Summer Course and Workshop on Single Molecule/nanoparticle Spectroscopy and Imaging

(1) The International Summer Course and Workshop (June 2012, NCTU); 76 participants
Lecturers: Johan Hofkens (KU Leuven, Belgium)
Tamai Naoto (Kwansei Gakuin University, Japan)
Organizing Committee: Yun-Wei Chiang (NTHU), Hiro-o Hamaguchi (NCTU), Hsin-Yun Hsu (NCTU), Kuo-Chu Hwang (NTHU), Jih-Ru Hwu (NTHU), Yaw-Kuen Li (NCTU), Atsushi Miura (NCTU), Jeng-Tzeng Sheu (NCTU), Shinsuke Shigeto (NCTU), Pawel Urban (NCTU), Tung-Kung Wu (NCTU)
(2) The 2nd International Summer Course and Workshop (June 2013, NCTU); 82 participants
Lecturers: Hiroaki Misawa (Hokkaido University, Japan)
Tatsuya Tsukuda (University of Tokyo, Japan)
Christy Landes (Rice University, U.S.A.)
Stephan Link (Rice University, U.S.A.)
Organizing Committee: Yu-Chie Chen (NCTU), Yun-Wei Chiang (NTHU), Hiro-o Hamaguchi (NCTU), Hsin-Yun Hsu (NCTU), Jer-Shing Huang (NTHU), Jih-Ru Hwu (NTHU), Kuo-Chu Hwang (NTHU), Yaw-Kuen Li (NCTU), Cheng-An J. Lin (CYCU), Atsushi Miura (NCTU), Jeng-Tzeng Sheu (NCTU), Shinsuke Shigeto (NCTU), Pawel Urban (NCTU), Tung-Kung Wu (NCTU)
(3) The 3nd International Summer Course and Workshop (June 2014, NCTU); 107 participants

Lecturers: Steven De Feyter (KU Leuven, Belgium)
Mizuo Maeda (RIKEN Institute, Japan)
Tomoji Kawai (Osaka University, Japan)
Organizing Committee: Yun-Wei Chiang (NTHU), Hiro-o Hamaguchi (NCTU), Hsin-Yun Hsu (NCTU), Kuo-Chu Hwang (NTHU), Jih-Ru Hwu (NTHU), Yaw-Kuen Li (NCTU), Jeng-Tzeng Sheu (NCTU), Shinsuke Shigeto (NCTU), Pawel Urban (NCTU), Tung-Kung Wu (NCTU), Cheng-An J. Lin (CYCU), Jer-Shing Huang (NTHU), Yu-Chie Chen (NCTU)

(4) The 4th Hsinchu Summer Course and Workshop (June 2015, NCTU); 125 participants
Lecturers: Hitoshi Tamiaki (Ritsumeikan University, Japan)
Haruo Inoue (Tokyo Metropolitan University, Japan)
Keisuke Goda (University of Tokyo, Japan)
Takeharu Nagai (Osaka University, Japan)
Local Organizing Committee: Jiun-Tai Chen, Yen-Ju Cheng, Hsin-Yun Hsu, Ian Liau (Co-Chair), Hiroshi Masuhara (Co-Chair) (NCTU)
Organizing Committee: Yu-Chie Chen, Eric Diau, Hiro-o Hamaguchi, Jeng-Tzong Sheu, Pawel Urban, Tung-Kung Wu (NCTU)
Yun-Wei Chiang, Jer-Shing Huang, Kuo-Chu Hwang, Jih-Ru Hwu (NTHU)
Honorary Organizing Committee
Chain-Shu Hsu, Yuan-Pern Lee, Yaw-Kuen Li(NCTU)

(5) The 5th Hsinchu Summer Course and Workshop (June 2016, NCTU); 176 participants
Lecturers: Martin Vach (Tokyo Institute of Technology, Japan)
Chihaya Adachi (Kyushu University, Japan)
Tsutomu Miyasaka (Toin University of Yokohama, Japan)
Junji Kido (Yamagata University, Japan)
Hiroaki Misawa (Hokkaido University, Japan)
Local Organizing Committee: Jiun-Tai Chen, Yen-Ju Cheng, Hsin-Yun Hsu, Ian Liau (Co-Chair), Hiroshi Masuhara (Co-Chair), Teruki Sugiyama (NCTU)
Organizing Committee: Teng-Ming Steve Chen, Eric Diau, Kien-Wen Sun, Chien-Lung Wang (NCTU)
Chien-Tien Chen, Chien-Hong Cheng, Yun Chi (NTHU)
Honorary Organizing Committee: Chain-Shu Hsu, Yuan-Pern Lee, Yaw-Kuen Li (NCTU)

(6) The 6th Hsinchu Summer Course and Workshop (June 2017, NCTU); 157 participants
(Co-organized by JSPS Grants-in-Aid for Scientific Research "Nano-Material Manipulation and Structural Order Control with Optical Forces")
Lecturers: Hajime Ishihara (Osaka University, Japan) “Optical properties and manipulation of nanomaterials”
Seiji Akita (Osaka Prefecture University) “Electronic and mechanical properties of nanomaterials”
Yasuyuki Tsuboi (Osaka City University) “Fabrication and manipulation of bio-molecular and polymer nanomaterials”
Maarten Roeffaers (KU Leuven): “Imaging and chemical properties of nanomaterials”
Tsukasa Torimoto (Nagoya Univesity) “Fabrication and functionalization of metal and semiconductor nanomaterials”
Organizing Committee: Jiun-Tai CHhen, Yen-Ju Cheng, Li-Kang Chu, Hsin-Yun Hsu, Hajime Ishihara, Ian Liau, Hiroshi Masuhara, Takashige Omatsu, Chi-How Peng, Keiji Sasaki, Teruki Sugiyama, Chien-Lung Wang
Honorary Organizing Committee: Kikuo Cho, Chain-Shu Hsu, Tadashi Ito, Yuan-Pern Lee, Yaw-Kuen Li

Masuhara School (增原塾) at NCTU

(1) (July 2, 2017, NCTU)；Japanese graduate students who belong to laboratories supervised by the members of JSPS Grant-in-Aid Project on “Nano-Material Optical-Manipulation”; 24 participants

(2) (March 26, 2018, NCTU)；Professors, undergraduate students, and high school students who belong to “High-grade Global Education Program for Sciences (HiGEPS)” organized by Saitama University; 20 participants

Super Science High School Students Visiting Us

(1) Osaka Takatsuki High School, 97 students, 2016.11.16
(2) Oita Maitsuru High School, 20 students, 2016.12.15
(3) Osaka Takatsuki High School, 86 students, 2017.11.17
(4) Oita Maitsuru High School, 25 students, 2017.12.26

HiGEPS (High-grade Global Education Program for Sciences) Visiting Us

(1) Saitama University and High schools in Saitama prefecture,
4 professors, 4 undergraduate students, 4 high school students
2018.03.26

Professors we invited to Department Seminar of Applied Chemistry

(1) Yasuyuki Tsuboi (Hokkaido University)
"Laser and Plasmonic Photochemistry", October 2011

(2) Tsuyoshi Asahi (Ehime University)
"Organic Nanoparticle Colloids: Preparation, Optical Potential Applications", October 2011

(3) Yasuhisa Mizutani (Osaka University)
"Watching Ultrafast Protein Dynamics by Time-Resolved Visible and Ultraviolet Resonance Raman Spectroscopy", October 2011

(4) Kirsch-De Mesmaeker (Free University of Brussels)
"From Mononuclear to Polynuclear Complexes Assembling with Bridging Ligands or Derivatized Oligonucleotides", November 2011

(5) Shun Hirota (NAIST)
"Investigation and Regulation of Protein and Peptide Structural Changes", December 2011

(6) Takashi Fuyuki (NAIST)
"Recent Progress in High Efficiency Crystalline Si Solar Cells"
April 2012

(7) Hiroshi Daimon (NAIST)
"Three-Dimensional Measurement of Orbital Angular Momentum, Orbital Symmetry, and Atomic Structure Using Synchrotron Radiation Two-Dimensional Photoelectron Spectroscopy", April 2012

(8) Haruo Inoue (Tokyo Metropolitan University)
"How Can We Get through The Bottleneck of The Artificial Photosynthesis?", May 2012

(9) Jun-ichi Kikuchi (NAIST)
"Cerasomes as a Bioinspired Organic-Inorganic Hybrid Nanomaterial", May 2012

(10) Maki Kawai (The University of Tokyo)
"Single Molecule Level Spectroscopy of Molecules at Surfaces", October 2012

(11) Kei Murakoshi (Hokkaido University)
"Selection-Rule Breakdown at Plasmon-Assisted Electronic Excitation of A Single Molecule at Metal Nano-Gap", December 2012

(12) Isao Azumaya (Tokushima Bunri University)
"Spontaneous Resolution of Achiral Organic Compounds" December 2012
(13) Noboru Kitamura (Hokkaido University)
"Spectroscopic and Photophysical Characteristics of Organoboranes and Their Transition Metal Complexes", December 2012
(14) Hideko Koshima (Ehime University)
"Solid-state Photochemistry: From Photoreactions to mechanical Crystal Machinery", April 2013
(15) Hiroshi Fukumura (Tohoku University)
"Laser-Induced Phase Separation of Binary Solvents: Its Fundamentals and Application to Photochemistry", May 2013
(16) Seiichiro Nakabayashi (Saitama University)
"Hydrogen Nano-Bubble at Normal Hydrogen Electrode", May 2013
(17) Kazuhiko Mizuno (NAIST)
"Photochemical Behavior of Inter-and Intramolecular Exciplexes" May 2013
(18) Michiya Fujiki (NAIST)
"Mirror Symmetry Breaking and Restoration from Optically Inactive polymer Particles in Suspension by Solvent Chirality Transfer and/or by Pumping Circularly Polarized Light: Inspired from Oparin's Coacervate Hypothesis", May 2013
(19) Arthur Chiou (National Yang Ming University)
"Optical Tweezers Based Bio-Micro-Rheology", October 2013
(20) Shun Hirota (NAIST)
"Assembling and function of cytochrome c", October 2013
(21) Hiroyuki Sugimura (Kyoto University)
"Nanofabrication of Surface Materials", October 2013
(22) Hiroyuki Yoshikawa (Osaka University)
"Plasmonic Nanoparticle Manipulation and Biosensing with Focused Laser Beams", November 2013
(23) Hikaru Kobayashi (Osaka University)
"New Chemical Methods for Improvement of Crystalline Si Solar Characteristics", December 2013
(24) Kazushi Miki (National Institute for Materials Science)
"Metal Nanoparticles 2D Array for Chemical Reactor and Bio Sensor", April 2014

(25) Toru Nakano (Osaka University, Dean of Graduate School of Frontier Bioscience)
"Introduction to Epigenetics", October 2014
(26) Jun-ichi Hotta (Yamagata University)
"Super-Resolution Fluorescence Microscopy and its Application on Diatoms", December 2014
(27) Hiroaki Misawa (Hokkaido University)
"Frontier in Plasmonic Chemistry", December 2014
(28) Koichi Kato (Okazaki Institute for Integrative Bioscience & Institute for Molecular Science)
"Biophysical Exploration of Biomolecular Systems Characterized by Conformational Dynamics and Dynamical Assembly", December 2014
(29) Yasuhiro Iwasawa (The University of Electro-Communications)
"Intriguing Insights into How Catalysts Behave in Automobile Fuel Cells by Time- and Spatially-Resolved XAFS Techniques", December 2014
(30) Yoshihisa Inoue (Osaka University)
"Photochirogenesis in Molecular, Supramolecular and Biomolecular Regimes", March 2015
(31) Kizashi Yamaguchi (Osaka University)
"Theoretical Studies of Native and Artificial Catalysts for Water Oxidation by the X-ray Free Electron Laser", May 2015.
(32) Takanori Fukushima (Tokyo Institute of Technology)
"Design of Functional Soft Materials Based on the Concept of "π-Figuration", May 2015.
(33) Junji Nishii (Hokkaido University)
"Periodic Structured Devices for Optical Imaging and Plasmon-enhanced Fluorescence Microscopy", September 2015
(34) Kazue Kurihara (Tohoku University)
"Surface Forces Measurement: Fundamentals and Recent Development", October 2015
(35) Gen Sazaki (Hokkaido University)
"Surface Melting of Ice Crystals Revealed by Advanced Optical Microscopy", October 2015
(36) Yasuyuki Tsuboi (Osaka City University)
"Plasmon-induced-Breakthrough in Photochemistry: Reaction, Processing, and Manipulation", November 2015

(37) Keiji Sasaki (Hokkaido University)
"Photon Nanoshaping and Its Application to Photochemistry" April 2016
(38) Hiromi Okamoto (Institute for Molecular Science)
"Micro- and Nano-scopic Optical Activity Measurements", May 2016
(39) Nobuo Kimizuka (Kyushu University)
"Molecular Self-assembly for Photon Upconversion", May 2016
(40) Jiro Abe (Aoyama Gakuin University)
"Fundamentals and Applications of Fast Photoswitch Molecules" May 2016
(41) Atsushi Takahara (Kyushu University)
"Design of (Organic Material/Natural Inorganic Nanotube) Assemblies through Precise Interfacial Structure Control", October 2016
(42) Vasudevan Pillai Biju (Hokkaido University)
"Impeding Oxidation and Blinking in Single Semiconductor Quantum Dots", November 2016
(43) Hiroyuki Sugimura (Kyoto University)
"Chemistry and Photochemistry of Graphene Oxide", December 2016
(44) Hiroaki Misawa (Hokkaido University)
"Plasmon Coupling in Photochemistry", February 2017
(45) Satoshi Nishimura (Jichi Medical University)
"Living animal imaging methods for biological research using handmade one/two photon fluorescence microscope", March 2017
(46) Tadashi Sugawara (Kanagawa University, Emeritus of The University of Tokyo)
"Construction of Giant Vesicle-based Model Protocells", October 2017
(47) Susumu Uchiyama (Osaka University)
"Biophysical Characterizations of Biopharmaceuticals", December 2017
(48) Ryota Iino (Institute for Molecular Science)
"High-speed Single-molecule Imaging Analysis of Protein Molecular Motors Probed by Gold Nanoprobes", December 2017

Professors we invited to Laboratory Seminar

(1) Shoji Ito (Osaka University)
"Evaluation of Nanoscale Heterogeneity in Thin Film Materials with Wide-Field Single Molecule Fluorescence Microscopy" 2009.04.29

(2) Takahiro Kaji (Osaka University)
"Conformational Fluctuation of DNA Chains on Time Scales from ns to ms Revealed by Single-Molecule Photon Statistics" 2009.04.29

(3) Hiroyuki Sugimura (Kyoto University)
"VUV Microfabrication-Photopatterning of Organic Materials Using Vacuum Ultra-Violet Light" 2009.04.29

(4) Mitsuru Ishikawa (AIST)
"Enhancement of fluorescence detection using one-dimensional photonic crystal structures" 2009.10.13

(5) Vasudevan Pillai Biju (AIST)
"Bioconjugated quantum dots for probing biophysical dynamics in living cells" 2009.10.13

(6) Tamitake Itoh (AIST)
2009.10.13

(7) Masaaki Haga (Chuo University)
"Manipulation and immobilization of single DNA and nanoparticles at laser focal point on Au surface and its application" 2010.01.25

(8) Michel Sliwa (University de Lillel, France)
"Chemometric Analysis of Ultrafast Transient Absorption Spectroscopy Data: Characterization of The Ultrafast Photodynamics of Photochromic Reactions" 2010.08.19

(9) Kenji Katayama (Chuo University)
"A New Transient Grating Technique and Its Application for Photochemical Reaction Dynamics Measurement" 2011.01.13 ~ 2011.01.16

(10) Hitoshi Watarai (Osaka University)
"Novel Application of Magnetic Fields in Micro-Analytical Chemistry" 2011.03.07

(11) Minoru Kato (Ritsumeikan University)
"Understanding of Pressure Denaturation of Proteins: An Approach from Model Peptides" 2011.07.08

(12) Hiroshi Miyasaka (Osaka University)
"Multiphoton-gated Photochromic Reaction in Diarylethene and Fulgide Derivatives" 2011.11.16
(13) Masaaki Ashida (Osaka University)
"Optical Manipulation of Semiconductor Nanoparticles Using Resonant Radiation Force" 2012.04.06
(14) Hajime Ishihara (Osaka Prefecture University)
"Challenge for Resonant Optical Manipulation of Nanostructures" 2012.04.06
(15) Hirofumi Tanaka (Osaka University)
"Electronic Measurement in Nanoscale: Nanoparticle on Nanocarbon Systems" 2012.04.16
(16) Dong-Hee Son (Texas A&M University)
"Energy Transfer and Charge Carrier Transfer Dynamics in Mn-doped Semiconductor Nanocrystals" 2012.05.21
(17) Keitaro Yoshihara (Emeritus professor of Institute for Molecular Science)
"Reminiscence of a Molecular Scientist: Some Words for Young Researchers" 2012.05.28
(18) Yukiteru Katsumoto (Hiroshima University)
"Molecular Picture of the Thermo-Responsive Polymers" 2012.08.06
(19) Hideko Koshima (Ehime University)
"Solid-state Photochemistry: from Photoreactions to Mechanical Crystal Machinery" 2012.08.21 ~ 2012.08.25
(20) Yu Nabetani (Tokyo Metropolitan University)
"Photochemistry of Molecular Assembly Coupled with Surrounding Microenvironment" 2012.08.22
(21) Hiroshi Yoshikawa (Saitama University)
"Bio-applications of Ultrafast Laser Pulses to Protein Crystallization and Cell Adhesion Strength Measurement" 2012.08.22
(22) A.M. Brouwer (University of Amsterdam)
"Fluorescence Microscopy in Materials Science" 2012.09.06
(23) Tohru Yoshioka (Kaohsiung Medical University)
"Significance of Proton Signaling in the Living Cell" 2012.09.19
(24) Masahiro Kitajima (National Defense Academy of Japan)
"Coherent Phonons and Application to The Study of SERS Dynamics" 2012.10.02

(25) Travor Smith (University of Melbourne)
"Microscopy with High Spatial and Temporal Resolution" 2012.10.02
(26) Atsushi Nakajima (Keio University)
"Electronic Properties of Binary Super Atom Clusters and Their Assembly" 2012.10.03
(27) Tadaaki Ikoma (Niigata University)
"Photocarrier Dynamics in Organic Solar Cell Studied by Magnetic Field Effects" 2012.10.26
(28) Hiroyuki Takei (Toyo University)
"Cap-shaped Noble metal Particles Applied to Various Surface-enhanced Spectroscopic Technique" 2013.02.25
(29) Tomoaki Hinoue (Osaka University)
"Control of Self-assembly and Crystallization of Polymers by Inkjet Ssystem" 2013.03.22
(30) Elena Perevedentseva (National Dong Hwa University)
"Biomedical Applications of Nano Diamond" 2013.05.13
(31) Hiromasa Niinomi (Nagoya University)
"Emergence and Amplification of Chirality in Sodium Chlorate Chiral Crystallization from An Aqueous Solution" 2013.10.15
(32) Hiroshi Ikeda (Osaka Prefecture University)
"Spectroscopic and Exploratory Study of the Radical Cation Possessing One-Electron Sigma Bond" 2013.11.19
(33) Yasunori Matsui (Osaka Prefecture University)
"The Excited State C-C Bond Cleavage-Emission System Based on Methylenecyclopropanes" 2013.11.19
(34) Eisuke Ohta (Osaka Prefecture University)
"Synthesis of 2,2'-bis(diarylboryl)biphenyl and Theoretical Study on the One-Electron Sigma-Bonding Nature of Its Radical Anion" 2013.11.19
(35) Kuan-Lin Liu (Katholieke University Leuven)
"Light Microscope for Catalysis Study" 2013.12.27
(36) Eri Chatani (Kobe University)
"Exploring Early Association of Protein Molecules in the Amyloid Formation" 2014.01.20
(37) Shun Hirota (NAIST)
"Constructing Protein Supramolecules by Domain Swapping. Its Formation Mechanism and Effect on Cell Membranes" 2014.03.10

(38) Tetsu Yonezawa (Hokkaido University)
"Facile Preparation of Metel Nano/fine Particles for Electronics and Fluorescence" 2014.03.10
(39) Kei Murakoshi (Hokkaido University)
"Plasmon-induced Photoexcitation to Break a Selection Rule of Electronic Excitation" 2014.04.30
(40) Rachel Méallet-Renault (Department of Chemistry Ecole Normale Supérieure de Cachan, France)
"Fluorescent Organic Nanoparticles for Bioimaging" 2014.06.13
(41) Takashige Omatsu (Graduate School of Advanced Integration Science, Chiba University)
"Chiral Photonics－Helical Light Pioneer Chiral Materials Science-" 2014.06.23
(42) Hiroshi Yoshikawa (Saitama University)
"Quantitative Evaluation of Cell Adhesion by Advanced Optical Techniques" 2014.07.30
(43) Naritaka Kobayashi (Saitama University)
"Atomic-Scale Imaging at Solid/Liquid Interfaces by FM-AFM" 2014.07.30
(44) Satoshi Fujita (University of Fukui)
"Electrospun Nanofibers for Prevention of Cancer Recurrence" 2014.08.29
(45) Yu Nabetani (Tokyo Metropolitan University)
"Nanostructure and Photoreaction of Molecular Assemblies in Various Microenvironments" 2014.09.12
(46) Takayuki Uwada (Josai University)
"Spectroscopic Investigation and Crystallization of Photoluminescent Au Quantum Dots Encapsulated in Protein" 2014.11.03
(47) Hisashi Okumura (Research Center for Computational Science, Institute for Molecular Science, National Institutes of Natural Sciences, Okazaki, Japan)
"Molecular Dynamics Simulations for Dimerization and Disruption of Amyloid- fibril" 2014.11.26
(48) Fuyuto Takahashi (Chiba University)
"Chiral Structure Fabrication by Optical Vortex Processing" 2014.12.23

(49) Morihiko Hamada (Kagawa University, Japan)
"Photochemical Reaction of CdSe/ZnS Single Quantum Dots with Electron Acceptors and Donors" 2015.01.14 ~ 2015.01.16
(50) Shimpei Nishimura (NCTU/Saitama University)
"Laser Trapping Studies on Protein Crystallization: Research and Life in Taiwan as a First Student of Double Degree Program between National Chiao Tung University and Saitama Universtiy" 2015.02.11
(51) Yoshihiko Arita (School of Physics & Astronomy, University of St Andrews, UK)
"Let Nothing Slow You down: New Perspectives in Optical Manipulation" 2015.04.29 ~ 2015.05.02
(52) Yugo Hayashi (NAIST)
"Domain Swapping of Thermostable Cytochrome C" 2015.06.03
(53) Yoichiroh Hosokawa (NAIST)
"Experimental and Theoretical Analysis of Femtosecond Laser Impulse and Its Application for Plant Cell Physiology" 2015.06.16
(54) Fu Jen Kao (Institute of Biophotonics, National Yang-Ming University)
"Two-photon Microscopy with Stimulated Emission" 2015.06.16
(55) Wei Shun Chang (Department of Chemistry Rice University)
"Steady-state Absorption, Scattering and Time-resolved Transient Extinction Spectra of Single Plasmonic Nanoparticles" 2015.06.24
(56) Hiroaki Misawa (Hokkaido University)
"Gold nano-structures with large near field enhancement" 2015.08.12
(57) Hiroaki Misawa (Hokkaido University)
"Advanced Lithography Technology for Nano-fabrications" 2015.09.17
(58) Anwar Usman (Universiti Brunei Darussalam)
"Multiexciton Generation and Photoinduced Electron Transfer in Ag2S and PbS Quantum Dots ─Research and Life in Saudi Arabia and Brunei Darussalam─" 2015.09.17
(59) Hiroaki Misawa (Hokkaido University)
"Atomic Layer by layer Deposition Technology for Next Generation Electronics" 2015.09.21
(60) Hiroaki Misawa (Hokkaido University)
"Advanced Etching Technologies for Nano-fabricaitons" 2015.10.29

(61) Hiroaki Misawa (Hokkaido University)
"Essential Instruments for Measurement of Nano-structure and Nano-material" 2015.11.02

(62) Fuyuki Ito (Shinshu University)
"Fluorescence Visualization of Molecular Assembly Processes during Solvent Evaporation" 2015.11.16 ~ 104.11.18

(63) Hiroaki Misawa (Hokkaido University)
"Interaction between Plasmonic Metal Nanostructures and Molecules" 2015.11.23

(64) Hiroaki Misawa (Hokkaido University)
"Plasmon-assisted Energy Converstion Systems" 2015.11.26

(65) Hiroshi Yoshikawa (Saitama University)
"Control of Protein Crystal Growth by Femtosecond Laser Ablation" 2015.12.07

(66) Akihiro Furube (Institute of Technology and Science, Tokushima university)
"Ultrafast Spectroscopic Study on Exciton and Charge Transfer in Solar Energy Conversion Nanomaterials" 2016.03.07

(67) Shun Hirota (NAIST)
"Structure and Function of Proteins and Protein Complexes" 2016.03.29 ~ 2016.03.31

(68) Fumitaka Ishiwari (Institute of Innovative Research, Tokyo Institute of Technology, Japan)
"Bioinspired Design of a Ca^{2+} Sensor Using Polymer Chain Dynamics" 2016.05.16 ~ 2016.05.18

(69) Yasuteru Shigeta (Center for Computational Sciences, University of Tsukuba, Japan)
"Computational analyses on structures and photochemical properties of molecules" 2016.11.02

(70) Olivier Soppera (Institut de Science des Materiaux de Mulhouse CNRS UMR 7361, France)
"Unconventional Processes and Materials for Light-induced Micro-nanofabrication" 2016.11.30

(71) Shutaro Ishida (Hokkaido University)
"Nano-particle rotation using a plasmonic nano-structure" 2017.02.20

(72) Hiromasa Niinomi (Chiba University)
"Emergence and Amplification of Chirality in Sodium Chlorate Chiral Crystallization from an Aqueous Solution" 2017.04.25

(73) Hiromasa Niinomi (Chiba University)
"Enantioselective amplification in $NaClO_3$ chiral crystallization induced by circularly polarized laser trapping of plasmonic particles at air/solution enantioselective amplification in $NaClO_3$ chiral crystallization induced by circularly polarized laser" 2017.05.09
(74) Yoichiro Hosokawa (NAIST)
"Laser cell analysis and manipulation for future biotechnology" 2017.05.23
(75) Wei Shun Chang (Rice University)
"Spectro-electrochemical and ultrafast microscopies on single plasmonic nanostructures" 2017.05.31
(76) Takeharu Nagai (Osaka University)
"Various application of Super-duper Chemiluminescent proteins - from Bioimaging to Glowing Plants" 2017.06.16
(77) Masahiro Higashi (University of the Ryukyus)
"Theoretical investigation of excited-state reactions and properties in condensed phases" 2017.08.07
(78) Hideyoshi Motogi (University of the Ryukyus)
"Theoretical study on domain-swapped oligomer formation of cytchrome c" 2017.08.07
(79) Hiroshi Yoshikawa (Saitama University)
"Active control of self-organization of biomolecules by using focused laser beams" 2017.11.14
(80) Ryuzo Kawamura (Saitama University)
"ATP-fueled active network of microtubules driven by kinesin biomotor proteins" 2017.11.14
(81) Hiroaki Misawa (Hokkaido University)
"Recent advanced in plasmonic chemistry" 2017.11.14
(82) Johan Hofkens (Katholieke Universiteit Leuven)
"Recent Advances in Single Molecule Spectroscopy and Imaging" 2017.11.22


Nobuyo M.

Research Activity

Representative papers demonstrating future possibilities in laser trapping studies

GDCh Communications Angewandte

Amyloid Fibrils Hot Paper

International Edition: DOI: 10.1002/anie.201702352
German Edition: DOI: 10.1002/ange.201702352

A Single Spherical Assembly of Protein Amyloid Fibrils Formed by Laser Trapping

Ken-ichi Yuyama, Mariko Ueda, Satoshi Nagao, Shun Hirota, Teruki Sugiyama,* and Hiroshi Masuhara**

Abstract: *Protein amyloids have received much attention owing to their correlation with serious diseases and to their promising mechanical and optical properties as future materials. Amyloid formation has been conducted by tuning temperature and chemical conditions, so that its nucleation and the following growth are analyzed as ensemble dynamics. A single spherical assembly of amyloid fibrils of cytochrome c domain-swapped dimer was successfully generated upon laser trapping. The amyloid fibrillar structure was confirmed by fluorescence characterization and electron microscopy. The prepared spheres were further manipulated individually in solution to fabricate a three-dimensional microstructure and a line pattern. Amyloid formation dynamics and amyloid-based microstructure fabrication are demonstrated based on direct observation of a single spherical assembly, which foresees a new approach in amyloid studies.*

Dynamics and mechanism of amyloid formation and crystallization of proteins have been studied comparatively, since both consist of nucleation and the following growth process where some time lag is usually observed.[1] Amyloid nucleation is started from misfolded and unfolded conformations of proteins and leads to fibrillation through mutual interactions of prefibrillar oligomer intermediates.[2] Protein crystallization is coupled with the formation of protein clusters containing solvent waters and the subsequent generation of a highly concentrated area of such clusters.[3] Nucleation and the crystal growth proceed in such an area of a few tens to a few hundreds of nanometers. Most of the experiments for amyloid formation and crystallization are carried out in solution by tuning pH,[1] salt concentration,[1] and temperature[2] and by applying ultrasonication,[1] electromagnetic field,[1] and pulsed laser irradiation.[3,4] Therefore, all the processes of nucleation and growth of amyloid and crystal in solution proceed randomly in parallel, whose dynamic evolutions are monitored and analyzed as an ensemble of amyloid fibrils or crystals. It is considered very promising to propose a new experimental approach for preparing a single spherical assembly of protein amyloid, analyzing its dynamics, and fabricating micro-structures from single assemblies. It will enable us to perform amyloid studies by watching always when and where individual assemblies of amyloid fibrils are prepared, monitored, and utilized.

Herein we report a laser trapping study on oxidized monomeric horse cytochrome (cyt) c and its domain-swapped dimer (Figure 1 A,B).[7] Cyt c is a well-known globular heme

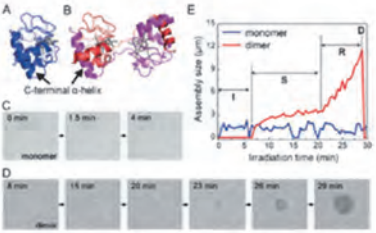

Figure 1. Laser trapping of cyt c. A), B) Molecular structures of oxidized monomeric and domain-swapped dimeric horse cyt c. C), D) Laser trapping of monomeric and dimeric cyt c. The size of images is 40 × 35 μm². E) The time evolution of the assembly size estimated from the captured images. I = incubation, S = saturation tendency, R = rapid enlargement, D = disappearance.

[*] Dr. K. Yuyama, Prof. T. Sugiyama, Prof. H. Masuhara

Angew Chem. Int. Ed., 2017, 56, 6737-6743

THE JOURNAL OF PHYSICAL CHEMISTRY

Article

Femtosecond Laser Trapping Dynamics of Nanoparticles: A Single Transient Assembly Formation Leading to Their Directional Ejection

Wei-Yi Chiang,[†,‡] Anwar Usman,[*,‡] Teruki Sugiyama,[*,†,∥] Johan Hofkens,[*,§] and Hiroshi Masuhara[*,†]

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Supporting Information

ABSTRACT: We investigated femtosecond laser trapping dynamics of silica nanoparticles with different hydrophobic surface properties. We demonstrated that the hydrophobic surface on the silica nanoparticles facilitates mutual association of the nanoparticles in the optical trapping site. Such association of optically trapped nanoparticles is a prerequisite to induce their directional ejection away from the trapping site. The directional ejection of the optically trapped nanoparticles is most probably due to asymmetric three-dimensional ejecting forces generated by the electromagnetic interaction between transient assembly in the focal spot and the incident pulses. These findings provide important insights into the directional ejection of nanoparticles from the trapping site in the femtosecond laser trapping, and this physicochemical phenomenon is controlled by both the trapping laser and material properties.

J. Phys. Chem. C, 2018, in press

Research Article | Vol. 25, No. 5 | 6 Mar 2017 | OPTICS EXPRESS 4655

Optics EXPRESS

Resonance optical trapping of individual dye-doped polystyrene particles with blue- and red-detuned lasers

TETSUHIRO KUDO,[1,3] HAJIME ISHIHARA,[2] AND HIROSHI MASUHARA[1,4]

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[2]*Department of Physics and Electronics, Osaka Prefecture University, Sakai, Osaka 599-8531, Japan*

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[4]*masuhara@masuhara.jp*

Abstract: We demonstrate resonance optical trapping of individual dye-doped polystyrene particles with blue- and red-detuned lasers whose energy are higher and lower compared to electronic transition of the dye molecules, respectively. Through the measurement on how long individual particles are trapped at the focus, we here show that immobilization time of dye-doped particles becomes longer than that of bare ones. We directly confirm that the immobilization time of dye-doped particles trapped by the blue-detuned laser becomes longer than that by the red-detuned one. These findings are well interpreted by our previous theoretical proposal based on nonlinear optical response under intense laser field. It is discussed that the present result is an important step toward efficient and selective manipulation of molecules, quantum dots, nanoparticles, and various nanomaterials based on their quantum mechanical properties.

OCIS codes: (140.7010) Laser trapping; (260.5740) Resonance; (350.4855) Optical tweezers or optical manipulation.

LANGMUIR

Article

pubs.acs.org/Langmuir

Femtosecond-Laser-Enhanced Amyloid Fibril Formation of Insulin

Tsung-Han Liu,[†] Ken-ichi Yuyama,[†,⊥] Takato Hiramatsu,[‡] Naoki Yamamoto,[‡] Eri Chatani,[‡,∥] Hiroshi Miyasaka,[§] Teruki Sugiyama,[*,†,∥] and Hiroshi Masuhara[*,†]

[†]Department of Applied Chemistry, National Chiao Tung University, Hsinchu 30010, Taiwan

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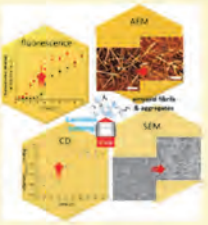
ABSTRACT: Femtosecond (fs)-laser-induced crystallization as a novel crystallization technique was proposed for the first time by our group, where the crystallization time can be significantly shortened under fs laser irradiation. Similarly, we have further extended our investigation to amyloid fibril formation, also known as a nucleation-dependence process. Here we demonstrate that the necessary time for amyloid fibril formation can be significantly shortened by fs laser irradiation, leading to favorable enhancement. The enhancement was confirmed by both spectral measurements and direct observations of amyloid fibrils. The thioflavin T fluorescence intensity of laser-irradiated solution increased earlier than that of the control solution, and such a difference was simultaneously revealed by ellipticity changes. At the same time before intensity saturation in fluorescence, the number of amyloid fibrils obtained under laser irradiation was generally more than that in the control solution. Besides, such an enhancement is correlated to the laser power threshold of cavitation bubbling. Possible mechanisms are proposed by referring to fs-laser-induced crystallization and ultrasonication-induced amyloid fibril formation.



Langmuir, 2017, 33 (33), 8311–8318

THE JOURNAL OF PHYSICAL CHEMISTRY C

Article

pubs.acs.org/JPCC

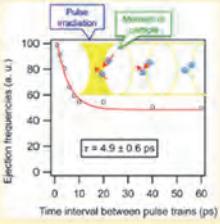
Picosecond Motional Relaxation of Nanoparticles in Femtosecond Laser Trapping

Masayasu Muramatsu,[*,†,§] Tse-Fu Shen,[†] Wei-Yi Chiang,[†] Anwar Usman,[‡] and Hiroshi Masuhara[*,†]

[†]Department of Applied Chemistry and Institute of Molecular Science, National Chiao Tung University, Hsinchu 30010, Taiwan

[‡]Department of Chemistry, Faculty of Science, Universiti Brunei Darussalam, Jalan Tungku Link, Gadong BE1410, Negara Brunei Darussalam

ABSTRACT: Repetitive drag and release dynamics by impulsive force is characteristic of optical trapping by femtosecond laser pulses. We studied the dynamics utilizing double pulse train and found that trapped polystyrene particles are ejected repetitively from the focal spot and its frequencies become less for longer interval of the pulse trains. The ejection changes drastically in a few-ps interval region, although particles cannot move appreciable distance in such a short time. It means that displacement of particles by a conventional diffusive motion is not dominant and another fast process has an important role in femtosecond pulse trapping. We also revealed that the silica nanoparticles shows a decay at few-ps, indicating that the picosecond decay is not due to a material property but considered to be a general dynamics. We propose that a picosecond relaxation process of inertia force of particles is important for understanding laser trapping dynamics by femtosecond laser pulses.



J. Phys. Chem. C, 2016, 120(9), 5251-5256

LANGMUIR

Article

pubs.acs.org/Langmuir

Optically Evolved Assembly Formation in Laser Trapping of Polystyrene Nanoparticles at Solution Surface

Shun-Fa Wang,[†] Tetsuhiro Kudo,[†] Ken-ichi Yuyama,[*,†] Teruki Sugiyama,[‡,†] and Hiroshi Masuhara[*,†]

[†]Department of Applied Chemistry and Institute of Molecular Science, National Chiao Tung University, Hsinchu 30010, Taiwan

[‡]Graduate School of Materials Science, Nara Institute of Science and Technology, Ikoma, Nara 630-0192, Japan

Supporting Information

ABSTRACT: Assembling dynamics of polystyrene nanoparticles by optical trapping is studied with utilizing transmission/reflection microscopy and reflection microspectroscopy. A single nanoparticle assembly with periodic structure is formed upon the focused laser irradiation at solution surface layer and continuously grows up to a steady state within few minutes. By controlling nanoparticle and salt concentrations in the colloidal solution, the assembling behavior is obviously changed. In the high concentration of nanoparticles, the assembly formation exhibits fast growth, gives large saturation size, and leads to dense packing structure. In the presence of salt, one assembly with the elongated aggregates was generated from the focal spot and 1064 nm trapping light was scattered outwardly with directions, while a small circular assembly and symmetrical expansion of the 1064 nm light were found without salt. The present nanoparticle assembling in optical trapping is driven through multiple scattering in gathered nanoparticles and directional scattering along the elongated aggregates derived from optical association of nanoparticles, which dynamic phenomenon is called optically evolved assembling. Repetitive trapping and release processes of nanoparticles between the assembly and the surrounding solution always proceed, and the steady state at the circular assembly formed by laser trapping is determined under optical and chemical equilibrium.

Langmuir, 2016, 32, 12488-12496

NANO LETTERS

Letter

pubs.acs.org/NanoLett

Optical Trapping-Formed Colloidal Assembly with Horns Extended to the Outside of a Focus through Light Propagation

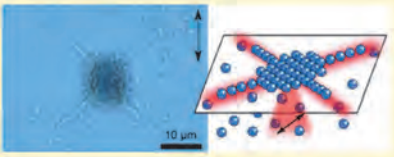
Tetsuhiro Kudo,* Shun-Fa Wang, Ken-ichi Yuyama, and Hiroshi Masuhara*

Department of Applied Chemistry and Institute of Molecular Science, National Chiao Tung University, Hsinchu 30010, Taiwan

Supporting Information

ABSTRACT: We report optical trapping and assembling of colloidal particles at a glass/solution interface with a tightly focused laser beam of high intensity. It is generally believed that the particles are gathered only in an irradiated area where optical force is exerted on the particles by laser beam. Here we demonstrate that, the propagation of trapping laser from the focus to the outside of the formed assembly leads to expansion of the assembly much larger than the irradiated area with sticking out rows of linearly aligned particles like horns. The shape of the assembly, its structure, and the number of horns can be controlled by laser polarization. Optical trapping study utilizing the light propagation will open a new avenue for assembling and crystallizing quantum dots, metal nanoparticles, molecular clusters, proteins, and DNA.

KEYWORDS: *Optical trapping, colloidal assembly, light propagation, optical binding, glass/solution interface*



Nano Lett., 2016, 16(5), 3058-3062

CRYSTAL GROWTH & DESIGN

Cryst. Growth Des., 2016, 16(2), 953-960

pubs.acs.org/crystal

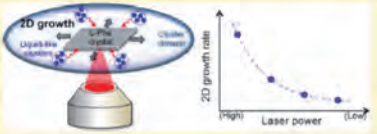
Two-Dimensional Growth Rate Control of L-Phenylalanine Crystal by Laser Trapping in Unsaturated Aqueous Solution

Ken-ichi Yuyama,[†] Jino George,[‡] K. George Thomas,[‡] Teruki Sugiyama,*[,†] and Hiroshi Masuhara*[,†]

[†]Department of Applied Chemistry and Institute of Molecular Science, National Chiao Tung University, Hsinchu 30010, Taiwan
[‡]School of Chemistry, Indian Institute of Science Education and Research, Thiruvananthapuram, 695016, India

Supporting Information

ABSTRACT: The growth rate control of single L-phenylalanine plate-like anhydrous crystal is successfully demonstrated by laser trapping at an air/solution interface of the unsaturated aqueous solution. Focusing a continuous-wave near-infrared laser beam into the interface generates single L-phenylalanine crystal at the focal spot even under unsaturated condition. Subsequently, the plane area of the generated crystal becomes larger linearly with time under continued laser irradiation into the crystal central part. Two-dimensional crystal growth rate defined as a slope of the temporal change in the crystal plane area strongly depends on initial solution concentration as well as irradiation time until single crystal formation is confirmed by eye under a microscope. When the laser power is decreased after the crystallization, the growth rate is slowed down accordingly. Thus, the two-dimensional growth rate is arbitrarily controlled by tuning the laser power. As the critical phenomenon underlying the crystal growth, we propose that a dense domain consisting of a large number of the liquid-like clusters is formed prior to the crystallization. The dynamics and mechanism of the two-dimensional crystal growth is discussed by considering the supply of the solutes to the crystal edge from the cluster domain dependent on the laser power.



CRYSTAL GROWTH & DESIGN

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Dynamics and Mechanism of Laser Trapping-Induced Crystal Growth of Hen Egg White Lysozyme

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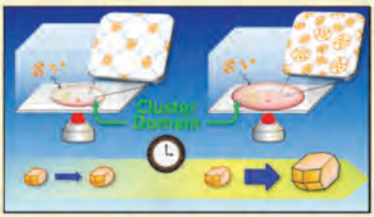
Supporting Information

ABSTRACT: We propose the dynamics and mechanism of laser trapping-induced crystal growth of hen egg-white lysozyme (HEWL). A continuous-wave near-infrared laser beam is used as a trapping light source and focused at a point 10 μm away from a target tetragonal HEWL crystal that is spontaneously generated in solution. Laser trapping of HEWL liquid-like clusters in solution increases local concentration in the focus, where the free motion and orientation of the clusters are strongly restricted, and the clusters show high rigidity and ordering. The cluster association and reorientation at the micrometer-sized focus is evolved to a large highly concentrated domain of the clusters, where the specific target crystal is grown. Initially, the high rigidity and ordering of the clusters strongly suppress the crystal grow rate compared to spontaneous crystal growth. Continuous laser trapping at the focus of the initially formed domain, however, leads to the transition to another domain with different concentration, rigidity, and ordering of the clusters, which surprisingly enhances the crystal growth rate. More interestingly, the clusters in both domains have anisotropic features reflecting the laser polarization direction, which also contributes to the crystal growth.



THE JOURNAL OF PHYSICAL CHEMISTRY Letters

Letter

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Laser Trapping and Crystallization Dynamics of L-Phenylalanine at Solution Surface

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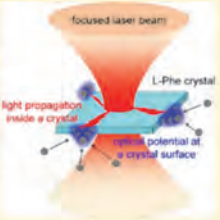
Supporting Information

ABSTRACT: We present laser trapping behavior of L-phenylalanine (L-Phe) at a surface of its unsaturated aqueous solution by a focused continuous-wave (CW) near-infrared (NIR) laser beam. Upon the irradiation into the solution surface, laser trapping of the liquid-like clusters is induced concurrently with local laser heating, forming an anhydrous plate-like crystal at the focal spot. The following laser irradiation into a central part of the plate-like crystal leads to laser trapping at the crystal surface not only for L-Phe molecules/clusters but also for polystyrene (PS) particles. The particles are closely packed at crystal edges despite that the crystal surface is not illuminated by the laser directly. The molecules/clusters are also gathered and adsorbed to the crystal surface, leading to crystal growth. The trapping dynamics and mechanism are discussed in view of optical potential formed at the crystal surface by light propagation inside the crystal.



SECTION: Surfaces, Interfaces, Porous Materials, and Catalysis

J. Phys. Chem. Lett., 4(15), 2436-2440 (2013)

THE JOURNAL OF PHYSICAL CHEMISTRY C

Article

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Femtosecond Pulse-Width Dependent Trapping and Directional Ejection Dynamics of Dielectric Nanoparticles

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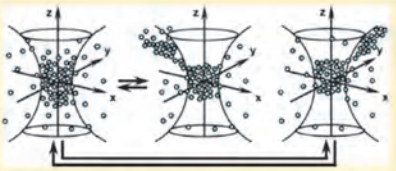
Supporting Information

ABSTRACT: We demonstrate that laser pulse duration, which determines its impulsive peak power, is an effective parameter to control the number of optically trapped dielectric nanoparticles, their ejections along the directions perpendicular to polarization vector, and their migration distances from the trapping site. This ability to controllably confine and eject the nanoparticle is explained by pulse width-dependent optical forces exerted on nanoparticles in the trapping site and ratio between the repulsive and attractive forces. We also show that the directional ejections occur only when the number of nanoparticles confined in the trapping site exceeds a definite threshold. We interpret our data by considering the formation of transient assembly of the optically confined nanoparticles, partial ejection of the assembly, and subsequent filling of the trapping site. The understanding of optical trapping and directional ejections by ultrashort laser pulses paves the way to optically controlled manipulation and sorting of nanoparticles.



J. Phys. Chem. C, 117(37), 19182-19188 (2013)

ACCOUNTS
of chemical research

Laser Trapping Chemistry: From Polymer Assembly to Amino Acid Crystallization

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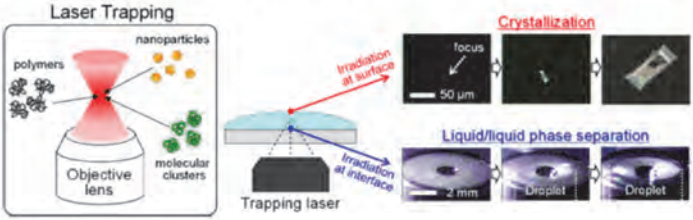
RECEIVED ON MAY 29, 2012

CONSPECTUS

Spatiotemporally Controlled Nucleation and Growth by Laser Trapping



Acc. Chem. Res., 45, 11, 1946-1954 (2012)

THE JOURNAL OF PHYSICAL CHEMISTRY Letters

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Control of Crystal Polymorph of Glycine by Photon Pressure of a Focused Continuous Wave Near-Infrared Laser Beam

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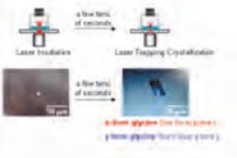
ABSTRACT Crystal polymorph of glycine is controlled by tuning the power of a linearly polarized continuous wave 1064-nm laser beam. Upon focusing the beam to the air/solution interface of a supersaturated glycine/D_2O solution, its single crystal is spatiotemporally formed at a focal spot within a few seconds to a few tens of seconds. Fourier transform infrared measurement and single-crystal X-ray crystallographic analysis of the fabricated single crystal reveal that two polymorphs of α- and γ-forms are prepared depending on the laser power. The probability of γ-form preparation, which is not available under ambient conditions, arises up to 50% at 1.3 W laser power after an objective lens. The mechanism of the polymorph control is discussed in view of both photon pressure and local temperature elevation due to laser irradiation at the focal spot.

SECTION Nanoparticles and Nanostructures



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96. Asahi, T.; Sugiyama, T.; Masuhara, H., “Laser fabrication and spectroscopy of organic nanoparticles”, *Accounts of Chemical Research*, 41, 1790-1798 (2008)
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List of Invited Talks

1. Colloquium of Katholieke Universiteit Leuven for Honorary doctorate for Professor Thomas Ebbesen, Invited
   Leuven, Belgium, February. 1, 2018.
   “Optical trapping and assembling of molecules and nanoparticles”
   Hiroshi Masuhara
2. Symposium on Nano-Material Manipulation and Structural Order Control with Optical Forces, Plenary
   Osaka, Japan, January. 22, 2018.
   “Photochemistry, Photoscience and Science of “Photon Pressure”
   Hiroshi Masuhara
3. International Conference of Applied Sciences 2018, Plenary
   Taipei, Taiwan, January. 9, 2018.
   “Laser Trapping Dynamics and Chemistry”
   Hiroshi Masuhara
4. 1st Workshop of Australian Research Council Excellence of Science in Exciton Science, Plenary
   Melbourne, Australia, December 11, 2017
   “My Exciton Science, Related Projects in Japan, and University Globalization in Taiwan”
   Hiroshi Masuhara
5. 2017 The 5th Solid-State Physics Seminar at Osaka University, Invited
   Osaka, Japan, December 19, 2017
   “Collective motion of the nanoparticles under laser trapping”
   Tetsuhiro Kudo
6. Toyota Riken International Workshop on Chirality in Soft Matter, Invited
   Nagoya, Japan, November 26, 2017
   ”Crystallization and Enantiomorphism Controlled by Optical Trapping”
   Teruki Sugiyama
7. 2017 Taiwan-Israel Bilateral Workshop on Optofluidics and Electrokinetics, Invited
   Hsinchu, Taiwan, November 9, 2017
   “Optical Trapping Dynamics of Nanoparticles by CW and Femtosecond Lasers”
   Hiroshi Masuhara

8. Asian spectroscopy conference 2017, Invited
   Hsinchu, Taiwan, September 4, 2017
   ”Laser Trapping Dynamics and Chemistry Utilizing Spectroscopy”
   Teruki Sugiyama
9. The 64th JSAP Spring Meeting, 2016 (The Japan Society of Applied Physics), Invited
   Yokohama, Japan, March 14, 2017
   “Assembly formation dynamics of nanoparticles based on interplay of optical trapping and light propagation/light scattering”
   Tetsuhiro Kudo
10. Symposium on Surface Science & Nanotechnology -25th Anniversary of SSSJ Kansai- (SSSN-Kansai), invited
    Kyoto, Japan, January 25, 2017
    ”Nanoparticle assembling and molecular crystallization at solution surface by laser trapping”
    Teruki Sugiyama
11. 9th Asian and Oceanian Photochemistry Conference (APC2016), invited
    Singapore, Singapore, December 8, 2016
    ”Laser Trapping-Induced Crystallization: From Amino Acid to Protein”
    Teruki Sugiyama
12. 1st International Symposium on PhotoSynergetics, Invited
    Osaka, Japan, June 2, 2016
    “What to expect from this research group: Laser Trapping Chemistry”,
    Hiroshi Masuhara
13. Public Lecture at Universiti Brunei Darussalam, Invited
    Brunei, May 19, 2016
    “Photon Science & Technology and Molecular Systems (1)”
    Hiroshi Masuhara
14. 251th National ACS Meeting, Physical Principles in Functional Nanoscience: Symposium in Honor of Mostafa A. El-Sayed, Invited
    San Diego, USA, March 16, 2016
    “Laser Trapping Assembling and Crystallization of Nanoparticles at Solution Surface”
    Hiroshi Masuhara, Ken-ichi Yuyama, Masayasu Muramatsu, Teruki Sugiyama
15. Invited Seminar at Katholieke Universiteit Leuven
    Leuven, Belgium, September 13, 2016
    “Advances in Laser Trapping Chemistry and Spectroscopy”

Hiroshi Masuhara

16. France-Japan Bilateral Workshop; Toward an international laboratory between France & Japan on Photochemistry, Invited
    Tokyo, Japan, April 1, 2016
    “Laser Trapping Chemistry”
    Hiroshi Masuhara
17. International Conference on Materials for the Millennium, Invited
    Kochi, India, January 15, 2016
    “Photoluminescence Enhancement and Spectral Fluctuations of CdSe/ZnS Quantum Dots in Solutions and at Interfaces: From Single-molecule Studies to the Construction of Self-assembled Nanostructures”
    Morihiko Hamada, Ken-ichi Yuyama, Hiroshi Masuhara, Shinsuke Nakanishi, Vasudevan Pillai Biju
18. International Conference on Photochemistry (ICP2015), Invited
    Jeju, Korea, July 1, 2015
    “Laser Trapping Dynamics and Mechanism of Molecular Clusters and Nanoparticles in Solution”
    Hiroshi Masuhara, TerukiSugiyama, Ken-ichiYuyama, Jing-Ru Tu, Shun-Fa Wang, Shimpei Nishimura
19. 2nd International Symposium on Plant Environmental Sensing, Invited
    Tokyo, Japan, March 15, 2015
    “Laser-induced Phenomena and Their Applications to Bio/Nano Science”
    Hiroshi Masuhara
20. 18th Osaka City University International Conference (OCUIC 2015), Invited
    Osaka, Japan, March 9, 2015
    ”Control of protein crystallization using laser trapping”
    Teruki Sugiyama
21. JSPS Grant - in - Aid for Scientific Research on Innovative Areas: " Application of Cooperative-Excitation into Innovative Molecular Systems with High-Order Photofunctions " The 2nd International Symposium, Invited
    Osaka, Japan, January 23, 2015
    “Photon Science & Technology and Photochemistry”
    Hiroshi Masuhara
22. The 10th SPSJ International Polymer Conference (IPC2014),

Keynote
Tsukuba, Japan, December 2, 2014
“Photon Science& Technology and Polymers”
Hiroshi Masuhara

23. The 1st International Symposium on Interactive Materials Science Cadet Program of Graduate School of Engineering Science, Keynote
Osaka, Japan, November 19, 2014
“Laser Trapping Assembling Dynamics of Molecules and Nanoparticles”
Hiroshi Masuhara

24. Collaborative Conference on Crystal Growth 2014, Invited
Phuket, Thailand, November 5, 2014
”Crystallization and crystal growth of lysozyme induced by laser trapping”
Teruki Sugiyama

25. Collaborative Conference on Crystal Growth 2014, Invited
Phuket, Thailand, November 4-7, 2014
“Control of Crystal Growth of L-Phenylalanine by Optical Trapping”
Ken-ichi Yuyama

26. Invited Seminar at Georgia Institute of Technology
Atlanta, USA, October 23, 2014
“Laser Trapping Assembling Dynamics of Molecules and Nanoparticles”
Hiroshi Masuhara

27. Invited Seminar at Ecole Normale Superier Cachan
Cachan, France, September 23, 2014
“Laser Trapping Assembling Dynamics of Molecules and Nanoparticles”
Hiroshi Masuhara

28. Puli Lecture at National Chi Nan University, Invited
Puli, Taiwan, June 20, 2014
“New Chemistry by Laser Trapping”
Hiroshi Masuhara

29. The Second RIKEN-NCTU Symposium on Physical and Chemical Sciences, Invited
Wako, Japan, June 5, 2014
“Laser trapping study toward molecular science”
Hiroshi Masuhara

30. 1st Optical Manipulation Conference (OMC'14), Optical manipulation

and its satellite topics, Plenary
Yokohama, Japan, April 22, 2014
“Laser Trapping Assembling of Clusters and Nanoparticles”
Hiroshi Masuhara

31. Invited Seminar at at Chiba University
Chiba, Japan, April 21, 2014
“Laser trapping-induced phase transition of molecules, polymers, and nanoparticles in solution”
Hiroshi Masuhara, Teruki Sugiyama, Ken-ichi Yuyama

32. Invited Seminar at Rice University,
Houston, USA, February 3, 2014
“Laser trapping dynamics of molecular clusters and nanoparticles in solution”
Hiroshi Masuhara, T. Sugiyama, K. Yuyama, A. Usman

33. SPIE Photonics West (8983-19), Plenary
San Francisco, USA, February 4, 2014
“Laser trapping studies toward fabrication of organic materials and devices”
Hiroshi Masuhara, T. Sugiyama, K. Yuyama, A. Usman

34. Symposium on Functional Nanostructures/Symposium Honoring the 60th Birthday of Prof. Thomas W. Ebbesen, Invited
Strasbourg, France, January 31, 2014
“Laser trapping, assembling and crystallization of nanoparticles and amino acid clusters in solution”
Hiroshi Masuhara

35. JSPS Grant - in - Aid for Scientific Research on Innovative Areas: "Dynamical ordering of biomolecular systems for creation of integrated functions" The 2nd International Symposium, Invited
Kyoto, Japan, January 12, 2014
“A millimeter-sized assembly of amino acids in solution formed by laser trapping”
Hiroshi Masuhara

36. CNRS Bronze Medal Scientific Symposium, Invited
Lille, France, November 5, 2013
“Laser Trapping in Chemistry and Material Science”
Hiroshi Masuhara

37. The First MPI-NCTU Joint Symposium on Correlated Materials, Thin Films and Chemical Physics of Solid, Invited
Hsinchu, Taiwan

"Laser Trapping and Crystallization Dynamics at Solution Interface/Surface"
Hiroshi Masuhara, Teruki Sugiyama, Ken-ichi Yuyama

38. Invited Seminar at Katholieke Universiteit Leuven
Leuven, Belgium, September 17, 2013
"Laser Trapping and Crystallization Dynamics at Solution Surface and Interface"
Hiroshi Masuhara

39. 2013 Fall Symposium of Photochemistry Association in Taiwan, Keynote
Danshui, Taiwan, September 6, 2013
"Cooperative Photochemical Reaction of Molecular Solids and Its Evolution to Their Morphological Changes"
Hiroshi Masuhara

40. 2013 SPIE Optics+Photonics Conference 8810 Optical Trapping and Optical Manipulation X, Oral
San Diego, USA, August 29, 2013
"Femtosecond Optical Trapping of Dielectric Nanospheres: Three Dimensional Mapping of Their Directional Ejection"
Wei-Yi Chiang, Anwar Usman, Hiroshi Masuhara

41. Invited seminar at Toyo University
Kawagoe and Itakura, Japan, July 4, 2013
"In situ laser micropatterning of proteins for dynamically arranging living cells"
Kazunori Okano

42. 5th International Symposium on Optical Tweezers in Life Sciences, Invited
Berlin, Germany, June 18, 2013
"Laser Trapping and Crystallization Dynamics of Biomolecules and Nanoparticles"
Hiroshi Masuhara

43. 11th International Symposium on Functional π-electron systems, Invited
Arcachon, France, June 2, 2013
"Laser Trapping in Chemistry and Materials Science"
Hiroshi Masuhara

44. Organic Electronics Summer School, Invited
Biarritz, France, May 28, 2013
"Laser fabrication and single particle spectroscopy of organic

nanoparticles”
Hiroshi Masuhara

45. Invited Seminar at Department of Chemistry, National Taiwan University,
Taipei, Taiwan, May 9, 2013
“Laser Trapping in Chemistry and Material Science”
Hiroshi Masuhara

46. Invited Seminar at Department of Chemical Engineering, National Cheng Kung University
Tainan, Taiwan, 19 April 2013
“Laser Trapping in Chemistry and Material Science”
Hiroshi Masuhara

47. 5th European Conference on Applications of Femtosecond Lasers in Materials Science (FemtoMat 2013), Invited
Mauterndorf, Austria, March 18, 2013
“Laser Trapping Assembly, Scattering, and Crystallization by CW and Femtosecond Lasers”
Hiroshi Masuhara, Teruki Sugiyama, Ken-ichi Yuyama, and Anwar Usman

48. Annual Meeting of Physical Society of Republic of China, Invited
Hualien, Taiwan, January 31, 2013
“Optical Trapping of Nanoparticles by Femtosecond Laser Pulses”
Hiroshi Masuhara

49. Invited Seminar at National Dong Hwa University
Hualien, Taiwan, December 18, 2012
“Laser assembling, scattering, and crystallization of nanoparticles and molecules in solution”
Hiroshi Masuhara

50. Japan-India Bilateral Seminar on Supramolecular Nanomaterials for Energy Innovation, Invited
Takamatsu, Japan, October 15-16, 2012
“Laser Trapping Chemistry”
Hiroshi Masuhara, T. Sugiyama, K. Yuyama, A. Usman, and W. Y. Chiang

51. RCAS-TNNA Symposium, Invited
Taipei, Taiwan, October 5, 2012
“Laser trapping chemistry: From polymer assembling to amino acid crystallization”
Hiroshi Masuhara, Teruki Sugiyama, Ken-ichi Yuyama

52. Department Seminar at National Yang Ming University, Invited
Taipei, Taiwan, October, 1 2012
"Laser trapping chemistry: From polymer assembling to amino acid crystallization"
Hiroshi Masuhara
53. XXIV IUPAC Symposium on Photochemistry, Oral
Coimbra, Portugal, July 15, 2012
"Laser trapping crystallization of glycine and its polymorph control"
Hiroshi Masuhara, Teruki Sugiyama, Ken-ichi Yuyama
54. Solvay Colloquium at Universrsité Libre de Bruruxelles, Invited
Brussels, Belgium, May 8, 2012
"Laser light can crystallize amino acids and proteins in solution"
Hiroshi Masuhara
55. 3rd AIST-ANNA Seminar on Nanoparticles & Single Molecules, Invited
Takamatsu, Japan, February 17, 2012
"Laser Trapping Chemistry on Nanoparticle Assembling and Phase Transition"
Hiroshi Masuhara
56. RCAS-ANNA International Symposium, Invited
Taipei, Taiwan, November 17, 2011
"Molecular Trapping Phenomena by CW and Femtosecond Laser Irradiation"
Hiroshi Masuhara, T. Uwada, A. Usman, K. Yuyama, T. Sugiyama
57. International Scientific Instrument Technology Workshop, Invited
Hsinchu, Taiwan, October 24, 2011
"Femtosecond Laser Fabrication and Manipulation in Bio/Nano Science"
Hiroshi Masuhara
58. The 2nd International Symposium on Recent Advances in Applied Sciences, Invited
Hualien, Taiwan, October 3, 2011
"Radiation pressure chemistry: Confinement of polymerization and solidification by a focused laser beam"
Hiroshi Masuhara
59. 242nd ACS National Meeting & Exposition, Invited
Denver, USA, August 30, 2011
"Assembling and crystallization of amino acids and proteins by intense laser irradiation in solution"

Hiroshi Masuhara, Teruki Sugiyama, Ken-ichi Yuyama, Takayuki Uwada, and Atsushi Miura

60. The 25th International Conference on Photochemistry, Invited
Beijing, P. R. China, August 7-12, 2011
“Laser trapping dynamics of gold nanoparticles probed by wide-field light scattering spectroscopic imaging”
Hiroshi Masuhara, Takayuki Uwada, Teruki Sugiyama

61. International Workshop on Nanoplasmonics for Energy and the Environment, Invited
Vigo, Spain, June 10, 2011
“Laser trapping and wide-field Rayleigh scattering imaging of gold nanoparticles in solution”
Hiroshi Masuhara, Takayuki Uwada

62. Invited Seminar at Ecole Normale Superier Paris
Paris, France, June 6, 2011
“Laser-induced Crystallization and Crystal Growth”
Hiroshi Masuhara

63. The 2nd Taiwan-Japan Symposium on Nanomedicine, Invited
Taipei, Taiwan, February 24, 2011
“Living cell manipulation, nanoparticle preparation, and molecular crystallization by lasers”
Hiroshi Masuhara

64. Japan-Taiwan joint workshop: Future Perspective on NanoBio Science Pioneered by Light, Invited
Hsinchu, Taiwan, October 2011
"Tightly focused laser induced trapping, migration, assembling, and fabrication of gold nanoparticles under optical microscope"
Takayuki Uwada

65. 2011 台灣光化學小組研討會議, Invited
Taipei, Taiwan, September 2011
"聚焦雷射誘發結晶和奈米粒子的形成"
Takayuki Uwada

66. 6th Asian Photochemistry Conference, Award Lecture
Auckland, New Zealand, November 15, 2010
“An exploratory study with lasers: From nanosecond laser photolysis to laser trapping crystallization”
Hiroshi Masuhara

67. 3rd Nanotechnology International Forum, Invited
Moscow, Russia, November 1-3. 2010

Laser Nanoscience and Nanotechnology in View of Materials
Hiroshi Masuhara

68. International Scientific Instrument Technology Workshop
Instrument Technology Research Center, National Applied Research Laboratories
Hsinchu, Taiwan, October 25, 2010
"Laser Fabrication and Microspectroscopy of Organic Nanoparticles"
Hiroshi Masuhara

69. 2010 The International Conference on Green Technologies, Keynote
Pingtung, Taiwan, October 6, 2010
"Laser and Organic Nanoparticles: From Nano to Real Worlds"
Hiroshi Masuhara

70. Third Asia Pacific Symposium on Radiation Chemistry (APSRC 2010) and DAE-BRNS Tenth Biennial Trombay Symposium on Radiation & Photochemistry (TSRP2010), Invited
Lonavala, India, September 15, 2010
"Laser is opening a new horizon in molecular crystallization studies"
Hiroshi Masuhara and Teruki Sugiyama

71. XXIII IUPAC Symposium on Photochemistry, Invited
Ferrara, Italy, July 14, 2010
"Laser trapping crystallization dynamics at surface and interface: glycine and nanoparticle solutions"
Hiroshi Masuhara, Teruki Sugiyama, Thitiporn Rungsimanon, Ken-ichi Yuyama, Takayuki Uwada, and Atsushi Miura

72. Invited Seminar at National Synchrotron Radiation Research Center
Hsinchu, Taiwan, June 22, 2010
"Laser Fabrication of Molecular Nanoparticles and Nanocrystals"
Hiroshi Masuhara

73. Invited Seminar at Instrument Technology Research Center
Hsinchu, Taiwan, June 10, 2010
"Exploration with Lasers into New Areas of Molecular Photoscience"
Hiroshi Masuhara

74. The 3rd Taiwan-Japan Joint Symposium on Organized Nanomaterials and Nanostructures Related to Photoscience, Oral
Taroko, Hualien, Taiwan, March 23, 2010
"Laser trapping crystallization and polymorph control of glycine in solution"
Hiroshi Masuhara, Thitiporn Rungsimanon, Ken-chi Yuyama, and Teruki Sugiyama

75. The 4th Yamada Conference on Advanced Photon and Science Evolution, Invited
Ibaraki, Osaka, Japan, June 3, 2010
"Molecular Nano Fabrication and Crystallization by Lasers"
Hiroshi Masuhara
76. Invited Seminar at Indian Institute of Technology Bombay,
Mumbai, India, February 2, 2010,
"Laser and Organic Nanoparticles"
Hiroshi Masuhara
77. M L Sircar Lecture at Indian Association for the Cultivation of Science, Invited
Kolkata, India, February 3, 2010
"Exploratory Research in Photoscience: Laser Tsunami Manipulation of Single Living Cells and Laser Trapping Crystallization of Molecules"
Hiroshi Masuhara
78. Invited Seminar at University of Hyderabad
Hyderabad, India, 2010, February 6, 2010
"Laser-induced Crystallization and Related Phenomena of Glycine and Proteins in Solution"
Hiroshi Masuhara
79. The Raman-Mizushima Lecture in the Annual Meeting of Chemical Research Society of India, Award Lecture
Hyderabad, India, 2010, February 7, 2010
"Laser and Organic Nanoparticles"
Hiroshi Masuhara
80. Invited Lecture at Tata Institute of Fundamental Research
Mumbai, India, 2010, February 8, 2010
"Laser and Organic Nanoparticles"
Hiroshi Masuhara
81. Invited Lecture at Bhabha Atomic Research Centre
Mumbai, India, 2010, February 9, 2010
"Exploration with Lasers into New Areas of Molecular Photoscience"
Hiroshi Masuhara
82. 11th Japan-Belgium Symposium on Polymer Science, Invited
Tokyo, Japan, November 10, 2009
"Laser-induced crystallization and crystal growth of amino acids and proteins in solution"
Hiroshi Masuhara, Teruki Sugiyama, Ken-ichi Yuyama, Thitiporn

Rungsimanon, Atsushi Miura, Takayuki Uwada, and Anwar Usman

83. Invited Seminar at ISIS, CNRS et Universite Strasburg
Strasburg, France, December 16, 2009
"Laser–induced Crystallization and Related Phenomena of Glycine and Protein in Solution"
Hiroshi Masuhara, Teruki Sugiyama, Kenichi Yuyama, Thitiporn Rungsimanon, Atsushi Miura, Takayuki Uwada

84. 2009 RCAS Taiwan-Japan Workshop on Single Molecule/Confocal Microscopy, Invited
Taipei, Taiwan, October 15, 2009
"Spectroscopy, Photochemistry, and Fabrication of Single Nanocrystals"
Hiroshi Masuhara

85. Wazapalooza: Mike Wasielewski's 60th Birthday Symposium, Invited
Evanston, USA, September 25-26, 2009
"Laser–induced Crystallization and Crystal Growth: Exploration with Lasers into New Areas of Molecular Photoscience"
Hiroshi Masuhara

86. International Conference on Organic Photonics and Electronics 2009 (ICOPE2009) & The 11th International Conference on Organic Nonlinear Optics (ICONO 11), Plenary
Beijing, P. R. China, September 21, 2009
"Spectroscopic and imaging study on laser trapping dynamics and crystallization of amino acids and proteins in solution"
Hiroshi Masuhara, Teruki Sugiyama, Ken-ichi Yuyama, Thitiporn Rungsimanon, Takayuki Uwada, and Atsushi Miura

87. XXIV International Conference on Photochemistry (ICP 2009), Invited
Toledo, Spain, July 21, 2009
"Crystallization and crystal growth of amino acids in solution by photon pressure of a focused cw near-infrared laser beam"
Hiroshi Masuhara, Teruki Sugiyama, Kenichi Yuyama, and Thitiporn Rungsimanon

88. Laser and Organic Nanoparticles" International Conference Organic nanophotonics (ICON2009), Plenary
St. Petersburg, Russia, June 22, 2009
"Laser and Organic Nanoparticles"
Hiroshi Masuhara, Teruki Sugiyama, Kenichi Yuyama, Thitiporn Rungsimanon, Atsushi Miura, and Takayuki Uwada

89. Spring Annual Meeting of the Korean Chemical Society, Invited
A Special Symposium of Physical Chemistry Division “Physical Chemistry for Biological Application”
Seoul, Korea, April 17, 2009
“Femtosecond “Laser Tsunami” Manipulation for Single Living Cells in Solution”
Hiroshi Masuhara
90. Invited Seminar at Korea Advanced Institute of Science and Technology
Korea, April 20, 2009
“Laser Trapping Dynamics and Crystallization of Molecules in Solution”
Hiroshi Masuhara, Teruki Sugiyama
91. Asian Academic Seminar 2009, Invited
KAST, Kawasaki, March 2-7, 2009
“Laser Trapping Spectroscopy and Crystallization in Solution”
Hiroshi Masuhara
92. The 1st NCTU-NAIST workshop on Molecular/Nano Science, Invited
Hsinchu, Taiwan, November 2009
"Development of Rayleigh scattering microspectroscopy and its application to particle diffusion/assembling dynamics study"
Takayuki Uwada
93. The 8th GIST/NAIST Joint Symposium on Advanced Materials, Invited
Ikoma, Japan, November 26, 2008
“Dynamics, mechanism, and application of laser ablation of molecular and bio systems”
Hiroshi Masuhara, Yoichiroh Hosokawa, Teruki Sugiyama, and Kazunori Okano
94. The 2nd Japan-Taiwan Joint Symposium on Organized Nanomaterials and Nanostructures Related to Photoscience, Invited
Kyoto, Japan, November 5, 2008
“Laser tsunami crystallization and laser trapping crystallization: a challenge for molecular materials”
Hiroshi Masuhara, Yoichiroh Hosokawa, Teruki Sugiyama, Atsushi Miura, and Takayuki Uwada
95. The 3rd BK21 International Symposium on Materials Chemistry, Invited
Busan, Korea, October 20, 2008

"Spectroscopy and Imaging of Single Nanoparticles"
Hiroshi Masuhara

96. Symposium on Organic Micro- and Nano-Crystals (as a satellite meeting of IUCr 2008), Invited
Sendai, Japan, August 22, 2008
"Spectroscopy and laser fabrication of single organic nano crystals"
Hiroshi Masuhara, Tsuyoshi Asahi, and Teruki Sugiyama

97. Invited Lecture at Samsung Electronics Co. Ltd.
Korea, August 18, 2008
"Photophysical/chemical Processes and Recent Topics on Nano Fabrication and Patterning"
Hiroshi Masuhara

98. SPIE Optics+Photonics 2008, Invited
San Diego, USA, August 12, 2008
"Molecular assembling and crystallization in solution by photon pressure of a focused cw laser beam"
Hiroshi Masuhara, Teruki Sugiyama, Hiroyuki Yoshikawa, Yu Nabetani, and Takuji Adachi

99. IUPAC Symposium on Photochemistry, Oral
Gothenburg, 2008 July 29
"Protein Crystallization by Femtosecond Laser Ablation in Supersaturated Solution"
Hiroshi Masuhara

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Dual Degree Defense Meeting of National Chiao Tung University (Taiwan) and Katholieke Univerisitei Leuven (Belgium) for Dr. Wei-Yi Chiang in Room 522 SBII on November 21, 2017.
Profs. Y.-P. Lee, J. Hofkens, M. Roeffaers, A. Usman, T. Sugiyama, Y. Teranishi, Hsin-Yu Hsu, and H. Masuhara were its Committee Members.

Chair Professor Hiroshi MASUHARA
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