PROGRESS IN BIOMEDICAL OPTICS AND IMAGING
Vol. 16 No. 27

Multiphoton Microscopy in the Biomedical Sciences XV

Ammasi Periasamy
Peter T. C. So
Karsten König
Editors

8–10 February 2015
San Francisco, California, United States

Sponsored by
SPIE

Cosponsored by
Becker and Hickl (Germany)• Carl Zeiss • Chroma Technology Corporation (United States) • Coherent Inc. • Semrock Inc. (United States) • ISS, Inc. • JenLab GmbH (Germany) • Leica Mircosystems • Spectra-Physics®, a Newport Corporation Brand (United States) • Princeton Instruments • Veroptics (United States)

Published by
SPIE

Volume 9329

Proceedings of SPIE, 1605-7422, V. 9329

Multiphoton Microscopy in the Biomedical Sciences XV, edited by Ammasi Periasamy, Peter T. C. So, Karsten König,
Proc. of SPIE Vol. 9329, 932901 · © 2015 SPIE · CCC code: 1605-7422/15/$18 · doi: 10.1117/12.2192260

The papers included in this volume were part of the technical conference cited on the cover and title page. Papers were selected and subject to review by the editors and conference program committee. Some conference presentations may not be available for publication. The papers published in these proceedings reflect the work and thoughts of the authors and are published herein as submitted. The publisher is not responsible for the validity of the information or for any outcomes resulting from reliance thereon.

Please use the following format to cite material from this book:
Author(s), "Title of Paper," in *Multiphoton Microscopy in the Biomedical Sciences XV*, edited by Ammasi Periasamy, Peter T. C. So, Karsten König, Proceedings of SPIE Vol. 9329 (SPIE, Bellingham, WA, 2015) Article CID Number.

ISSN: 1605-7422
ISBN: 9781628414196

Published by
SPIE
P.O. Box 10, Bellingham, Washington 98227-0010 USA
Telephone +1 360 676 3290 (Pacific Time) · Fax +1 360 647 1445
SPIE.org

Printed in the United States of America.

Publication of record for individual papers is online in the SPIE Digital Library.

SPIE Digital Library
SPIEDigitalLibrary.org

Paper Numbering: Proceedings of SPIE follow an e-First publication model, with papers published first online and then in print. Papers are published as they are submitted and meet publication criteria. A unique citation identifier (CID) number is assigned to each article at the time of the first publication. Utilization of CIDs allows articles to be fully citable as soon as they are published online, and connects the same identifier to all online, print, and electronic versions of the publication. SPIE uses a six-digit CID article numbering system in which:

- The first four digits correspond to the SPIE volume number.
- The last two digits indicate publication order within the volume using a Base 36 numbering system employing both numerals and letters. These two-number sets start with 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B … 0Z, followed by 10-1Z, 20-2Z, etc.

The CID Number appears on each page of the manuscript. The complete citation is used on the first page, and an abbreviated version on subsequent pages.

Contents

vii *Authors*

ix *Conference Committee*

xiii *Introduction*

SESSION 1 KEYNOTE SESSION

9329 03 **Multiphoton microscopy in brain imaging (Keynote Paper)** [9329-2]

SESSION 2 FLIM/FRET/FCS I

9329 0A **Observing conformations of single F_0F_1-ATP synthases in a fast anti-Brownian electrokinetic trap** [9329-9]

9329 0B **Imaging of oxygenation in 3D tissue models with multi-modal phosphorescent probes** [9329-97]

SESSION 3 FLIM/FRET/FCS II

9329 0C **Cell metabolism, FLIM and PLIM and applications (Invited Paper)** [9329-10]

9329 0D **Flavin fluorescence lifetime imaging of living peripheral blood mononuclear cells on micro and nano-structured surfaces** [9329-11]

9329 0E **Characterization of porcine eyes based on autofluorescence lifetime imaging** [9329-12]

9329 0G **Development of confocal immunofluorescence FRET microscopy to Investigate eNOS and GSNOR localization and interaction in pulmonary endothelial cells** [9329-144]

9329 0H **Time-resolved spectral imaging: better photon economy, higher accuracy** [9329-14]

SESSION 4 TECHNOLOGY DEVELOPMENT AND APPLICATION I

9329 0N **Two-photon excited fluorescence microendoscopic imaging using a GRIN lens** [9329-20]

9329 0O **Two-photon excited fluorescence emission from hemoglobin** [9329-21]

9329 0P **In vivo pump-probe microscopy of melanoma: characterizing shifts in excited state photodynamics with respect to invasiveness** [9329-22]

SESSION 5 TECHNOLOGY DEVELOPMENT AND APPLICATION II

9329 0Q **Multiphoton tomography of astronauts (Invited Paper)** [9329-23]

9329 0T **Study of acetowhitening mechanisms in live mammalian cells with label-free subcellular-level multimodal nonlinear optical microscopy** [9329-26]

SESSION 6 TECHNOLOGY DEVELOPMENT AND APPLICATION III

9329 0U **Optical reprogramming with ultrashort femtosecond laser pulses (Invited Paper)** [9329-27]

9329 0V **Compact fixed wavelength femtosecond oscillators for multi-photon imaging** [9329-28]

9329 0Z **Multiphoton light-sheet microscopy using wavelength mixing: fast multicolor imaging of the beating Zebrafish heart with low photobleaching** [9329-32]

SESSION 7 SHG/THG MICROSCOPY I

9329 12 **Four-wave mixing microscopy: a high potential nonlinear imaging method** [9329-36]

SESSION 8 SHG/THG MICROSCOPY II

9329 19 **Non-linear imaging and characterization of atherosclerotic arterial tissue using combined SHG and FLIM microscopy** [9329-42]

9329 1C **Second harmonic generation imaging in tissue engineering and cartilage pathologies** [9329-45]

SESSION 9 BIOMEDICAL APPLICATIONS OF COHERENT RAMAN I

9329 1J **Monitoring lipid accumulation in the green microalga *Botryococcus braunii* with frequency-modulated stimulated Raman scattering** [9329-52]

SESSION 10 BIOMEDICAL APPLICATIONS OF COHERENT RAMAN II

9329 1N **Histology *in vivo*: chemical contrast combined with clinical multimodal multiphoton tomography** [9329-56]

9329 1P **Simultaneous quadruple modal nonlinear optical imaging for gastric diseases diagnosis and characterization** [9329-58]

SESSION 11 COHERENT RAMAN TECHNICAL DEVELOPMENT I

9329 1T **Fast spectrum extraction from SRS spectral images by independent component analysis with image compression and post sampling** [9329-62]

SESSION 12 COHERENT RAMAN TECHNICAL DEVELOPMENT II

9329 20 **Towards low-noise fiber sources for coherent Raman microscopy** [9329-70]

9329 22 **Detecting polymeric nanoparticles with coherent anti-Stokes Raman scattering microscopy in tissues exhibiting fixative-induced autofluorescence** [9329-72]

POSTER SESSION

9329 27 **Parallel and flexible imaging using two-photon RESOLFT microscopy with spatial light modulator control (JenLab Young Investigator Award)** [9329-76]

9329 28 **New insights and system designs for temporally focused multiphoton optogenetics** [9329-77]

9329 29 **Effects of anesthesia on the cerebral capillary blood flow in young and old mice** [9329-78]

9329 2A **Determination of the spectral dependence of reduced scattering and quantitative second-harmonic generation imaging for detection of fibrillary changes in ovarian cancer** [9329-79]

9329 2B ***Ex vivo* label-free microscopy of head and neck cancer patient tissues** [9329-80]

9329 2C **A modular two-photon microscope for simultaneous imaging of distant cortical areas in vivo** [9329-81]

9329 2G **Improvement of the spatial resolution in multiphoton microscopy by saturated excitation of fluorescence** [9329-85]

9329 2H **Imaging calcium carbonate distribution in human sweat pore in vivo using nonlinear microscopy** [9329-86]

9329 2I **Statistical analysis on activation and photo-bleaching of step-wise multi-photon activation fluorescence of melanin** [9329-87]

9329 2L **High-resolution nonlinear ellipse rotation measurements for 3D microscopy** [9329-90]

9329 2M **Second harmonic generation quantitative measurements on collagen fibrils through correlation to electron microscopy** [9329-91]

9329 2N **2D simultaneous spatial and temporal focusing multiphoton microscopy for fast volume imaging with improved sectioning ability** [9329-92]

9329 2O **Optimizing laser and probe molecules for multi-photon microscopy** [9329-93]

9329 2P **Motionless polarization-resolved second harmonic generation imaging of corneal collagen** [9329-94]

9329 2Q ***In vivo* visualization of collagen fiber produced by cultured osteoblasts using sensitive second-harmonic-generation microscopy equipped with a 10-fs mode-locked Ti:sapphire laser** [9329-95]

9329 2U **Adaptation of commercial microscopes for advanced imaging applications** [9329-100]

9329 2W **Laser scanning stereomicroscopy for fast volumetric imaging with two-photon excitation and scanned Bessel beams** [9329-102]

9329 2X **Applied 3D printing for microscopy in health science research** [9329-103]

9329 33 **Multiphoton tomography to detect chemo- and biohazards** [9329-111]

9329 36 **Imaging cardiomyocytes in intact tissue with a remote focusing microscope (Student Poster Session Award)** [9329-114]

9329 38 **Investigating cell membrane structure and dynamics with TCSPC-FLIM** [9329-141]

9329 39 **Microsecond wide-field TCSPC microscopy based on an ultra-fast CMOS camera** [9329-142]

9329 3A **Comprehensive quantitative evaluation of FLIM-FRET microscopy** [9329-143]

Authors

Numbers in the index correspond to the last two digits of the six-digit citation identifier (CID) article numbering system used in Proceedings of SPIE. The first four digits reflect the volume number. Base 36 numbering is employed for the last two digits and indicates the order of articles within the volume. Numbers start with 00, 01, 02, 03, 04, 05, 06, 07, 08, 09, 0A, 0B...0Z, followed by 10-1Z, 20-2Z, etc.

Aimé, C., 2M
Allegra Mascaro, A. L., 03
Avti, Pramod, 29
Baldacchini, T., 0V
Bancelin, S., 2M
Barbano, E. C., 2L
Batista, Ana, 0E, 0U, 2P
Beaurepaire, Emmanuel, 0Z
Beeby, Andrew, 39
Beeson, K., 2O
Bélanger, Samuel, 29
Bisinger, D., 0C
Blab, Gerhard A., 0H
Borisov, Sergei, 0B
Börsch, Michael, 0A
Brehm, Bernhard, 19
Breunig, Hans Georg, 0E, 0U, 1N, 2P
Breymayer, J., 0C
Brideau, Craig, 2U, 2X
Brinchman, Jan E., 1C
Brown-Steinke, Kathleen, 0G
Bruncko, J., 0D
Bub, G., 36
Bückle, Rainer, 0Q
Burton, R. A. B., 36
Campagnola, Paul J., 2A
Campbell, Kirby R., 2A
Castonguay, Alexandre, 29
Chandrappa, Dayananda, 1J
Chen, Jerry L. 2C
Chen, Xueqin, 2H
Chen, Xun, 2W
Chorvat, D., Jr., 0D
Cicchi, Riccardo, 19
Coradin, T., 2M
Corbett, A. D., 36
Costantini, I., 03
Coura, J. A., 2L
Dall, Christopher P., 0P
Dana, Hod, 28
Deb, Sanghamitra, 0P
Degan, Simone, 0P
Dietzek, Benjamin, 19
DiMarzio, Charles A., 2I
Dmitriev, Ruslan I., 0B
Duport, François, 2G
Düser, Monika G., 0A
Ehmke, Tobias, 12
Emplit, Philippe, 2G
Fereidouni, Farzad, 0H
Finnøy, Andreas, 1C
Formanek, Florian, 2H
Franke, T., 0V
Gainey, Christina S., 0P
Galey, Jean-Baptiste, 2H
Gao, Jian, 0N
Garrett, N. L., 22
Gasecka, Alicja, 2H
Gerlach, Nicole, 0Q
Gerritsen, Hans C., 0H
Gladine, C., 0D
Godfrey, L., 22
Goldman, Serge, 2G
Gorza, Simon-Pierre, 2G
Gu, Zetong, 2I
Gusachenko, I., 2M
Hakulinen, T., 0V
Hase, Eiji, 2Q
Heinrich, Ulrike, 0Q
Heisterkamp, Alexander, 12
Heitkamp, Thomas, 0A
Helmchen, Fritjof, 2C
Hirosawa, Kenichi, 2N
Hirvonen, Liisa M., 39
Horilova, J., 0D
Huang, Zhiwei, 0T, 1P
Isobe, Keisuke, 2N
Kalinina, S., 0C
Kannari, Fumihiko, 2N
Klein, J., 0V
Knebl, Andreas, 12
Knott, G. W., 03
König, Karsten, 0E, 0Q, 0U, 1N, 2P, 33
Kowalczuk, L., 2M
Krüppel, Roland, 2C
Lai, Zhenhua, 2I
Lajdova, I., 0D
Lalatsa, A., 22
Lamb, Erin S., 20
Latour, G., 2M
Lattermann, Annika, 19
Lei, Ming, 2W
Le Marois, Alix, 38
Lesage, Frédéric, 29
Li, Runze, 2W
Lilledahl, Magnus, 1C
Lin, Danying, 0N
Lin, Jian, 0T, 1P

Luo, Yi, 0O
Maco, B., 03
Mahou, Pierre, 0Z
Marcek Chorvatova, A., 0D
Mateasik, A., 0D
Matthäus, Christian, 19
Mayblum, Tom, 28
Meyer, Tobias, 19
Midorikawa, Katsumi, 2N
Miguez, M. L., 2L
Misoguti, L., 2L
Moeini, Mohammad, 29
Moger, Julian, 1J, 22
Morgado, António Miguel, 0E
Nguyen, Anh Dung, 2G
Niu, Hanben, 0N
Olderøy, Magnus, 1C
Olstad, Kristin, 1C
Owen, Dylan M., 38
Ozeki, Yasuyuki, 1T
Palmer, Lisa A., 0G
Papkovsky, Dmitri B., 0B
Parilov, E., 2O
Pavone, Francesco S., 03, 19
Pei, Hanzhang, 20
Peng, Tong, 2W
Peng, Xiao, 0N
Periasamy, Ammasi, 0G, 3A
Petrášek, Zdenek, 39
Pietruszka, Anna, 0Q
Poon, Kelvin, 2U
Popp, Jürgen, 19
Potasek, M., 2O
Pouliot, Philippe, 29
Qu, Jianan Y., 0O
Qu, Junle, 0N
Rehman, Shagufta, 0G
Reitsma, Keimpe, 0H
Rigneault, Hervé, 2H
Rowlands, Christopher J., 27
Rück, A., 0C
Sacconi, L., 03
Sato, Katsuya, 2Q
Schanne-Klein, M.-C., 2M
Schatzlein, A., 22
Schejter, Adi, 28
Serrano, D. R., 22
Shah, Amy T., 2B
Shoham, Shy, 28
Silvestri, L., 03
Skala, Melissa C., 2B
Smirnoff, Nicholas, 1J
So, Peter T. C., 27
Song, Qiyuan, 2N
Starke, Ilka, 0A
Stys, Peter, 2U, 2X
Su, Bertram, 0A
Suhling, Klaus, 38, 39
Sun, Qiqi, 0O
Sun, Yuansheng, 3A
Supatto, Willy, 0Z
Svindrych, Zdenek, 3A
Tabatabaei, Maryam S., 29
Tameze-Rivas, Yasmine, 0P
Teh, Sengkhoon, 0T
Teplicky, T., 0D
Tilbury, Karissa B., 2A
Uchegbu, I. F., 22
Uchugonova, Aisada, 0E, 0U, 2P
Vanholsbeeck, Frédérique, 2G
Van Horn, Mark, 2W
Vermot, Julien, 0Z
Voigt, Fabian F, 2C
Wallrabe, Horst, 3A
Wang, Chun-Chin, 1J
Wang, Qi, 0N
Wang, Zi, 0T, 1P
Warren, Warren S., 0P
Weinigel, Martin, 0Q, 1N
Wilson, Jesse W., 0P
Wilson, T., 36
Wise, Frank W., 20
Wu, Di, 2W
Xue, Yi, 27
Yan, Wei, 0N
Yang, Yanlong, 2W
Yao, Baoli, 2W
Yasui, Takeshi, 2Q
Ye, Tong, 0N, 2W
Yin, Jihao, 2I
Zadoyan, R., 0V
Zareinia, Kourosh, 2X
Zarrabi, Nawid, 0A
Zeng, Yan, 0O
Zhang, Jennifer Y., 0P
Zhang, Wei, 0O
Zhang, Xi, 2I
Zheng, Wei, 0O
Zheng, Wei, 0T, 1P
Zhou, Jie, 0N
Zhou, Xing, 2W
Zilio, S. C., 2L

Conference Committee

Symposium Chairs

James G. Fujimoto, Massachusetts Institute of Technology (United States)
R. Rox Anderson, Wellman Center for Photomedicine, Massachusetts General Hospital (United States)and Harvard School of Medicine (United States)

Program Track Chairs

Ammasi Periasamy, University of Virginia (United States)
Daniel L. Farkas University of Southern California (United States)

Conference Chairs

Ammasi Periasamy, University of Virginia (United States)
Peter T. C. So, Massachusetts Institute of Technology (United States)
Karsten König, Universität des Saarlandes (Germany)

Conference Program Committee

Wolfgang Becker, Becker & Hickl GmbH (Germany)
Alberto Diaspro, Istituto Italiano di Tecnologia (Italy)
Chen-Yuan Dong, National Taiwan University (Taiwan)
Kevin W. Eliceiri, University of Wisconsin-Madison (United States)
Scott Fraser, California Institute of Technology (United States)
Paul M. W. French, Imperial College London (United Kingdom)
Hans C. Gerritsen, Universteit Utrecht (Netherlands)
Enrico Gratton, University of California, Irvine (United States)
Min Gu, Swinburne University of Technology (Australia)
Stefan W. Hell, Max-Planck-Institut für Biophysikalische Chemie (Germany)
Paul J. Campagnola, University of Wisconsin-Madison (United States)
Satoshi Kawata, Osaka University (Japan)
Fu-Jen Kao, National Yang-Ming University (Taiwan)
Arnd K. Krueger, Spectra-Physics®, a Newport Corporation Brand (United States)
Joseph R. Lakowicz, University of Maryland School of Medicine (United States)
Steve M. McDonald, Coherent, Inc. (United States)
Angelika C. Rueck, Universtät Ulm (Germany)
Junle Qu, Shenzhen University (China)
Steven S. Vogel, National Institutes of Health (United States)

Paul W. Wiseman, McGill University (Canada)
X. Sunney Xie, Harvard University (United States)
Bernhard Zimmermann, Carl Zeiss Jena GmbH (Germany)
Warren R. Zipfel, Cornell University (United States)
Chris Xu, Cornell University (United States)

Session Chairs

1 Keynote Session
Ammasi Periasamy, University of Virginia (United States)

2 FLIM/FRET/FCS I
Angelika C. Rueck, Universtät Ulm (Germany)

3 FLIM/FRET/FCS II
Michael Börsch, Friedrich-Schiller-Universtät Jena (Germany)

4 Technology Development and Application I
Karsten König, Universität des Saarlandes (Germany)

5 Technology Development and Application II
Aisada Uchugonova, Universität des Saarlandes (Germany)

JenLab Young Investigator Award Papers Presentation
Ammasi Periasamy, University of Virginia (United States)

6 Technology Development and Application III
Peter T. C. So, Massachusetts Institute of Technology (United States)

7 SHG/THG Microscopy I
Chen-Yuan Dong, National Taiwan University (Taiwan)

Award Presentation
Ammasi Periasamy, University of Virginia (United States)

8 SHG/THG Microscopy II
Paul J. Campagnola, University of Wisconsin-Madison (United States)

9 Biomedical Applications of Coherent Raman I
X. Sunny Xie, Harvard University (United States)

10 Biomedical Applications of Coherent Raman II
Daniel Cote, Centre de Recherche de l'Univ. Laval Robert-Giffard (Canada)

11 Coherent Raman Technical Development I
Ji-Xin Cheng, Purdue University (United States)

12 Coherent Raman Technical Development II
Dan Fu, Harvard University (United States)

Posters-Sunday
Holly Aaron, University of California, Berkeley (United States)
Steven S. Vogel, National Institutes of Health (United States)
Jesse W. Wilson, Duke University (United States)
Kevin W. Eliceiri, University of Wisconsin-Madison (United States)

Introduction

Multiphoton microscopy has been established as the 3D imaging method of choice for studying biomedical specimens from single cells to whole animals with sub-micron resolution. Two decades have passed since the realization of two-photon laser scanning microscopy. The ever-expanding scope of applications and the continuing instrumental innovations require a forum where new ideas can be exchanged and presented. Our conference at the SPIE BiOS 2015 meeting continues to address this need.

This was the 15th year of this conference and we started our conference with three keynote lectures from leaders in the field: Drs. Paras N. Prasad, Univ. at Buffalo (United States) [9329-1], Francesco S. Pavone, European Lab. for Non-linear Spectroscopy (Italy) [9329-2], and Wolfgang Becker, Becker & Hickl GmbH (Germany) [9329-3].

For the 4th year in a row, the conference was extremely pleased to have the JenLab Young Investigator Award in addition to our regular poster awards. This award was donated by Dr. Karsten König, President and Founder of JenLab GmbH (Germany). The award selection committee included Drs. Arnd Krueger, NewPort-Spectra Physics (United States); Conor Evans, Harvard Univ. (United States); Alberto Diaspro, Istituto Italiana di Tecnologia (Italy); and two of the conference chairs, Karsten König and Ammasi Periasamy. The selection process included the abstract, manuscript, and poster presentation. Two finalists were selected for oral presentation after their poster presentation. The two finalists were (1) Mr. Kirby R. Campbell from Univ. of Wisconsin-Madison (United States), for "Determination of the spectral dependence of reduced scattering and quantitative SHG imaging for detection of fibrillary changes in ovarian cancer" [9329-79] and (2) Ms. Yi Xue from Massachusetts Institute of Technology, Boston, Massachusetts (United States), for "Parallel and flexible imaging using two-photon RESOLFT microscopy with spatial light modulator control" [9329-76]. **Ms. Yi Xue** from Massachusetts Institute of Technology, Boston, Massachusetts (United States) was selected as the **winner of the JenLab Young Investigator Award 2015**.

For 15 years in a row, the conference organized poster awards for the students and postdoctoral fellows. The poster award was donated by all the conference sponsors including: Becker & Hickl, Chroma Technology, Coherent, ISS, Spectra-Physics, Princeton Instruments, Leica Microsystems, Semrock (IDEX), Veroptics and Carl Zeiss.

The 4 poster award winners were:

1. Charles-André Couture, Institut National de la Recherche Scientifique (Canada): "Interferometric second harmonic generation imaging of biological tissues" [9329-75]
2. Dapeng Zhang, The Chinese Univ. of Hong Kong (Hong Kong, China): "Multi-photon laser scanning omnidirectional imaging with tunable frame rate" [9329-89]
3. Joe T. Sharick, Vanderbilt Univ. (United States): "Monitoring metabolic enzyme activity in cells with fluorescence lifetime imaging of NAD(P)H" [9329-107]

4. Alexander D. Corbett, Univ. of Oxford (United Kingdom): "Imaging cardiomyocytes in intact tissue with a remote focusing microscope" [9329-114]

Some of the most valuable contributions in this volume are articles written by highly experienced practitioners of multiphoton microscopy. They have enumerated the most important considerations in designing multi-photon microscopes and imaging experiments. Further, updates on the state-of-the-art commercial multiphoton microscope systems are presented. This volume also includes articles describing some recent advances in major multiphoton microscope components and applications including laser light sources, ultrafast optics, filters, FRET, FLIM, FCS, Raman, CARS, SRS and CRS microscopy and spectroscopy, single molecule, super-resolution imaging, endoscopy, and various scientific and clinical applications.

On a personal note, the conference chairs are grateful for the participation of all authors and session chairs; and acknowledge the innovation-driven manufacturers and sponsors of this conference (Becker & Hickl, Chroma Technology, Coherent, ISS, Spectra-Physics, Princeton Instruments, Leica Microsystems, Semrock (IDEX), Veroptics, Carl Zeiss, and JenLab) for their enthusiastic support in organizing this conference successfully for the last 15 years. We look forward to other exciting conferences in the second decade and welcome your continued participation and support.

Ammasi Periasamy
Karsten König
Peter T. C. So

Congratulations to the 2014 Nobel Laureates in Chemistry

One personal note to the Fluorescence Microscopy Community: We were all delighted and congratulated the 2014 Nobel Laureates in Chemistry at the Photonics West 2015 BiOS in a special plenary session on Nobel award on 8 February 2015. This is the first time the SPIE organization celebrated the Nobel award in a special plenary session. Three scientists' shared the 2014 Nobel award for their achievements in super resolution microscopy:

Dr. Eric Betzig from Janelia Farm, Howard Hughes Medical Institute, Ashburn, Virginia (United States), for his achievement in Photoactivated Localization Microscopy (PALM).

Dr. Stefan W. Hell from Max-Planck-Institut für biophysikalische Chemie (Germany), for his achievement in Stimulated Emission Depletion (STED) microscopy.

Dr. William E. Moerner (WE) from Stanford Univ., California (United States), for his achievement in single molecule detection.

All the 'buzz' of the Nobel award was about that "Living Room", where Eric Betzig built the PALM microscopy imaging system in his friend's (Dr. Harald Hess) home. Eric Betzig dedicated his Nobel lecture about super-resolution optics to "all people taking risks but in the end failed". William Moerner mentioned that a single molecule is extremely small, which he was able to detect using various techniques. Stefan Hell also discovered in his journey to the award that it is possible to overcome the generally accepted resolution barrier. There is nothing that is impossible in science. All three have presented other scientific work in this conference at various times. Stefan Hell for example gave two memorable keynote lectures at this multiphoton conference during 2005, "Fluorescence nanoscopy through reversible optically saturable transitions" [5700-01], and again in 2010, "Nanoscopy with focused light" [7569-02].

The editors wish to congratulate the 2014 Nobel Laureates in Chemistry for their achievements in super-resolution microscopy.