PROCEEDINGS OF SPIE

SPIDigitalLibrary.org/conference-proceedings-of-spie

Front Matter: Volume 6443

, "Front Matter: Volume 6443," Proc. SPIE 6443, Three-Dimensional and Multidimensional Microscopy: Image Acquisition and Processing XIV, 644301 (31 March 2007); doi: 10.1117/12.729066

SPIE.

Event: SPIE BiOS, 2007, San Jose, California, United States

Three-Dimensional and Multidimensional Microscopy: Image Acquisition and Processing XIV

Jose-Angel Conchello
Carol J. Cogswell
Tony Wilson
Editors

23–25 January 2007
San Jose, California, USA

Sponsored and Published by
SPIE—The International Society for Optical Engineering

Volume 6443

Proceedings of SPIE—The International Society for Optical Engineering, 9780819465566, v.
6443

SPIE is an international technical society dedicated to advancing engineering and scientific
applications of optical, photonic, imaging, electronic, and optoelectronic technologies.

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 *Three-Dimensional and Multidimensional Microscopy: Image Acquisition and Processing XIV*, edited by Jose-Angel Conchello, Carol J. Cogswell, Tony Wilson, Proceedings of SPIE Vol. 6443 (SPIE, Bellingham, WA, 2007) Article CID Number.

ISSN 1605-7422
ISBN 9780819465566

Published by
SPIE—The International Society for Optical Engineering
P.O. Box 10, Bellingham, Washington 98227-0010 USA
Telephone 1 360/676-3290 (Pacific Time) • Fax 1 360/647-1445
<http://www.spie.org>

Copyright © 2007, The Society of Photo-Optical Instrumentation Engineers

Copying of material in this book for internal or personal use, or for the internal or personal use of specific clients, beyond the fair use provisions granted by the U.S. Copyright Law is authorized by SPIE subject to payment of copying fees. The Transactional Reporting Service base fee for this volume is \$18.00 per article (or portion thereof), which should be paid directly to the Copyright Clearance Center (CCC), 222 Rosewood Drive, Danvers, MA 01923. Payment may also be made electronically through CCC Online at <http://www.copyright.com>. Other copying for republication, resale, advertising or promotion, or any form of systematic or multiple reproduction of any material in this book is prohibited except with permission in writing from the publisher. The CCC fee code is 1605-7422/07/\$18.00.

Printed in the United States of America.

Contents

vii *Conference Committee*

SESSION 1 OPTICAL COHERENCE TOMOGRAPHY AND MICROSCOPY

- 644304 **Improved image-forming optics for transmission optical projection tomography** [6443-03]
Y. Wang, Oregon Health and Science Univ. (USA) and Foshan Univ. (China); R. Wang,
Oregon Health and Science Univ. (USA)

SESSION 2 METHODS FOR IMPROVED SPATIAL AND TEMPORAL RESOLUTION

- 644307 **Investigation of image properties in super-resolution microscopy using two-color
fluorescence dip spectroscopy** [6443-06]
Y. Iketaki, T. Watanabe, Olympus Corp. (Japan); N. Bokor, Budapest Univ. of Technology
and Economics (Hungary); M. Fujii, Tokyo Institute of Technology (Japan)
- 64430A **Large-area subpixel resolution imaging using a spatial light modulator** [6443-09]
A. Ballestad, B. McFadden, P. Lane, N. McKinnon, C. MacAulay, British Columbia Cancer
Research Ctr. (Canada); P. Constantinou, B. Wilson, Ontario Cancer Ctr. (Canada);
J. Yeow, Univ. of Waterloo (Canada)
- 64430B **True-color nanosecond time-gated fluorescence imaging using a CCD detector** [6443-10]
A. C. Mitchell, E. J. Wall, C. G. Morgan, Univ. of Salford (United Kingdom)

SESSION 3 NEW METHODS AND INSTRUMENTS I: FLUORESCENCE

- 64430C **Absolute and relative quantification and calibration for sectioning fluorescence
microscopy using standardized uniform fluorescent layers and SIPchart-based correction
procedures** [6443-26]
J. M. Zwier, Univ. of Amsterdam (Netherlands); L. Oomen, L. Brocks, K. Jalink, The
Netherlands Cancer Institute (Netherlands); G. J. Brakenhoff, Univ. of Amsterdam
(Netherlands)

Pagination: Proceedings of SPIE follow an e-First publication model, with papers published first online and then in print and on CD-ROM. Papers are published as they are submitted and meet publication criteria. A unique, consistent, permanent 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 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.

- 64430D **A novel approach to determining the three-dimensional location of microscopic objects with applications to 3D particle tracking** [6443-11]
S. Ram, Univ. of Texas Southwestern Medical Ctr. at Dallas (USA) and Univ. of Texas at Arlington (USA); J. Chao, P. Prabhat, Univ. of Texas Southwestern Medical Ctr. at Dallas (USA) and Univ. of Texas at Dallas (USA); E. S. Ward, Univ. of Texas Southwestern Medical Ctr. at Dallas (USA); R. J. Ober, Univ. of Texas Southwestern Medical Ctr. at Dallas (USA) and Univ. of Texas at Dallas (USA)
- 64430E **Compact optical design for dual-axes confocal endoscopic microscopes** [6443-12]
M. J. Mandella, J. T. C. Liu, Stanford Univ. (USA); W. Piyawattanametha, Stanford Univ. (USA) and National Electronics and Computer Technology Ctr. (Thailand); H. Ra, P.-L. Hsiung, L. K. Wong, O. Solgaard, T. D. Wang, C. H. Contag, G. S. Kino, Stanford Univ. (USA)
- 64430G **Spectral imaging of microscopic samples with high-performance CCD array-based spectrometer** [6443-14]
O. Pawluczyk, R. Pawluczyk, P&P Optica Inc. (Canada)
- 64430H **An optical technique for fast focusing applied to high-aperture microscopy** [6443-15]
E. Botcherby, R. Juškaitis, M. Booth, T. Wilson, Univ. of Oxford (United Kingdom)

SESSION 4 NEW METHODS AND INSTRUMENTS II: PHASE AND REFLECTED LIGHT

- 64430J **Quantitative phase imaging using grating-based quadrature phase interferometer** [6443-17]
J. Wu, Z. Yaqoob, X. Heng, X. Cui, C. Yang, California Institute of Technology (USA)
- 64430K **Multiwavelength digital holographic microscopy for submicron topography of reflecting specimens** [6443-18]
F. Montfort, F. Charrière, J. Kühn, École Polytechnique Fédérale de Lausanne (Switzerland); T. Colomb, Ctr. Hospitalier Univ. Vaudois (Switzerland); E. Cucho, Y. Emery, Lyncée Tec SA (Switzerland); P. Marquet, Ctr. Hospitalier Univ. Vaudois (Switzerland); C. Depeursinge, École Polytechnique Fédérale de Lausanne (Switzerland)
- 64430L **A compact polarization converter to observe molecular orientation** [6443-19]
M. Hashimoto, K. Yoshiki, R. Kanamaru, Osaka Univ. (Japan); N. Hashimoto, Citizen Watch Co., Ltd. (Japan); T. Araki, Osaka Univ. (Japan)
- 64430M **Calibration of a phase-shifting DIC microscope for quantitative phase imaging** [6443-45]
S. V. King, A. R. Libertun, Univ. of Colorado, Boulder (USA); C. Preza, Univ. of Memphis (USA); C. J. Cogswell, Univ. of Colorado, Boulder (USA) and CDM Optics, Inc. (USA)

SESSION 5 RECENT ADVANCES IN COMPUTATIONAL MICROSCOPY

- 64430N **Extension of multidimensional microscopy to ultrasensitive applications with maximum-likelihood analysis** [6443-21]
L. M. Davis, G. Shen, Univ. of Tennessee Space Institute (USA)

- 64430O **Signal post processing in frequency domain OCT and OCM using a filter bank approach** [6443-22]
B. Hofer, Cardiff Univ. (United Kingdom) and Vienna Univ. of Technology (Austria);
B. Považay, B. Hermann, A. Unterhuber, Cardiff Univ. (United Kingdom); G. Matz,
F. Hlawatsch, Vienna Univ. of Technology (Austria); W. Drexler, Cardiff Univ. (United Kingdom)

SESSION 6 ANALYSIS AND CHARACTERIZATION OF MICROSCOPES

- 64430Q **Comparison of three-dimensional transfer function analysis of alternative phase imaging methods** [6443-23]
S. S. Kou, C. J. R. Sheppard, National Univ. of Singapore (Singapore)
- 64430R **Mie scattering model for dual-axes confocal architecture** [6443-24]
L. K. Wong, Stanford Univ. School of Medicine (USA); M. J. Mandella, Stanford Univ. (USA);
P. Holcomb, Breault Research Organization, Inc. (USA); G. S. Kino, Stanford Univ. (USA);
T. D. Wang, Stanford Univ. School of Medicine (USA)
- 64430S **Effects of specimen morphology on adaptive confocal and multiphoton microscopy** [6443-25]
M. J. Booth, T. Wilson, Univ. of Oxford (United Kingdom)

SESSION 7 RECENT ADVANCES IN MULTIPHOTON AND CONFOCAL MICROSCOPY I

- 64430U **Development of a random access multiphoton microscope for fast three-dimensional functional recording of neuronal activity** [6443-28]
D. Reddy, Rice Univ. (USA); P. Saggau, Baylor College of Medicine (USA) and Rice Univ. (USA)

SESSION 8 RECENT ADVANCES IN MULTIPHOTON AND CONFOCAL MICROSCOPY II

- 64430W **Confocal fluorescence lifetime imaging microscopy based on a real-time sampling method** [6443-30]
Y. S. Bae, D. Lee, S. Moon, Y. J. Won, D. Y. Kim, Gwangju Institute of Science and Technology (South Korea)
- 64430X **Full-pupil versus divided-pupil confocal line-scanners for reflectance imaging of human skin in vivo** [6443-31]
D. Gareau, S. Abeytunge, M. Rajadhyaksha, Memorial Sloan Kettering Cancer Ctr. (USA)
- 64430Y **High-resolution laser scanning microscopy with saturated excitation of fluorescence** [6443-32]
K. Fujita, S. Kawano, Osaka Univ. (Japan); M. Kobayashi, Nanophoton Corp. (Japan);
S. Kawata, Osaka Univ. (Japan) and RIKEN (Japan)
- 64430Z **Observation of cell dynamics by laser scanning Raman microscope** [6443-33]
K. Hamada, K. Fujita, Osaka Univ. (Japan); M. Kobayashi, Nanophoton Corp. (Japan);
S. Kawata, Osaka Univ. (Japan) and RIKEN (Japan)

644310 **Programmable diffractive optics for laser scanning confocal microscopy** [6443-34]
B. R. Boruah, M. A. A. Neil, Imperial College London (United Kingdom)

644311 **Toward a compact dual-wedge point-scanning confocal reflectance microscope**
[6443-35]
W. C. Warger II, S. A. Guerrero, C. A. DiMarzio, Northeastern Univ. (USA)

SESSION 9 NOVEL ILLUMINATION SOURCES

644313 **Microscopy using micropixelated light emitting diodes** [6443-37]
V. Poher, G. T. Kennedy, D. S. Elson, P. M. W. French, M. A. A. Neil, Imperial College London (United Kingdom); H. Z. Zhang, E. Gu, Z. Gong, C. Griffin, J. M. Girkin, M. D. Dawson, Univ. of Strathclyde (United Kingdom)

644315 **Fluorescence lifetime imaging using light-emitting diodes** [6443-39]
G. T. Kennedy, D. S. Elson, I. Munro, V. Poher, P. M. W. French, M. A. A. Neil, Imperial College London (United Kingdom)

POSTER SESSION

644317 **Measurement of relative phase distribution of onion epidermal cells by using the polarization microscope** [6443-42]
I. H. Shin, J. Y. Lee, S. Lee, D. J. Lee, D. Y. Kim, Gwangju Institute of Science and Technology (South Korea)

644318 **High-speed line-scanning confocal microscope for biological imaging** [6443-43]
S.-H. Jung, C.-K. Kim, S.-B. Ju, Y.-J. Cho, H.-W. Jeong, B.-M. Kim, Yonsei Univ. (South Korea)

644319 **Soft computing approach to confocal and two-photon excitation microscopy** [6443-44]
G. Vicidomini, Univ. of Genoa (Italy) and IFOM (Italy); P. P. Mondal, ICTP (Italy); A. Diaspro, Univ. of Genoa (Italy), IFOM (Italy), and CNR Institute of Biophysics (Italy)

Author Index

Conference Committee

Symposium Chairs

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

Program Track Chairs

Ammasi Periasamy, University of Virginia (USA)
Daniel Farkas, Cedars-Sinai Medical Center (USA)

Conference Chairs

Jose-Angel Conchello, Oklahoma Medical Research Foundation (USA)
Carol J. Cogswell, University of Colorado/Boulder (USA) and CDM Optics, Inc. (USA)
Tony Wilson, University of Oxford (United Kingdom)

Program Committee

Fred Brakenhoff, Universiteit van Amsterdam (Netherlands)
Thomas G. Brown, University of Rochester (USA)
Charles A. DiMarzio, Northeastern University (USA)
Mats G. Gustafsson, University of California/San Francisco (USA)
Gordon S. Kino, Stanford University (USA)
Raimund J. Ober, The University of Texas at Dallas (USA) and The University of Texas Southwestern Medical Center (USA)
Rudolf Oldenbourg, Marine Biological Laboratory (USA)

Session Chairs

- 1 Optical Coherence Tomography and Microscopy
 Raimund J. Ober, The University of Texas at Dallas (USA) and The University of Texas Southwestern Medical Center (USA)
- 2 Methods for Improved Spatial and Temporal Resolution
 Mats G. Gustafsson, University of California/San Francisco (USA)
- 3 New Methods and Instruments I: Fluorescence
 Fred Brakenhoff, Universiteit van Amsterdam (Netherlands)
- 4 New Methods and Instruments II: Phase and Reflected Light
 Thomas G. Brown, University of Rochester (USA)

- 5 Recent Advances in Computational Microscopy
Gordon S. Kino, Stanford University (USA)
- 6 Analysis and Characterization of Microscopes
Gordon S. Kino, Stanford University (USA)
- 7 Recent Advances in Multiphoton and Confocal Microscopy I
Charles A. DiMarzio, Northeastern University (USA)
- 8 Recent Advances in Multiphoton and Confocal Microscopy II
Charles A. DiMarzio, Northeastern University (USA)
- 9 Novel Illumination Sources
Thomas G. Brown, University of Rochester (USA)