

PROCEEDINGS OF SPIE

Ultrafast Phenomena and Nanophotonics XX

Markus Betz
Abdulahkem Y. Elezzabi
Editors

15–18 February 2016
San Francisco, California, United States

Sponsored by
SPIE

Cosponsored by
Spectra-Physics (United States)

Published by
SPIE

Volume 9746

Proceedings of SPIE 0277-786X, V. 9746

SPIE is an international society advancing an interdisciplinary approach to the science and application of light.

Ultrafast Phenomena and Nanophotonics XX, edited by Markus Betz, Abdulahkem Y. Elezzabi,
Proc. of SPIE Vol. 9746, 974601 · © 2016 SPIE · CCC code: 0277-786X/16/\$18
doi: 10.1117/12.2240356

Proc. of SPIE Vol. 9746 974601-1

The papers 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. Additional papers and presentation recordings may be available online in the SPIE Digital Library at SPIDigitalLibrary.org.

The papers 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 these proceedings:

Author(s), "Title of Paper," in *Ultrafast Phenomena and Nanophotonics XX*, edited by Markus Betz, Abdulkhakem Y. Elezzabi, Proceedings of SPIE Vol. 9746 (SPIE, Bellingham, WA, 2016) Article CID Number.

ISSN: 0277-786X
ISSN: 1996-756X (electronic)
ISBN: 9781628419818

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

Copyright © 2016, 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 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 0277-786X/16/\$18.00.

Printed in the United States of America.

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

**SPIE. DIGITAL
LIBRARY**
SPIDigitalLibrary.org

Paper Numbering: *Proceedings of SPIE* follow an e-First publication model. A unique citation identifier (CID) number is assigned to each article at the time of 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 and print versions of the publication. SPIE uses a six-digit CID article numbering system structured as follows:

- 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.

Contents

vii	<i>Authors</i>
ix	<i>Conference Committee</i>

THZ PLASMONICS

9746 02	Terahertz-field-induced ionization effect in a single nano island (Invited Paper) [9746-1]
---------	---

THZ SPECTROSCOPY I

9746 07	High-harmonic generation in solids (Invited Paper) [9746-6]
---------	--

DYNAMICS IN SEMICONDUCTOR NANOSTRUCTURES

9746 0A	Excitonic effects in quantum dot intraband spectroscopy indicating the formation of bound continuum excitons [9746-9]
9746 0E	An investigation of semiconductor nanoparticles for application to all-optical switching [9746-13]
9746 0F	Theory of coupled hybrid inorganic/organic systems: Excitation transfer at semiconductor/molecule interfaces [9746-14]

ULTRAFAST PHENOMENA IN CARBON NANOMATERIALS

9746 0G	Ultrafast electron transport in graphene and magnetic nanostructures (Invited Paper) [9746-15]
9746 0I	Buckled graphene-like materials in ultrashort and strong optical fields [9746-17]
9746 0K	Carbon nanotubes for mode-locking: polarization study [9746-19]

THZ SPECTROSCOPY II

9746 0R	Nonperturbative THz nonlinearities for many-body quantum control in semiconductors (Invited Paper) [9746-26]
---------	---

NONLINEAR OPTICAL PHENOMENA

- 9746 0V **Investigation of coupled optical parametric oscillators for novel applications (Invited Paper)** [9746-30]
- 9746 0W **Photocurrents in semiconductors and semiconductor quantum wells analyzed by k.p-based Bloch equations** [9746-31]

PLASMONICS AND METAMATERIALS

- 9746 10 **Ultrafast imaging of plasmons in a transmission electron microscope (Invited Paper)** [9746-36]
- 9746 12 **Design of integrated YIG-based isolators and high-speed modulators (Best Student Paper Award)** [9746-38]

NANOPHOTONICS

- 9746 15 **Ultrafast all-optical switching with photonic nanojets and semiconductor nanoparticles** [9746-41]
- 9746 17 **Ultrastrong light-matter-coupling at 250 GHz** [9746-43]
- 9746 18 **SPASER as a complex system: femtosecond dynamics traced by ab-initio simulations** [9746-44]

TWO-DIMENSIONAL SPECTROSCOPY

- 9746 1B **Multidimensional coherent spectroscopy of a semiconductor microcavity** [9746-46]
- 9746 1D **Efficient numerical method for calculating Coulomb coupling elements and its application to two-dimensional spectroscopy** [9746-48]

ULTRAFAST CARRIER AND SPIN DYNAMICS

- 9746 1E **Analyzing ultrafast laser-induced demagnetization in Co/Cu(001) via the depth sensitivity of the time-resolved transversal magneto-optical Kerr effect (Invited Paper)** [9746-50]
- 9746 1H **Heat-induced magnetization dynamics due to ultrafast exchange scattering with itinerant electrons (Invited Paper)** [9746-49]

ULTRAFAST STRUCTURAL AND PHONONIC DYNAMICS

- 9746 1K **Electro-phononics for modulating acoustic pulses (Invited Paper)** [9746-55]

PLASMONICS

9746 1Q **High-energy attosecond nanoplasmonic-based electron gun** [9746-61]

ULTRAFAST PHENOMENA IN 2D MATERIALS I

9746 1T **Coherent quantum dynamics of excitons in monolayer transition metal dichalcogenides (Invited Paper)** [9746-64]

POSTER SESSION

9746 20 **On the problems of stability and durability of field-emission current sources for electrovacuum devices** [9746-71]

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.

Aban'shin, Nikolay P., 20
Afkhamiardakani, Hanieh, 0K
Akchurin, Garif G., 20
Akchurin, Georgy G., 20
Apalkov, Vadym, 0I
Arissian, Ladan, 0K
Avetisyan, Yuri A., 20
Baierl, S., 0R
Baral, Alexander, 1H
Bayer, A., 0R
Beck, Mattias, 17
Bergeard, Nicolas, 1E
Berghäuser, Gunnar, 1T
Berruto, Gabriele, 10
Bieler, Mark, 0W
Born, Brandon, 0E, 15
Bougeard, D., 0R
Bovensiepen, Uwe, 1E
Bristow, Alan D., 1B
Carbone, Fabrizio, 10
Chen, Chang-Hsiao, 1T
Chen, Jinghao, 1E
Clark, Genevieve, 1T
Dass, Chandriker Kavir, 1T
Diels, Jean-Claude, 0K
Ding, Yujie J., 0V
Duc, Huynh Thanh, 0W
Elezzabi, A. Y., 12, 1Q
Eschenlohr, Andrea, 1E
Faist, Jérôme, 17
Firby, C. J., 12
Fratolocchi, Andrea, 18
Gehl, Michael, 1B
Geoffroy-Gagnon, Simon, 0E, 15
Greig, S. R., 1Q
Hao, Kai, 1T
Hohenleutner, M., 07, 0R
Holzman, Jonathan F., 0E, 15
Huber, R., 07, 0R
Huttner, U., 07
Jeong, Hoonill, 1K
Jho, Young-Dahl, 1K
Kamer, Brian, 0K
Khitrova, Galina, 1B
Kira, M., 07, 0R
Kivshar, Yuri S., 18
Knorr, Andreas, 0F, 1T
Knorr, M., 07
Koch, S. W., 07, 0R
Koochaki Kelardeh, Hamed, 0I
Krupa, Jeffrey D. A., 15
Kuhn, Sandra C., 0A, 1D
Lamb, Raymond J., 10
Lange, C., 0R
Langer, F., 07
Li, Lain-Jong, 1T
Li, Ming-Yang, 1T
Li, Xiaoqin, 1T
Lummen, Tom T. A., 10
Maag, T., 0R
Maissen, Curdin, 17
Malic, Ermin, 1T
McGrouther, Damien, 10
Meier, Torsten, 0W
Miroshnichenko, Andrey E., 18
Moody, Galan, 1T
Mootz, M., 0R
Passmann, Felix, 1B
Podzimski, Reinold, 0W
Priyadarshi, Shekhar, 0W
Reichl, Christian, 17
Richter, Marten, 0A, 0F, 1D
Rösner, Malte, 1E
Scalari, Giacomo, 17
Schmidt, Christian, 0W
Schneider, Hans Christian, 1H
Schubert, O., 07
Seo, Minah, 02
Singh, Akshay, 1T
Specht, Judith F., 0F
Stockman, Mark I., 0I
Tarasevitch, Alexander, 1E
Theuerholz, T. Sverre, 0F
Toma, Andrea, 10
Totero Gongora, Juan Sebastian, 18
Tran, Kha, 1T
Turchinovich, Dmitry, 0G
Verdenhalven, Eike, 0F
Vollmar, Svenja, 1H
Wegscheid, Werner, 17
Wehling, Tim O., 1E
Weidtmann, Boris, 1E
Wieczorek, Jens, 1E
Wilmer, Brian L., 1B
Xu, Lixiang, 1T
Xu, Xiaodong, 1T
Yakunin, Alexander N., 20
Zimmermann, Anke, 1D

Conference Committee

Symposium Chairs

Jean-Emmanuel Broquin, IMEP-LAHC (France)
Shibin Jiang, AdValue Photonics, Inc. (United States)

Symposium Co-chairs

David L. Andrews, University of East Anglia (United Kingdom)
Alexei L. Glebov, OptiGrate Corporation (United States)

Program Track Chair

James G. Grote, Air Force Research Laboratory (United States)

Conference Chairs

Markus Betz, Technische Universität Dortmund (Germany)
Abdulahkem Y. Elezzabi, University of Alberta (Canada)

Conference Program Committee

Alan D. Bristow, West Virginia University (United States)
Yujie J. Ding, Lehigh University (United States)
Kazuhiko Hirakawa, The University of Tokyo (Japan)
Rupert Huber, Universität Regensburg (Germany)
Robert A. Kaindl, Lawrence Berkeley National Laboratory
(United States)
Dai-Sik Kim, Seoul National University (Korea, Republic of)
Xiaoqin Li, The University of Texas at Austin (United States)
Christoph Lienau, Carl von Ossietzky Universität Oldenburg (Germany)
Torsten Meier, Universität Paderborn (Germany)
Walter Pfeiffer, Universität Bielefeld (Germany)
Pascal Ruello, Université du Maine (France)
Volker J. Sorger, The George Washington University (United States)
Fabrice Vallee, Université Claude Bernard Lyon 1 (France)

Session Chairs

- 1 THz Plasmonics
Abdulahkem Y. Elezzabi, University of Alberta (Canada)
- 2 THz Spectroscopy I
Markus Betz, Technische Universität Dortmund (Germany)

- 3 Dynamics in Semiconductor Nanostructures
Michael B. Johnston, University of Oxford (United Kingdom)
- 4 Ultrafast Phenomena in Carbon Nanomaterials
Markus Betz, Technische Universität Dortmund (Germany)
- 5 Ultrafast Phenomena in Perovskites
Dmitry Turchinovich, Max-Planck-Institut für Polymerforschung (Germany)
- 6 THz Spectroscopy II
Krzysztof Iwaszczuk, DTU Fotonik (Denmark)
- 7 Nonlinear Optical Phenomena
Kenneth L. Knappenberger, Florida State University (United States)
- 8 Plasmonics and Metamaterials
Maiken H. Mikkelsen, Duke University (United States)
- 9 Nanophotonics
Thomas Zentgraf, Universität Paderborn (Germany)
- 10 Two-Dimensional Spectroscopy
Christoph Lange, Universität Regensburg (Germany)
- 11 Ultrafast Carrier and Spin Dynamics
Tom Lummen, Ecole Polytechnique Fédérale de Lausanne (Switzerland)
- 12 Ultrafast Structural and Phononic Dynamics
James Lloyd-Hughes, The University of Warwick (United Kingdom)
- 13 Plasmonics
Ralph Ernstorfer, The Fritz-Haber Institut (Germany)
- 14 Ultrafast Phenomena in 2D Materials I
Shawn Greig, University of Alberta (Canada)
- 15 Ultrafast Phenomena in 2D Materials II
Rohit P. Prasankumar, Los Alamos National Laboratory (United States)