Contents

vii Authors
 ix Conference Committee
 xiii Introduction
 xv Nano-bio-optomechanics: nanoaperture tweezers probe single nanoparticles, proteins, and their interactions (Plenary Paper) [9544-501]

TAILORING IR LIGHT I: NOVEL EMITTERS, SOURCES, AND DETECTORS

9546 03 Wideband and wide angle thermal emitters for use as lightbulb filaments [9546-2]

TAILORING IR LIGHT II: EXTRA-ORDINARY BEAM CONTROL

9546 07 Selectively reflective transparent sheets [9546-76]

PHOTONIC-CRYSTAL-BASED ACTIVE DEVICES

9546 0D Fabrication and characterization of near thresholdless lasers at room temperature (Invited Paper) [9546-12]

FROM ORDER TO DISORDER: MOLDING LIGHT BY BREAKING PERIODIC ORDER

9546 0E Transverse Anderson localization and image transport through disordered fibers (Invited Paper) [9546-13]
9546 0F Hyperuniform photonic slabs for high-Q cavities and low-loss waveguides [9546-14]

DYNAMIC CONTROL OF OPTICAL SYSTEMS

9546 0K Highly-nonlinear quantum-engineered polaritonic metasurfaces (Invited Paper) [9546-20]
9546 0O Advanced electrodynamic mechanisms for the nanoscale control of light by light (Invited Paper) [9546-24]

NEW LASING PARADIGMS

9546 0Z Single mode parity-time laser (Best Student Paper) [9546-35]
## QUANTUM DOTS: NEW FUNCTIONALITIES AND FABRICATION

| 9546 15 | Controlled growth of CdSe quantum dots on silica spheres [9546-41] |

## WEAK AND STRONG COUPLING

| 9546 16 | Collective properties and strong coupling in the near-field of a meta-surface (Invited Paper) [9546-42] |

## NEW PLATFORMS AND THEORETICAL METHODS FOR SPONTANEOUS EMISSION

| 9546 1A | Theory of phonon-modified spontaneous emission and photoluminescence intensity from quantum dots coupled to structured photonic reservoirs (Invited Paper) [9546-46] |
| 9546 1C | Photonic and plasmonic nanoresonators: a modal approach (Invited Paper) [9546-48] |

## TOPOLOGICAL EFFECTS AND EFFECTIVE GAUGE FIELDS IN PHOTONICS

| 9546 1G | Using time-dependent effective gauge field for photons to achieve dynamic localization of light [9546-51] |

## EXOTIC TRANSPORT AND AMPLIFICATION BY SYNERGY OF GAIN AND LOSS

| 9546 1H | Light scattering in pseudo-passive media with uniformly balanced gain and loss (Invited Paper) [9546-54] |
| 9546 1J | Parity-time anti-symmetric parametric amplification (Invited Paper) [9546-56] |

## EXTREME LIGHT CONTROL FOR ENERGY APPLICATIONS

| 9546 1M | Controlling optical absorption in metamaterial absorbers for plasmonic solar cells (Invited Paper) [9546-59] |
| 9546 1N | Optimized absorption of solar radiations in nano-structured thin films of crystalline silicon via a genetic algorithm (Invited Paper) [9546-60] |

## TUNABLE EM PHENOMENA AND DEVICES

| 9546 1Q | Transforming Cherenkov radiation in metamaterials (Invited Paper) [9546-63] |
| 9546 1S | Magneto-optical switches in metal-dielectric-metal plasmonic waveguides [9546-65] |
Second order nonlinearity in Si by inhomogeneous strain and electric fields (Invited Paper) [9546-66]

Hybrid optical-thermal devices and materials for light manipulation and radiative cooling (Invited Paper) [9546-6]

EXTRAORDINARY NONLINEAR PHENOMENA AND SYSTEMS

Optical pulse engineering and processing using optical nonlinearities of nanostructured waveguides made of silicon (Invited Paper) [9546-71]

POSTER SESSION

Intense terahertz-pulse generation by four-wave mixing process in induced gas plasma [9546-73]

Moving femtosecond soliton in layered structure with cubic nonlinearity [9546-78]
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.

Adams, Wyatt, 1M
Alù, Andrea, 0K
Amann, Markus-Christian, 0K
Amoah, Timothy, 0F
Andrews, David L., 0O
Antonosyan, Diana A., 1J
Ballato, John, 0E
Basiiri, A., 1H
Belkin, Mikhail A., 0K
Bianco, Federica, 0T
Boriskina, Svetlana V., 1U
Bradshaw, David S., 0O
Buranasiri, P., 21
Canet-Ferrer, J., 0D
Cazzanelli, Massimo, 1T
Chen, Gang, 1U
Clowes, Steven K., 07
Dancaert, Jan, 1Q
Demmerle, Frederic, 0K
Deparis, Olivier, 1N
Dowling, Jonathan P., 03
Fan, Shanlui, 0G
Felbacq, Didier, 16
Feng, Liang, 0Z
Florescu, Marlan, 07, 0F
Foroughi Nezhad, Vahid, 1S
Ginis, Vincent, 1Q
Gomez-Diaz, Juan Sebastian, 0K
Gordon, Reuven, 0X
Granier, Christopher H., 03
Güney, Durdu Ö., 1M
Gwamuri, Jephias, 1M
Haddadpour, Ali, 1S
Herman, Aline, 1N
Hsu, Wei-Chun, 1U
Huang, Xiaopeng, 1U
Hughes, S., 1A
Hugolin, J.-P., 1C
Jo, Dong-Hyun, 15
Kang, Kwang-Sun, 1S
Karbasi, Salman, 0E
Kim, Byoung-Ju, 15
Kim, Do-Kyoon, 15
Kim, Do-Kyun, 15
Koch, K. W., 0E
Kottos, T., 1H
Lalanne, P., 1C
Lavdas, Spyros, 1Z
Lee, Jongwon, 0K
Leeder, Jamie M., 00
Lim, Se-Han, 15
Llorens, J. M., 0D
Loomis, James, 1U
Lorenzo, Simón G., 03
Lysak, T. M., 25
Ma, Ren-Min, 0Z
Mafi, Arash, 0E
Martinez-Pastor, J. P., 0D
Mayer, Alexandre, 1N
Müller, Jérôme, 1N
Muñoz-Camúñez, L. E., 0D
Muñoz-Matutano, G., 0D
Nookala, Nishant, 0K
Osgood, Richard M., 1Z
Panoiu, Nicolae C., 1Z
Park, Jin-Young, 1S
Pavesi, Lorenzo, 1T
Pearce, Joshua M., 1M
Postigo, P. A., 0D
Prieto, I., 0D
Ripalda, J. M., 0D
Robles, C., 0D
Roy Choudhury, Kaushik, 1A
Sauvan, C., 1C
Schilling, Jörg, 1T
Schriever, Clemens, 1T
Soinsetev, Alexander S., 1J
Sukhorukov, Andrey A., 1J
Sweeney, Steven J., 07
Taboada, A. G., 0D
Tassin, Philippe, 1Q
Tong, Jonathan K., 1U
Trostino, Vyacheslav A., 25
Tymchenko, Mykhailo, 0K
Veretenincoff, Irina, 1Q
Veronis, Georgios, 03, 1S
Vitebskiy, I., 1H
Vora, Ankit, 1M
Waché, Rémi, 07
Wang, Yuan, 0Z
Weinstein, Lee, 1U
Wicham, S., 21
Wong, Zi Jing, 0Z
You, Jie, 1Z
Yu, Zongfu, 1S
Yuan, Luqi, 1G
Zhang, Xiang, 0Z
Conference Committee

Symposium Chairs

Satoshi Kawata, Osaka University (Japan)
Manijeh Razeghi, Northwestern University (United States)

Symposium Co-chairs

David L. Andrews, University of East Anglia (United Kingdom)
James G. Grote, Air Force Research Laboratory (United States)

Conference Chairs

Ganapathi S. Subramania, Sandia National Laboratories (United States)
Stavroula Foteinopoulou, The University of New Mexico (United States)

Conference Program Committee

Koray Aydin, Northwestern University (United States)
Paul V. Braun, University of Illinois at Urbana-Champaign (United States)
Kurt Busch, Humboldt-Universität zu Berlin (Germany)
Shanhui Fan, Stanford University (United States)
Didier Felbacq, Université Montpellier 2 (France)
Alexander V. Kildishev, Purdue University (United States)
Yuri S. Kivshar, The Australian National University (Australia)
Michal F. Lipson, Cornell University (United States)
Cefe López, Consejo Superior de Investigaciones Científicas (Spain)
Michelle L. Povinelli, The University of Southern California (United States)
Jörg Schilling, Martin-Luther-Universität Halle-Wittenberg (Germany)
Andrey A. Sukhorukov, The Australian National University (Australia)
Kosmas L. Tsakmakidis, University of California, Berkeley (United States)
Georgios Veronis, Louisiana State University (United States)
Ralf B. Wehrspohn, Fraunhofer-Institut für Werkstoffmechanik (Germany)
Daniel M. Wasserman, University of Illinois at Urbana-Champaign (United States)
William Whelan-Curtin, University of St. Andrews (United Kingdom)
Session Chairs

Opening Remarks
Ganapathi S. Subramania, Sandia National Laboratories (United States)

1 Tailoring IR Light I: Novel Emitters, Sources, and Detectors
Michelle L. Povinelli, The University of Southern California (United States)

2 Tailoring IR Light II: Extra-Ordinary Beam Control
Sanjay Krishna, The University of New Mexico (United States)

3 Photonic-Crystal-Based Active Devices
Arash Mafi, The University of New Mexico (United States)

4 From Order to Disorder: Molding Light by Breaking Periodic Order
Susumu Noda, Kyoto University (Japan)

NanoScience + Engineering Plenary Session
Satoshi Kawata, Osaka University (Japan)
David L. Andrews, University of East Anglia (United Kingdom)

5 Advances in Fabrication for Active Photonics
Simeon Bogdanov, Purdue University (United States)

6 Dynamic Control of Optical Systems
Rupert F. Oulton, Imperial College London (United Kingdom)

7 Single Photons and Photonic Quantum Information Platforms
Ganapathi S. Subramania, Sandia National Laboratories (United States)

8 New Lasing Paradigms
Immo Söllner, Niels Bohr Institute (Denmark)

9 Quantum Dots: New Functionalities and Fabrication
Arthur J. Fischer, Sandia National Laboratories (United States)

10 Weak and Strong Coupling
Stephen Hughes, Queen's University (Canada)

11 New Platforms and Theoretical Methods for Spontaneous Emission
Gennady B. Shvets, The University of Texas at Austin (United States)
12 Topological Effects and Effective Gauge Fields in Photonics
   Hakan E. Tureci, Princeton University (United States)

13 Exotic Transport and Amplification by Synergy of Gain and Loss
   Stavroula Foteinopoulou, The University of New Mexico (United States)

14 Extreme Light Control for Energy Applications
   Svetlana V. Boriskina, Massachusetts Institute of Technology
   (United States)

15 Tunable EM Phenomena and Devices
   Michael J. Naughton, Boston College (United States)

16 New EM Phenomena and Modeling Methods of Atomically Thick
   Materials
   Durdu O. Guney, Michigan Technological University (United States)

17 Extraordinary Nonlinear Phenomena and Systems
   Philippe Tassin, Chalmers University of Technology (Sweden)

Award Announcement and Closing Remarks
   Stavroula Foteinopoulou, The University of New Mexico (United States)
   Ganapathi S. Subramania, Sandia National Laboratories
   (United States)
Introduction

2015 has been proclaimed by the United Nations as “the International Year of Light and Light-based Technologies” to celebrate the extra-ordinary technologies we have available in our everyday lives thanks to the progress in the science of light. Light is a key protagonist in overcoming barriers in a vast range of applications, from telecommunications, to medical diagnosis and treatment, to energy management and computing.

To make use of the tremendous potential of light, we must be able to sculpt the landscape of light from the micro- to the nano-scale, while also being able to tame and trap light in time. Research with clever designs of complex structured materials continues to bring about new phenomena and capabilities with light. Pairing such extra-ordinary manmade photonic materials with active or dynamically tunable materials as well as quantum emitters unleashes new unexplored directions.

The Active Photonic Materials VII conference brought together the current developments in this exciting and growing field with new types of EM behaviors and devices being reported. Many exciting talks focused on new paradigms of light amplification, spontaneous emission, and lasing. These were enabled by a vast range of proposed mechanisms, such as by cleverly exploiting judiciously designed plasmonic resonances, exciting slow-light modes, exciting photonic defect states in periodic photonic crystals, and by utilizing light localization in randomly structured media. There were a number of interesting talks that also reported on the developments of new suitable theoretical tools necessary to properly understand and predict the behavior of emitters in these complex EM environments. A growing direction in the field of active photonic materials is that of controlling the system’s behavior by utilizing a synergistic interplay between gain and loss that manifests itself in the parity-time (PT) symmetric properties of the system. A number of related fascinating and counterintuitive EM phenomena were presented, such as loss-induced light amplification and lasing.

Inspired by electronic systems, a number of talks also reported photonic states with new non-trivial topologies that are resistant to scattering from defects and can find applications in photonic circuitry and quantum information processing. Quantum information processing has also been the central theme of many engaging presentations reporting exciting new results in controlling the transmission of single photon states, creating entangled photonic states, or photon counting detectors with photonic integrated circuits.

Moreover, there were interesting reports on the progress of fabrication of active photonic environments with controlled incorporation of quantum dots or the incorporation of materials with dynamically tunable properties, such as Al-doped zinc oxide. Last, but not least, several interesting presentations focused on extra-
ordinary tailoring of the absorptive and emissive properties of materials that are relevant to applications, such as energy harvesting, passive radiative cooling, and textiles for personal thermal management.

This year, we also introduced in our conference the Best Student Paper competition. We would like to thank all student contributors for the enthusiasm with which they participated in this competition, presenting outstanding and interesting results! The jury committee for this conference award determined three student papers that tied in the first place, which were presented with a SPIE-Best Student Paper award certificate in the closing of the conference. These are:

“Ultrafast dynamics of Al-doped zinc oxide under optical excitation” [9546-23], by Nathaniel Kinsey, Purdue University (United States) (presentation only)
Co-Author(s): Clayton T. DeVault, Jongbum Kim, Purdue University (United States); Marcello Ferrera, Purdue University, (United States), Heriot-Watt University (United Kingdom); Alexander V. Kildishev, Vladimir M. Shalaev, Alexandra Boltasseva, Purdue University (United States)

“Single mode parity-time laser” [9546-35], by Zi Jing Wong, University of California, Berkeley (United States) (see paper 95460Z in this proceedings volume)
Co-Author(s): Liang Feng, Renmin Ma, Yuan Wang, Xiang Zhang, University of California, Berkeley (United States)

“Improving emission in nanorod arrays using quasi-aperiodic inverse design” [9546-47], by P. Duke Anderson, University of California, Berkeley (United States) (presentation only)
Co-Author(s): Michelle L. Povinelli, The University of Southern California (United States)

Active Photonic Materials VII has brought together theorists and experimentalists to exchange state-of-the art results in this rapidly evolving area of research. As conference chairs, we would like to express our sincere thanks to all the participants of the 9546 conference who contributed their presentations as well as manuscripts to make this conference a stimulating and vibrant event.

Stavroula Foteinopoulou
Ganapathi S. Subramania