# PROCEEDINGS OF SPIE

# Metamaterials, Metadevices, and Metasystems 2023

Nader Engheta Mikhail A. Noginov Nikolay I. Zheludev Editors

20–23 August 2023 San Diego, California, United States

Sponsored and Published by SPIE

**Volume 12646** 

Proceedings of SPIE 0277-786X, V. 12746

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

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 SPIEDigitalLibrary.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 *Metamaterials, Metadevices, and Metasystems 2023*, edited by Nader Engheta, Mikhail A. Noginov, Nikolay I. Zheludev, Proc. of SPIE 12646, Seven-digit Article CID Number (DD/MM/YYYY); (DOI URL).

ISSN: 0277-786X

ISSN: 1996-756X (electronic)

ISBN: 9781510665064

ISBN: 9781510665071 (electronic)

Published by

SPIE

P.O. Box 10, Bellingham, Washington 98227-0010 USA Telephone +1 360 676 3290 (Pacific Time)

SPIE.org

Copyright © 2023 Society of Photo-Optical Instrumentation Engineers (SPIE).

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 fees. To obtain permission to use and share articles in this volume, visit Copyright Clearance Center 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.

Printed in the United States of America by Curran Associates, Inc., under license from SPIE.

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



**Paper Numbering:** A unique citation identifier (CID) number is assigned to each article in the Proceedings of SPIE 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 seven-digit CID article numbering system structured as follows:

- The first five 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**

٧	Conference Committee
	SPACE-TIME PHENOMENA
12646 02	Generating structured space-time light bullets with nonlocal metasurface (Invited Paper) [12646-20]
	FUNDAMENTALS III
12646 03	Interference effects in plasmon-enhanced metal photoluminescence (Invited Paper) [12646-24]
	DEVICES I
12646 04	Design and fabrication of metasurfaces for wavefront sensing and high-contrast imaging in the visible [12646-35]
12646 05	Low loss silicon nitride photonics for short wavelengths [12646-97]
	DEVICES II
12646 07	Design and verification of periodic metallic mesh structures for optical windows [12646-45]
	DEVICES III
12646 08	Metadiffuser fabricated by DUV KrF 248nm photolithography for wavefront manipulation [12646-54]
	DEVICES IV
12646 09	2D Bessel beam generation using symphotic medium [12646-91]

# **NOVEL PHENOMENA III** 12646 0A Light trapping in symmetric metasurface via electric octupole resonance [12646-78] 12646 OB Metasurface engineering for collective resonances, tailored emissivity, and enhanced photodetectors [12646-80] **SPECIAL SESSION II** 12646 0C Realization of a PT-symmetric microchip laser in the polarization space using nanostructured laser mirrors [12646-14] MONDAY POSTER SESSION 12646 0D End-to-end optimization of meta-lens doublet for high-quality wide-angle imaging [12646-88] 12646 OE Multilayer dielectric reflective metalens without metallic mirror [12646-90] **WEDNESDAY POSTER SESSION** 12646 OF High reflectance multilayered epsilon-near-zero AZO/ZnO metamaterial [12646-18] 12646 0G Epsilon-near-zero phase-matching for second-harmonic generation in semiconductor-based nanowire hyperbolic metamaterial [12646-19]

## **Conference Committee**

#### Symposium Chairs

**Gennady B. Shvets**, Cornell University (United States) **Cornelia Denz**, Physikalisch-Technische Bundesanstalt (Germany)

### Symposium Co-chairs

**Giovanni Volpe**, Göteborgs universitet (Sweden) **Sonja Franke-Arnold**, University of Glasgow (United Kingdom)

#### Conference Chairs

Nader Engheta, University of Pennsylvania (United States)
 Mikhail A. Noginov, Norfolk State University (United States)
 Nikolay I. Zheludev, University of Southampton (United Kingdom) and Nanyang Technological University (Singapore)

### Conference Program Committee

**Andrea Alù**, The City University of New York Advanced Science Research Center (United States)

Alexandra Boltasseva, Purdue University (United States)

**Igal Brener**, Sandia National Laboratories (United States)

Mark Brongersma, Stanford University (United States)

Joshua D. Caldwell, Vanderbilt University (United States)

**Subhasish Dutta Gupta**, University of Hyderabad (India)

**Jonathan A. Fan**, Stanford University (United States)

Javier García de Abajo, Institut de Ciències Fotòniques (Spain)

**Behrad Gholipour**, University of Alberta (Canada)

Harald W. Giessen, Universität Stuttgart (Germany)

Maria Kafesaki, Institute of Electronic Structure and Laser, Foundation for Research and Technology-Hellas (Greece) and University of Crete (Greece)

**Jacob B. Khurgin**, Johns Hopkins University (United States)

**Alexander V. Kildishev**, Purdue University (United States)

**Yuri S. Kivshar**, The Australian National University (Australia)

Kuniaki Konishi, The University of Tokyo (Japan)

**Uriel Levy**, The Hebrew University of Jerusalem (Israel)

Yu-Jung Lu, Academia Sinica (Taiwan)

Natalia M. Litchinitser, Duke University (United States)

**Renmin Ma**, Peking University (China)

**Tigran V. Shahbazyan**, Jackson State University (United States)

Timur Shegai, Chalmers University of Technology (Sweden)

Gennady B. Shvets, Cornell University (United States)

David R. Smith, Duke University (United States)

Sergei Tretyakov, Aalto University School of Science and Technology (Finland)

**Din Ping Tsai**, City University of Hong Kong (Hong Kong, China) **Jeong Weon Wu**, Ewha Womans University (Korea, Republic of)