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Issue 1: Frontiers of Optics and Photonics

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Issue 1: Frontiers Of Optics And Photonics (2021)

Editorial

Dennis Couwenberg, Federico Capasso

Editorial

DOI: 10.1515/nanoph-2020-0608
Published: 5 December 2020

The COVID-19 pandemic has resulted in a global humanitarian crisis. To support the people who are hit hardest by this pandemic, we organized a benefit by inviting leading scientists in the field of optics and photonics to contribute to this special issue. …

Section: Optoelectronics and Integrated Photonics

Section Title

Disorder effects in nitride semiconductors: impact on fundamental and device properties

Claude Weisbuch, Shuji Nakamura, Yuh-Renn Wu, James S. Speck

Review

DOI: 10.1515/nanoph-2020-0590
Published: 30 November 2020

Semiconductor structures used for fundamental or device applications most often incorporate alloy materials. In “usual” or “common” III–V alloys, based on the InGaAsP or InGaAlAs material systems, the effects of compositional disorder on the …

Ultralow threshold blue quantum dot lasers: what's the true recipe for success?

Alexander Raun, Evelyn Hu

Perspective

DOI: 10.1515/nanoph-2020-0382
Published: 7 September 2020

The family of III-nitride materials has provided a platform for tremendous advances in efficient solid-state lighting sources such as light-emitting diodes and laser diodes. In particular, quantum dot (QD) lasers using the InGaN/GaN material system promise …

Waiting for Act 2: what lies beyond organic light-emitting diode (OLED) displays for organic electronics?

Stephen R. Forrest

Perspective

DOI: 10.1515/nanoph-2020-0322
Published: 26 August 2020

Organic light-emitting diode (OLED) displays are now poised to be the dominant mobile display technology and are at the heart of the most attractive televisions and electronic tablets on the market today. But this begs the question: what is the next big …

Waveguide combiners for mixed reality headsets: a nanophotonics design perspective

Bernard C. Kress, Ishan Chatterjee

Review

DOI: 10.1515/nanoph-2020-0410
Published: 8 October 2020

This paper is a review and analysis of the various implementation architectures of diffractive waveguide combiners for augmented reality (AR), mixed reality (MR) headsets, and smart glasses. Extended reality (XR) is another acronym frequently used to refer to …

On-chip broadband nonreciprocal light storage

Moritz Merklein, Birgit Stiller, Khu Vu, Pan Ma, Stephen J. Madden, Benjamin J. Eggleton

Research Article

DOI: 10.1515/nanoph-2020-0371
Published: 5 October 2020

Breaking the symmetry between forward- and backward-propagating optical modes is of fundamental scientific interest and enables crucial functionalities, such as isolators, circulators, and duplex communication systems. Although there has been progress in …

High-Q nanophotonics: sculpting wavefronts with slow light

David Barton, Jack Hu, Jefferson Dixon, Elissa Klopfer, Sahil Dagli, Mark Lawrence, Jennifer Dionne

Perspective

DOI: 10.1515/nanoph-2020-0510
Published: 3 November 2020

Densely interconnected, nonlinear, and reconfigurable optical networks represent a route to high-performance optical computing, communications, and sensing technologies. Dielectric nanoantennas are promising building blocks for such architectures since they …

Thermoelectric graphene photodetectors with sub-nanosecond response times at terahertz frequencies

Leonardo Viti, Alisson R. Cadore, Xinxin Yang, Andrei Vorobiev, Jakob E. Muench, Kenji Watanabe, Takashi Taniguchi, Jan Stake, Andrea C. Ferrari, Miriam S. Vitiello

Research Article

DOI: 10.1515/nanoph-2020-0255
Published: 10 July 2020

Ultrafast and sensitive (noise equivalent power <1 nW Hz-1/2) light-detection in the terahertz (THz) frequency range (0.1–10 THz) and at room-temperature is key for applications such as time-resolved THz spectroscopy of gases, complex molecules and …

High-performance integrated graphene electro-optic modulator at cryogenic temperature

Brian S. Lee, Bumho Kim, Alexandre P. Freitas, Aseema Mohanty, Yibo Zhu, Gaurang R. Bhatt, James Hone, Michal Lipson

Research Article

DOI: 10.1515/nanoph-2020-0363
Published: 28 September 2020

High-performance integrated electro-optic modulators operating at low temperature are critical for optical interconnects in cryogenic applications. Existing integrated modulators, however, suffer from reduced modulation efficiency or bandwidth at low …

Asymmetric photoelectric effect: Auger-assisted hot hole photocurrents in transition metal dichalcogenides

Andrey Sushko, Kristiaan De Greve, Madeleine Phillips, Bernhard Urbaszek, Andrew Y. Joe, Kenji Watanabe, Takashi Taniguchi, Alexander L. Efros, C. Stephen Hellberg, Hongkun Park, Philip Kim, Mikhail D. Lukin

Research Article

DOI: 10.1515/nanoph-2020-0397
Published: 25 September 2020

Transition metal dichalcogenide (TMD) semiconductor heterostructures are actively explored as a new platform for quantum optoelectronic systems. Most state of the art devices make use of insulating hexagonal boron nitride (hBN) that acts as a wide-bandgap …

Seeing the light in energy use

Harry A. Atwater

Perspective

DOI: 10.1515/nanoph-2020-0381
Published: 9 December 2020

As photonics researchers work from home, and as we enter the first stages of re-entry into our laboratories, the COVID-19 pandemic has reminded us of two things: 1) meeting global challenges requires globally scalable solutions and 2) infrastructure is …

Section: Lasers, Active Optical Devices and Spectroscopy

Section Title

A high-repetition rate attosecond light source for time-resolved coincidence spectroscopy

Sara Mikaelsson, Jan Vogelsang, Chen Guo, Ivan Sytcevich, Anne-Lise Viotti, Fabian Langer, Yu-Chen Cheng, Saikat Nandi, Wenjie Jin, Anna Olofsson, Robin Weissenbilder, Johan Mauritsson, Anne L'Huillier, Mathieu Gisselbrecht, Cord L. Arnold

Research Article

DOI: 10.1515/nanoph-2020-0424
Published: 17 September 2020

Attosecond pulses, produced through high-order harmonic generation in gases, have been successfully used for observing ultrafast, subfemtosecond electron dynamics in atoms, molecules and solid state systems. Today's typical attosecond sources, however, are …

Fast laser speckle suppression with an intracavity diffuser

Simon Mahler, Yaniv Eliezer, Hasan Y?Lmaz, Asher A. Friesem, Nir Davidson, Hui Cao

Research Article

DOI: 10.1515/nanoph-2020-0390
Published: 14 October 2020

Fast speckle suppression is crucial for time-resolved full-field imaging with laser illumination. Here, we introduce a method to accelerate the spatial decoherence of laser emission, achieving speckle suppression in the nanosecond integration time scale. The …

Active optics with silk

Giulia Guidetti, Yu Wang, Fiorenzo G. Omenetto

Perspective

DOI: 10.1515/nanoph-2020-0358

Published: 14 August 2020
Optical devices have been traditionally fabricated using materials whose chemical and physical properties are finely tuned to perform a specific, single, and often static function, whereby devices' variability is achieved by design changes. Due to the …

Nanolaser arrays: toward application-driven dense integration

Suruj S. Deka, Sizhu Jiang, Si Hui Pan, Yeshaiahu Fainman

Review

DOI: 10.1515/nanoph-2020-0372
Published: 30 September 2020
The past two decades have seen widespread efforts being directed toward the development of nanoscale lasers. A plethora of studies on single such emitters have helped demonstrate their advantageous characteristics such as ultrasmall footprints, low power …

Two-dimensional spectroscopy on a THz quantum cascade structure

Sergej Markmann, Martin Franckié, Shovon Pal, David Stark, Mattias Beck, Manfred Fiebig, Giacomo Scalari, Jérôme Faist

Research Article

DOI: 10.1515/nanoph-2020-0369
Published: 20 October 2020
Understanding and controlling the nonlinear optical properties and coherent quantum evolution of complex multilevel systems out of equilibrium is essential for the new semiconductor device generation. In this work, we investigate the nonlinear system …

Homogeneous quantum cascade lasers operating as terahertz frequency combs over their entire operational regime

Alessandra Di Gaspare, Leonardo Viti, Harvey E. Beere, David D. Ritchie, Miriam S. Vitiello

Research Article

DOI: 10.1515/nanoph-2020-0378
Published: 28 September 2020
We report a homogeneous quantum cascade laser (QCL) emitting at terahertz (THz) frequencies, with a total spectral emission of about 0.6 THz, centered around 3.3 THz, a current density dynamic range Jdr = 1.53, and a continuous wave output power of 7 mW. …

Toward new frontiers for terahertz quantum cascade laser frequency combs

Miriam S. Vitiello, Luigi Consolino, Massimo Inguscio, Paolo De Natale

Research Article

DOI: 10.1515/nanoph-2020-0429
Published: 7 October 2020

Broadband, quantum-engineered, quantum cascade lasers (QCLs) are the most powerful chip-scale sources of optical frequency combs (FCs) across the mid-infrared and the terahertz (THz) frequency range. The inherently short intersubband upper state lifetime …

Soliton dynamics of ring quantum cascade lasers with injected signal

Franco Prati, Massimo Brambilla, Marco Piccardo, Lorenzo Luigi Columbo, Carlo Silvestri, Mariangela Gioannini, Alessandra Gatti, Luigi A. Lugiato, Federico Capasso

Research Article

DOI: 10.1515/nanoph-2020-0409
Published: 20 October 2020

Nonlinear interactions in many physical systems lead to symmetry breaking phenomena in which an initial spatially homogeneous stationary solution becomes modulated. Modulation instabilities have been widely studied since the 1960s in different branches of …

Section: Fiber Optics and Optical Communications

Section Title

Propagation stability in optical fibers: role of path memory and angular momentum

Zelin Ma, Siddharth Ramachandran

Review

DOI: 10.1515/nanoph-2020-0404
Published: 24 October 2020

With growing interest in the spatial dimension of light, multimode fibers, which support eigenmodes with unique spatial and polarization attributes, have experienced resurgent attention. Exploiting this spatial diversity often requires robust modes during …

Perspective on using multiple orbital-angular-momentum beams for enhanced capacity in free-space optical communication links

Alan E. Willner, Cong Liu

Perspective

DOI: 10.1515/nanoph-2020-0435
Published: 14 October 2020

Structured light has gained much interest in increasing communications capacity through the simultaneous transmission of multiple orthogonal beams. This paper gives a perspective on the current state of the art and future challenges, especially with regards …

Section: Biomedical Photonics

Section Title

A fiber optic–nanophotonic approach to the detection of antibodies and viral particles of COVID-19

Research Article

Navid Rajil, Alexei Sokolov, Zhenhuan Yi, Garry Adams, Girish Agarwal, Vsevolod Belousov, Robert Brick, Kimberly Chapin, Jeffrey Cirillo, Volker Deckert, Sahar Delfan, Shahriar Esmaeili, Alma Fernández-González, Edward Fry, Zehua Han, Philip Hemmer, George Kattawar, Moochan Kim, Ming-Che Lee, Chao-Yang Lu, Jon Mogford, Benjamin Neuman, Jian-Wei Pan, Tao Peng, Vincent Poor, Steven Scully, Yanhua Shih, Szymon Suckewer, Anatoly Svidzinsky, Aart Verhoef, Dawei Wang, Kai Wang, Lan Yang, Aleksei Zheltikov, Shiyao Zhu, Suhail Zubairy, Marlan Scully

DOI: 10.1515/nanoph-2020-0357
Published: 30 September 2020

Dr. Deborah Birx, the White House Coronavirus Task Force coordinator, told NBC News on “Meet the Press” that “he U.S. needs a ‘breakthrough’ in coronavirus testing to help screen Americans and get a more accurate picture of the virus’ spread.” …

Plasmonic control of drug release efficiency in agarose gel loaded with gold nanoparticle assemblies

Research Article

Luca Moretti, Andrea Mazzanti, Arianna Rossetti, Andrea Schirato, Laura Polito, Fabio Pizzetti, Alessandro Sacchetti, Giulio Cerullo, Giuseppe Della Valle, Filippo Rossi, Margherita Maiuri

DOI: 10.1515/nanoph-2020-0418
Published: 24 October 2020

Plasmonic nanoparticles (NPs) are exploited to concentrate light, provide local heating and enhance drug release when coupled to smart polymers. However, the role of NP assembling in these processes is poorly investigated, although their superior performance …

Metasurfaces for biomedical applications: imaging and sensing from a nanophotonics perspective

Review

Shuyan Zhang, Chi Lok Wong, Shuwen Zeng, Renzhe Bi, Kolvyn Tai, Kishan Dholakia, Malini Olivo

DOI: 10.1515/nanoph-2020-0373
Published: 7 September 2020

Metasurface is a recently developed nanophotonics concept to manipulate the properties of light by replacing conventional bulky optical components with ultrathin (more than 104 times thinner) flat optical components. Since the first demonstration of …

Hyperbolic dispersion metasurfaces for molecular biosensing

Review

Giovanna Palermo, Kandammathe Valiyaveedu Sreekanth, Nicolò Maccaferri, Giuseppe Emanuele Lio, Giuseppe Nicoletta, Francesco De Angelis, Michael Hinczewski, Giuseppe Strangi

DOI: 10.1515/nanoph-2020-0466
Published: 7 October 2020

Sensor technology has become increasingly crucial in medical research and clinical diagnostics to directly detect small numbers of low-molecular-weight biomolecules relevant for lethal diseases. In recent years, various technologies have been developed, a …

Section: Fundamentals of Optics

Section Title

A Tutorial on the Classical Theories of Electromagnetic Scattering and Diffraction

Review

Masud Mansuripur

DOI: 10.1515/nanoph-2020-0348
Published: 11 September 2020

Starting with Maxwell's equations, we derive the fundamental results of the Huygens-Fresnel-Kirchhoff and Rayleigh-Sommerfeld theories of scalar diffraction and scattering. These results are then extended to cover the case of vector electromagnetic fields. …

Reflectionless excitation of arbitrary photonic structures: a general theory

Review

A. Douglas Stone, William R. Sweeney, Chia Wei Hsu, Kabish Wisal, Zeyu Wang

DOI: 10.1515/nanoph-2020-0403
Published: 5 October 2020

We outline and interpret a recently developed theory of impedance matching or reflectionless excitation of arbitrary finite photonic structures in any dimension. The theory includes both the case of guided wave and free-space excitation. It describes the …

Section: Optimization Methods

Section Title

Multiobjective and categorical global optimization of photonic structures based on ResNet generative neural networks

Jiaqi Jiang, Jonathan A. Fan

Research Article

DOI: 10.1515/nanoph-2020-0407
Published: 14 October 2020

We show that deep generative neural networks, based on global optimization networks (GLOnets), can be configured to perform the multiobjective and categorical global optimization of photonic devices. A residual network scheme enables GLOnets to evolve from a …

Machine learning–assisted global optimization of photonic devices

Zhaxylyk A. Kudyshev, Alexander V. Kildishev, Vladimir M. Shalaev, Alexandra Boltasseva

Research Article

DOI: 10.1515/nanoph-2020-0376
Published: 3 November 2020

Over the past decade, artificially engineered optical materials and nanostructured thin films have revolutionized the area of photonics by employing novel concepts of metamaterials and metasurfaces where spatially varying structures yield tailorable “by …

Artificial neural networks for inverse design of resonant nanophotonic components with oscillatory loss landscapes

Joeri Lenaerts, Hannah Pinson, Vincent Ginis

Research Article

DOI: 10.1515/nanoph-2020-0379
Published: 30 November 2020

Machine learning offers the potential to revolutionize the inverse design of complex nanophotonic components. Here, we propose a novel variant of this formalism specifically suited for the design of resonant nanophotonic components. Typically, the first step …

Adjoint-optimized nanoscale light extractor for nitrogen-vacancy centers in diamond

Raymond A. Wambold, Zhaoning Yu, Yuzhe Xiao, Benjamin Bachman, Gabriel Jaffe, Shimon Kolkowitz, Jennifer T. Choy, Mark A. Eriksson, Robert J. Hamers, Mikhail A. Kats

Research Article

DOI: 10.1515/nanoph-2020-0387
Published: 30 November 2020

We designed a nanoscale light extractor (NLE) for the efficient outcoupling and beaming of broadband light emitted by shallow, negatively charged nitrogen-vacancy (NV) centers in bulk diamond. The NLE consists of a patterned silicon layer on diamond and …

Section: Topological Photonics

Section Title

Non-Hermitian and topological photonics: optics at an exceptional point

Midya Parto, Yuzhou G. N. Liu, Babak Bahari, Mercedeh Khajavikhan, Demetrios N. Christodoulides

Review

DOI: 10.1515/nanoph-2020-0434
Published: 5 October 2020

In the past few years, concepts from non-Hermitian (NH) physics, originally developed within the context of quantum field theories, have been successfully deployed over a wide range of physical settings where wave dynamics are known to play a key role. In …

Topological photonics: Where do we go from here?

Mordechai Segev, Miguel A. Bandres

Research Article

DOI: 10.1515/nanoph-2020-0441
Published: 7 October 2020

Topological photonics is currently one of the most active research areas in optics and also one of the spearheads of research in topological physics at large. We are now more than a decade after it started. Topological photonics has already proved itself as …

Topological nanophotonics for photoluminescence control

Aditya Tripathi, Sergey Kruk, Yunfei Shang, Jiajia Zhou, Ivan Kravchenko, Dayong Jin, Yuri Kivshar

Research Article

DOI: 10.1515/nanoph-2020-0374
Published: 17 September 2020

Rare-earth-doped nanocrystals are emerging light sources that can produce tunable emissions in colours and lifetimes, which has been typically achieved in chemistry and material science. However, one important optical challenge – polarization of …

Anomalous Anderson localization behavior in gain-loss balanced non-Hermitian systems

Tianshu Jiang, Anan Fang, Zhao-Qing Zhang, Che Ting Chan

Research Article

DOI: 10.1515/nanoph-2020-0306
Published: 28 July 2020

It has been shown recently that the backscattering of wave

propagation in one-dimensional disordered media can be entirely suppressed for normal incidence by adding sample-specific gain and loss components to the medium. Here, we study the Anderson …

Section: Quantum Computing, Quantum Optics, and QED

Section Title

Quantum computing and simulation

Juan Ignacio Cirac

Perspective

DOI: 10.1515/nanoph-2020-0351
Published: 22 September 2020

Quantum computers and simulators can have an extraordinary impact on our society. Despite the extraordinary progress they have made in recent years, there are still great challenges to be met and new opportunities to be discovered.

NIST-certified secure key generation via deep learning of physical unclonable functions in silica aerogels

Andrea Fratalocchi, Adam Fleming, Claudio Conti, Andrea Di Falco

Research Article

DOI: 10.1515/nanoph-2020-0368
Published: 3 November 2020

Physical unclonable functions (PUFs) are complex physical objects that aim at overcoming the vulnerabilities of traditional cryptographic keys, promising a robust class of security primitives for different applications. Optical PUFs present advantages over …

Thomas–Reiche–Kuhn (TRK) sum rule for interacting photons

Salvatore Savasta, Omar Di Stefano, Franco Nori

Research Article

DOI: 10.1515/nanoph-2020-0433
Published: 30 November 2020

The Thomas–Reiche–Kuhn (TRK) sum rule is a fundamental consequence of the position–momentum commutation relation for an atomic electron, and it provides an important constraint on the transition matrix elements for an atom. Here, we propose a TRK sum …

Macroscopic QED for quantum nanophotonics: emitter-centered modes as a minimal basis for multiemitter problems

Johannes Feist, Antonio I. Fernández-Domínguez, Francisco J. García-Vidal

Research Article

DOI: 10.1515/nanoph-2020-0451
Published: 20 October 2020

We present an overview of the framework of macroscopic quantum electrodynamics from a quantum nanophotonics perspective. Particularly, we focus our attention on three aspects of the theory that are crucial for the description of quantum optical phenomena in …

Generation and dynamics of entangled fermion–photon–phonon states in nanocavities

Mikhail Tokman, Maria Erukhimova, Yongrui Wang, Qianfan Chen, Alexey Belyanin

Research Article

DOI: 10.1515/nanoph-2020-0353
Published: 17 September 2020

We develop the analytic theory describing the formation and evolution of entangled quantum states for a fermionic quantum emitter coupled simultaneously to a quantized electromagnetic field in a nanocavity and quantized phonon or mechanical vibrational …

Polaritonic Tamm states induced by cavity photons

Charles A. Downing, Luis Martín-Moreno

Research Article

DOI: 10.1515/nanoph-2020-0370
Published: 15 September 2020

We consider a periodic chain of oscillating dipoles, interacting via long-range dipole–dipole interactions, embedded inside a cuboid cavity waveguide. We show that the mixing between the dipolar excitations and cavity photons into polaritons can lead to the …

Recent progress in engineering the Casimir effect – applications to nanophotonics, nanomechanics, and chemistry

Tao Gong, Matthew R. Corrado, Ahmed R. Mahbub, Calum Shelden, Jeremy N. Munday

Review

DOI: 10.1515/nanoph-2020-0425
Published: 25 September 2020

Quantum optics combines classical electrodynamics with quantum mechanics to describe how light interacts with material on the nanoscale, and many of the tricks and techniques used in nanophotonics can be extended to this quantum realm. Specifically, quantum …

Enhancement of rotational vacuum friction by surface photon tunneling

Zhujing Xu, Zubin Jacob, Tongcang Li

Research Article

DOI: 10.1515/nanoph-2020-0391
Published: 22 September 2020
When a neutral sphere is rotating near a surface in vacuum, it will experience a frictional torque due to quantum and thermal electromagnetic fluctuations. Such vacuum friction has attracted many interests but has been too weak to be observed. Here we …

Section: Plasmonics and Polaritonics

Section Title

Shrinking the surface plasmon

Fan Yang, Kun Ding, John Brian Pendry

Research Article

DOI: 10.1515/nanoph-2020-0361
Published: 31 July 2020
Surface plasmons at an interface between dielectric and metal regions can in theory be made arbitrarily compact normal to the interface by introducing extreme anisotropy in the material parameters. We propose a metamaterial structure comprising a square array …

Polariton panorama

D. N. Basov, Ana Asenjo-Garcia, P. James Schuck, Xiaoyang Zhu, Angel Rubio

Review

DOI: 10.1515/nanoph-2020-0449
Published: 17 November 2020
In this brief review, we summarize and elaborate on some of the nomenclature of polaritonic phenomena and systems as they appear in the literature on quantum materials and quantum optics. Our summary includes at least 70 different types of polaritonic …

Scattering of a single plasmon polariton by multiple atoms for in-plane control of light

Rituraj, Meir Orenstein, Shanhui Fan

Research Article

DOI: 10.1515/nanoph-2020-0340
Published: 7 September 2020
We study the interaction of a single photon in a surface plasmon polariton mode with multiple atoms. We propose a system of two atoms to achieve a tunable scattering from subscattering to superscattering regimes by changing the angle of the incident photon. …

A metasurface-based diamond frequency converter using plasmonic nanogap resonators

Qixin Shen, Amirhassan Shams-Ansari, Andrew M. Boyce, Nathaniel C. Wilson, Tao Cai, Marko Loncar, Maiken H. Mikkelsen

Research Article

DOI: 10.1515/nanoph-2020-0392
Published: 28 September 2020

Diamond has attracted great interest as an appealing material for various applications ranging from classical to quantum optics. To date, Raman lasers, single photon sources, quantum sensing and quantum communication have been demonstrated with integrated …

Selective excitation of individual nanoantennas by pure spectral phase control in the ultrafast coherent regime

Nicolò Accanto, Pablo M. De Roque, Marcial Galvan-Sosa, Ion M. Hancu, Niek F. Van Hulst

Research Article

DOI: 10.1515/nanoph-2020-0406
Published: 7 September 2020

Coherent control is an ingenious tactic to steer a system to a desired optimal state by tailoring the phase of an incident ultrashort laser pulse. A relevant process is the two-photon–induced photoluminescence (TPPL) of nanoantennas, as it constitutes a …

Semiconductor quantum plasmons for high frequency thermal emission

Angela Vasanelli, Yanko Todorov, Baptiste Dailly, Sébastien Cosme, Djamal Gacemi, Andrew Haky, Isabelle Sagnes, Carlo Sirtori

Research Article

DOI: 10.1515/nanoph-2020-0413
Published: 25 September 2020

Plasmons in heavily doped semiconductor layers are optically active excitations with sharp resonances in the 5–15 ?m wavelength region set by the doping level and the effective mass. Here, we demonstrate that volume plasmons can form in doped layers of …

Origin of dispersive line shapes in plasmon-enhanced stimulated Raman scattering microscopy

Cheng Zong, Ji-Xin Cheng

Research Article

DOI: 10.1515/nanoph-2020-0313
Published: 28 July 2020

Plasmon-enhanced stimulated Raman scattering (PESRS) microscopy has been recently developed to reach single-molecule detection limit. Unlike conventional stimulated Raman spectra, dispersive-like vibrational line shapes were observed in PESRS. Here, we …

Epitaxial aluminum plasmonics covering full visible spectrum

Chang-Wei Cheng, Soniya S. Raja, Ching-Wen Chang, Xin-Quan Zhang, Po-Yen Liu, Yi-Hsien Lee, Chih-Kang Shih, Shangjr Gwo

Research Article

DOI: 10.1515/nanoph-2020-0402
Published: 30 November 2020

Aluminum has attracted a great deal of attention as an alternative plasmonic material to silver and gold because of its natural abundance on Earth, material stability, unique spectral capability in the ultraviolet spectral region, and complementary …

Section: Metaoptics

Section Title

Metamaterials with high degrees of freedom: space, time, and more

Nader Engheta

Perspective

DOI: 10.1515/nanoph-2020-0414
Published: 5 October 2020

In this brief opinion article, I present a personal perspective on metamterials with high degrees of freedom and dimensionality and discuss their potential roles in enriching light–matter interaction in photonics and related fields.

The road to atomically thin metasurface optics

Mark L. Brongersma

Perspective

DOI: 10.1515/nanoph-2020-0444
Published: 30 November 2020

The development of flat optics has taken the world by storm. The initial mission was to try and replace conventional optical elements by thinner, lightweight equivalents. However, while developing this technology and learning about its strengths and …

Active nonlocal metasurfaces

Stephanie C. Malek, Adam C. Overvig, Sajan Shrestha, Nanfang Yu

Research Article

DOI: 10.1515/nanoph-2020-0375
Published: 25 September 2020

Actively tunable and reconfigurable wavefront shaping by optical metasurfaces poses a significant technical challenge often requiring unconventional materials engineering and nanofabrication. Most wavefront-shaping metasurfaces can be considered “local” …

Giant midinfrared nonlinearity based on multiple quantum well polaritonic metasurfaces

Ahmed Mekawy, Andrea Alù

Research Article

DOI: 10.1515/nanoph-2020-0408
Published: 14 September 2020

Ultrathin engineered metasurfaces loaded with multiple quantum wells (MQWs) form a highly efficient platform for nonlinear optics. Here we discuss different approaches to realize mid infrared metasurfaces with localized second-harmonic generation based on …

Near-field plates and the near zone of metasurfaces

Roberto Merlin

Research Article

DOI: 10.1515/nanoph-2020-0307
Published: 22 July 2020

A brief, tutorial account is given of the differences between the near and far regions of the electromagnetic field emphasizing the source-dependent behavior of the former and the universal properties of the latter. Field patterns of near-field plates, that …

High-efficiency metadevices for bifunctional generations of vectorial optical fields

Dongyi Wang, Tong Liu, Yuejiao Zhou, Xiaoying Zheng, Shulin Sun, Qiong He, Lei Zhou

Research Article

DOI: 10.1515/nanoph-2020-0465
Published: 13 October 2020

Vectorial optical fields (VOFs) exhibiting tailored wave fronts and spatially inhomogeneous polarization distributions are particularly useful in photonic applications. However, devices to generate them, made by natural materials or recently proposed …

Printing polarization and phase at the optical diffraction limit: near- and far-field optical encryption

Qinghua Song, Samira Khadir, Stéphane Vézian, Benjamin Damilano, Philippe De Mierry, Sébastien Chenot, Virginie Brandli, Romain Laberdesque, Benoit Wattellier, Patrice Genevet

Research Article

DOI: 10.1515/nanoph-2020-0352
Published: 28 July 2020

Securing optical information to avoid counterfeiting and manipulation by unauthorized persons and agencies requires innovation and enhancement of security beyond basic intensity encryption. In this paper, we present a new method for polarization-dependent …

Optical response of jammed rectangular nanostructures

Mutasem Odeh, Matthieu Dupré, Kevin Kim, Boubacar Kanté

Research Article

DOI: 10.1515/nanoph-2020-0431
Published: 30 November 2020

Random jammed dipole scatterers are natural composite and common byproducts of various chemical synthesis techniques. They often form complex aggregates with nontrivial correlations that influence the effective dielectric description of the medium. In this …

Dynamic phase-change metafilm absorber for strong designer modulation of visible light

Sun-Je Kim, Hansik Yun, Sungwook Choi, Jeong-Geun Yun, Kyungsoo Park, Sun Jae Jeong, Seung-Yeol Lee, Yohan Lee, Jangwoon Sung, Chulsoo Choi, Jongwoo Hong, Yong Wook Lee, Byoungho Lee

Research Article

DOI: 10.1515/nanoph-2020-0264
Published: 30 June 2020

Effective dynamic modulation of visible light properties has been significantly desired for advanced imaging and sensing technologies. In particular, phase-change materials have attracted much attention as active material platforms owing to their broadband …

Arbitrary polarization conversion for pure vortex generation with a single metasurface

Marco Piccardo, Antonio Ambrosio

Research Article

DOI: 10.1515/nanoph-2020-0332
Published: 14 August 2020

The purity of an optical vortex beam depends on the spread of its energy among different azimuthal and radial modes, also known as $ell $- and p-modes. The smaller the spread, the higher the vortex purity and more efficient its creation and detection. There …

Enhanced harmonic generation in gases using an all-dielectric metasurface

Jared S. Ginsberg, Adam C. Overvig, M. Mehdi Jadidi, Stephanie C. Malek, Gauri N. Patwardhan, Nicolas Swenson, Nanfang Yu, Alexander L. Gaeta

Research Article

DOI: 10.1515/nanoph-2020-0362
Published: 14 October 2020

Strong field confinement, long-lifetime resonances, and slow-light effects suggest that metasurfaces are a promising tool for nonlinear optical applications. These nanostructured devices have been utilized for relatively high efficiency solid-state …

Monolithic metasurface spatial differentiator enabled by asymmetric photonic spin-orbit interactions

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Research Article

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Spatial differentiator is the key element for edge detection, which is indispensable in image processing, computer vision involving image recognition, image restoration, image compression, and so on. Spatial differentiators based on metasurfaces are simpler …