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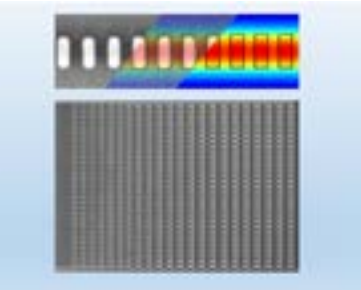


Waveguide sub-wavelength structures: a review of principles and applications

Robert Halir, Przemek J. Bock, Pavel Cheben, Alejandro Ortega-Moñux, Carlos Alonso-Ramos, Jens H. Schmid, Jean Lapointe, Dan-Xia Xu, J. Gonzalo Wangüemert-Pérez, Íñigo Molina-Fernández, Siegfried Janz

With the recent development of silicon photonics and high resolution lithography, periodic structures with a sub-wavelength pitch have found widespread application. This review provides an introduction to the physics of sub-wavelength structures and an extensive overview of their applications in waveguide devices, including: high efficiency fiber-chip couplers, wavelength multiplexers, athermal waveguide and ultra-broadband waveguide couplers.

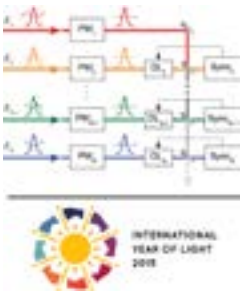
DOI: 10.1002/lpor.201400083

Functional and nonlinear optical metasurfaces

Alexander E. Minovich, Andrey E. Miroshnichenko, Anton Y. Bykov, Tatiana V. Murzina, Dragomir N. Neshev, Yuri S. Kivshar

Metasurfaces have become the subject of several rapidly growing areas of research. They show many useful properties of metadevices with engineered resonant electric and magnetic optical responses combined with low losses of thin-layer structures. The basic concepts of this rapidly growing research field are introduced and enriched by the recent development of metamaterials and subwavelength nanophotonics. The most interesting properties of photonic metasurfaces are reviewed and their useful functionalities are demonstrated.

DOI: 10.1002/lpor.201400402

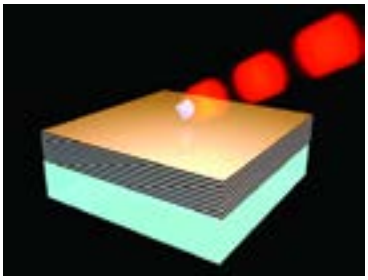


Coherent pulse synthesis: towards sub-cycle optical waveforms

Cristian Manzoni, Oliver D. Mücke, Giovanni Cirmi, Shaobo Fang, Jeffrey Moses, Shu-Wei Huang, Kyung-Han Hong, Giulio Cerullo, Franz X. Kärtner

The generation of sub-cycle light waveforms is at the frontiers of optics: ultrashort waveform generation calls for broad bandwidth and tailored spectral phase; coherent synthesis of fields from separate sources promises to fulfill both challenges. In this review, the experimental tools for coherent waveform synthesis and characterization are discussed, and the most recent advances are presented.

DOI: 10.1002/lpor.201400181



Enhancement of single-photon emission from nitrogen-vacancy centers with TiN/(Al,Sc)N hyperbolic metamaterial

Mikhail Y. Shalaginov, Vadim V. Vorobyov, Jing Liu, Marcello Ferrera, Alexey V. Akimov, Alexei Lagutchev, Andrey N. Smolyaninov, Vasily V. Klimov, Joseph Irudayaraj, Alexander V. Kildishev, Alexandra Boltasseva, Vladimir M. Shalaev

The broadband enhancement of single photon emission from nitrogen-vacancy centers in nanodiamonds coupled to a planar multilayer metamaterial with hyperbolic dispersion is studied experimentally. The metamaterial is fabricated as an epitaxial metal/dielectric superlattice consisting of CMOS-compatible ceramics: titanium nitride (TiN) and aluminum scandium nitride ($Al_xSc_{1-x}N$). It is demonstrated that employing the metamaterial results in significant enhancement of collected single photon emission and reduction of the excited-state lifetime. The results could have an impact on future CMOS-compatible integrated quantum sources.

DOI: 10.1002/lpor.201400185

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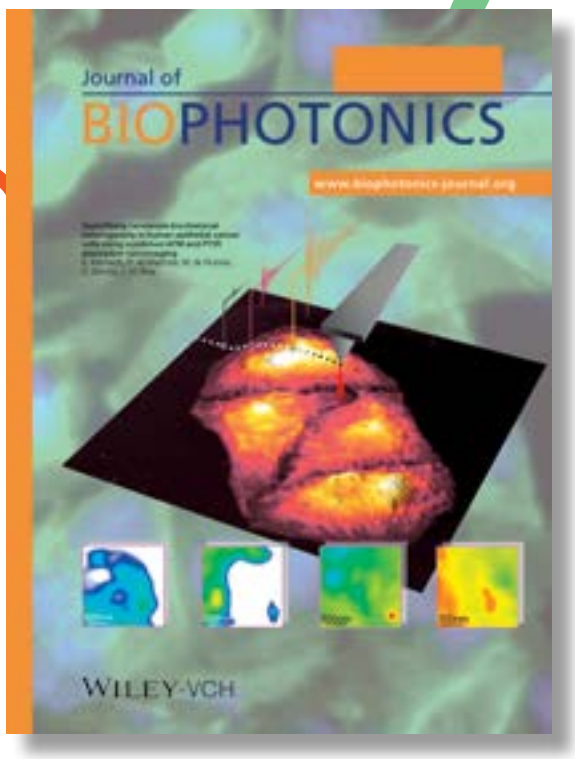

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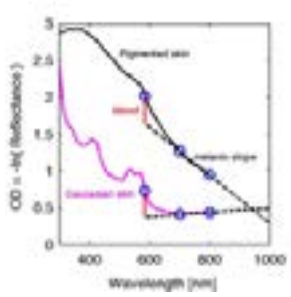
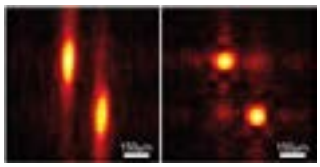


DOI: 10.1002/jbio.201400103

Quick analysis of optical spectra to quantify epidermal melanin and papillary dermal blood content of skin

Steven L. Jacques

A practical approach for assessing the melanin and blood content of the skin from total diffuse reflectance spectra is presented. The paper describes the non-rectilinear character of a quick analysis, which uses just three wavelengths, and shows that most any choice of two wavelengths in the 600–900 range can achieve the characterization of melanin. Monte Carlo simulations created spectral data for a skin model with epidermis, papillary dermis and reticular dermis to illustrate the analysis.



DOI: 10.1002/jbio.201400021

Isotropic high resolution optoacoustic imaging with linear detector arrays in bi-directional scanning

Mathias Schwarz, Andreas Buehler, Vasilis Ntziachristos

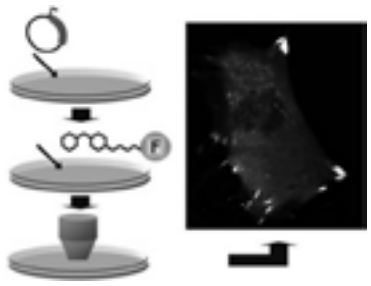
Optoacoustic imaging is often performed with onedimensional transducer arrays, in analogy to ultrasound imaging. Optoacoustic imaging using linear arrays offers ease of implementation but comes with several performance drawbacks, in particular poor elevation resolution, i.e. the resolution along the axis perpendicular to the focal plane. Herein, a bi-directional scanning approach using linear arrays is introduced that can improve the imaging performance to quasi-isotropic transverse resolution.

DOI: 10.1002/jbio.201200141

Recent advances in the development of Raman spectroscopy for deep non-invasive medical diagnosis

Pavel Matousek, Nicholas Stone

Raman spectroscopy has recently undergone major advances in the area of deep non-invasive characterisation of biological tissues. The progress stems from the development of spatially offset Raman spectroscopy (SORS) and renaissance of transmission Raman spectroscopy permitting the assessment of diffusely scattering samples at depths several orders of magnitude deeper than possible with conventional Raman spectroscopy. Examples of emerging applications include non-invasive diagnosis of bone disease, cancer and monitoring of glucose levels. This article reviews this fast moving field focusing on recent developments within the medical area.



DOI: 10.1002/jbio.201100018

Chemical tags: Applications in live cell fluorescence imaging

Richard Wombacher, Virginia W. Cornish

Technologies to visualize cellular structures and dynamics enable cell biologists to gain insight into complex biological processes. Currently, fluorescent proteins are used routinely to investigate the behavior of proteins in live cells. Chemical biology techniques for selective labeling of proteins with fluorescent labels have become an attractive alternative to fluorescent protein labeling. In the last ten years the progress in the development of chemical tagging methods have been substantial offering a broad palette of applications for live cell fluorescent microscopy. Several methods for protein labeling have been established, using protein tags, peptide tags and enzyme mediated tagging. This review focuses on the different strategies to achieve the attachment of fluorophores to proteins in live cells and cast light on the advantages and disadvantages of each individual method. Selected experiments in which chemical tags have been successfully applied to live cell imaging will be discussed and evaluated.

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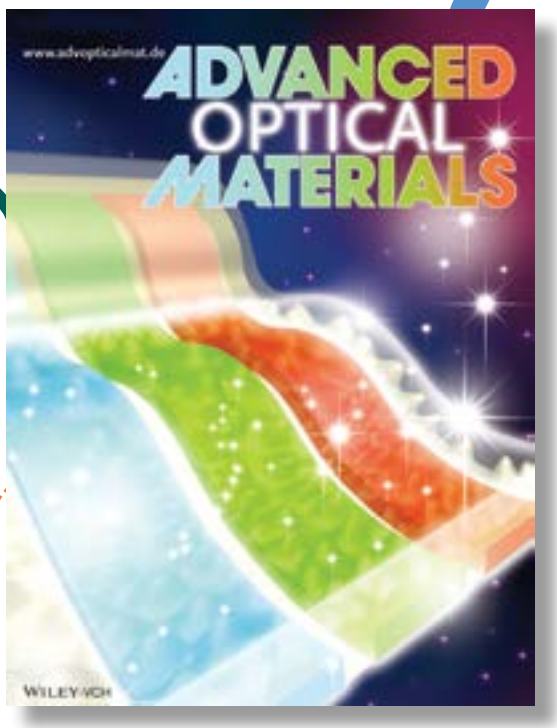

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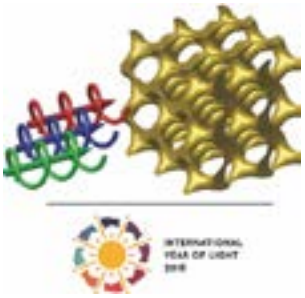
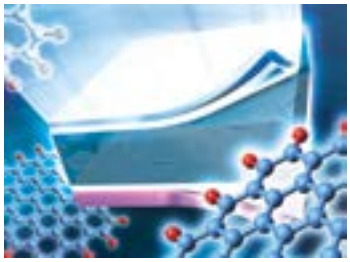


Optical Properties of Gyroid Structured Materials: From Photonic Crystals to Metamaterials

James A. Dolan, Bodo D. Wilts, Silvia Vignolini, Jeremy J. Baumberg, Ullrich Steiner, Timothy D. Wilkinson

Gyroids are chiral minimal surface morphologies which are found in a variety of natural and synthetic systems, ranging from butterfly wing scales to self-assembled block copolymers. The optical properties of gyroid structured materials are reviewed here on two fundamental length scales, which behave as either photonic crystals or optical metamaterials.

DOI: 10.1002/adom.201400333

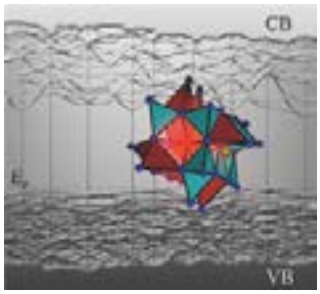


Highly Efficient Light-Emitting Diode of Graphene Quantum Dots Fabricated from Graphite Intercalation Compounds

Sung Ho Song, Min-Ho Jang, Jin Chung, Sung Hawn Jin, Bo Hyun Kim, Seung-Hyun Hur, Seunghyup Yoo, Yong-Hoon Cho, Seokwoo Jeon

Graphene quantum dot (GQD) light-emitting diodes (GQD-LEDs) are shown to have an electroluminescence exceeding 1000 cd m^{-2}. These devices are possible due to a novel synthesis method to create GQDs with minimal oxidation, guaranteeing high quantum yields via the solvothermal formation of graphite intercalation compounds between graphite powder and sodium potassium tartrate. The GQDs are incorporated into polymeric host layers in a multilayer device and irradiate blue (~400 nm) emission.

DOI: 10.1002/adom.201400184

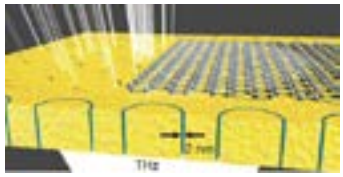


Investigations of the Electronic Structure and Bandgap of the Next-Generation LED-Phosphor $Sr[LiAl_3N_4]:Eu^{2+}$ – Experiment and Calculations

Thomas M. Tolhurst, Teak D. Boyko, Philipp Pust, Neil W. Johnson, Wolfgang Schnick, Alexander Moewes

The electronic structure of recently reported nitridolithoaluminate $Sr[LiAl_3N_4]:Eu^{2+}$ determined through soft X-ray spectroscopy measurements and density functional theory calculations is discussed. With its high emission intensity in the red region of the electromagnetic spectrum and its uniquely narrow bandwidth for an Eu^{2+}-doped phosphor, this breakthrough material shows great potential for use in illumination-grade pc-LEDs.

DOI: 10.1002/adom.201400558



Perfect Extinction of Terahertz Waves in Monolayer Graphene over 2-nm-Wide Metallic Apertures

Hyeong-Ryeol Park, Seon Namgung, Xiaoshu Chen, Nathan C. Lindquist, Vincenzo Giannini, Yan Francescato, Stefan A. Maier, Sang-Hyun Oh

A 99% extinction of terahertz wave transmission is experimentally demonstrated when single-layer graphene covers the openings of 2-nm-wide ($\approx\lambda/1\ 000\ 000$) slits through a metal film. By resonantly coupling terahertz waves with annular nanogaps, the extremely localized fields lead to enhanced intraband absorption in graphene, leading to high-contrast terahertz modulation as large as 80% with an operational voltage of 1.5 V.

DOI: 10.1002/adom.201400546

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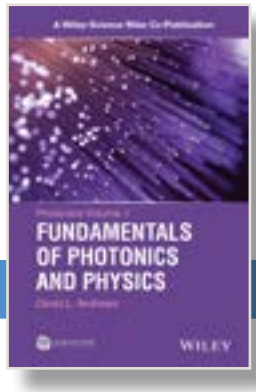

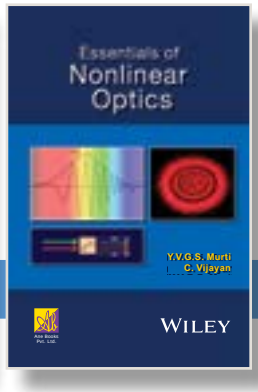

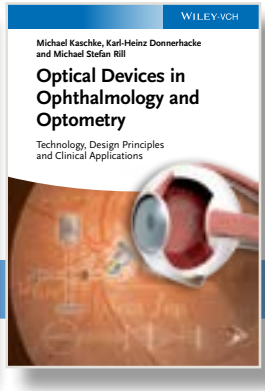

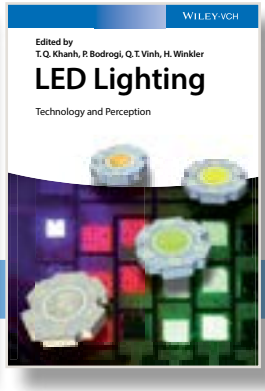

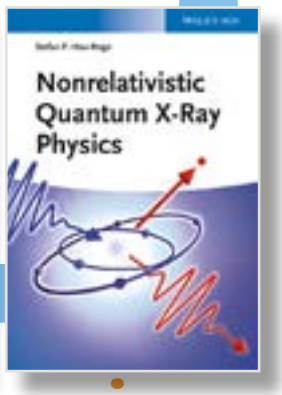

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