Download Free Molecular Plasmonics

Molecular Plasmonics

This volume presents a considerable number of interrelated contributions dealing with the new scientific ability to shape and control matter and electromagnetic fields on a sub-wavelength scale. The topics range from the fundamental ones, such as photonic metamateriials, plasmonics and sub-wavelength resolution to the more applicative, such as detection of single molecules, tomography on a micro-chip, fluorescence spectroscopy of biological systems, coherent control of biomolecules, biosensing of single proteins, terahertz spectroscopy of nanoparticles, rare earth ion-doped nanoparticles, random lasing, and nanocoax array architecture. The various subjects bridge over the disciplines of physics, biology and chemistry, making this volume of interest to people working in these fields. The emphasis is on the principles behind each technique and on examining the full potential of each technique. The contributions that appear in this volume were presented at a NATO Advanced Study Institute that was held in Erice, Italy, 3-18 July, 2011. The pedagogical aspect of the Institute is reflected in the topics presented in this volume.

This book presents the latest results of quantum properties of light in the nanostructured environment supporting surface plasmons, including waveguide quantum electrodynamics, quantum emitters, strong-coupling phenomena and lasing in plasmonic structures. Different approaches are described for controlling the emission and propagation of light with extreme light confinement and field enhancement provided by surface plasmons. Recent progress is reviewed in both experimental and theoretical investigations within quantum plasmonics, elucidating the fundamental physical phenomena involved and discussing the realization of quantum-controlled devices, including single-photon sources, transistors and ultra-compact circuitry at the nanoscale.

This thesis provides a comprehensive introduction to two active research directions within the field of plasmonics: (i) nonclassical, or quantum, aspects of the plasmonic response; and (ii) two-dimensional plasmonics, a recent innovation in the field stimulated by the advent of two-dimensional materials. It discusses the fundamentals of this field in detail, and explores several current research directions. Nonclassical plasmonics has been spurred on in recent years by the tremendous technological progress in nanofabrication and optical characterization; today, it is possible to investigate the plasmonic features of nanostructures with characteristic features in the few nanometer range. The book describes and analyzes the breakdown of the classical theory under these conditions and explores several alternatives and extensions. The unique electronic and dimensional features of novel two-dimensional materials, such as graphene, lie at the core of plasmonics' most rapidly developing subfield; two-dimensional plasmonics. This thesis provides a clear and comprehensive exposition of the central features for interested researchers looking for an entry point to this riveting area.

Reviews in Plasmonics is a comprehensive collection of current trends and emerging hot topics in the field of Plasmonics and closely related disciplines. It summarizes the years progress in Plasmonics and its applications, with authoritative analytical reviews specialized enough to be attractive to professional researchers, yet also appealing to the wider audience of scientists in related disciplines of Plasmonics.

Optical and Molecular Physics

Molecular Electronic Control Over Tunneling Charge Transfer Plasmons Modes

Molecular Plasmonics on Gold Nanoparticles

Plasmonic Devices Employing Extreme Light Concentration

This book discusses a new class of photonic devices, known as surface plasmon nanophotonic structures. The book highlights several exciting new discoveries, while providing a clear discussion of the underlying physics, the nanofabrication issues, and the materials considerations involved in designing plasmonic devices with new functionality. Chapters written by the leaders in the field of plasmonics provide a solid background to each topic.

Focusing on control and manipulation of plasmons at nanometer dimensions, nanoplasmonics combines the strength of electronics and photonics, and is predicted to replace existing integrated circuits and photonic devices. It is one of the fastest growing fields of science, with applications in telecommunication, consumer electronics, data storage, medical diagnostics, and energy.

Nanoplasmonics: Advanced Device Applications provides a scientific and technological background of a particular nanoplasmonic application and outlines the progress and challenges of the application. It reviews the latest developments in nanoplasmonic applications, such as optical storage, photovoltaics, photocatalysts, integrated chips, optical elements, and sensing. The areas of application were chosen for their practicality, and each chapter provides a balanced scientific review and technological progress of how these areas of application are shaping the future.

This book provides a first integrated view of nanophotonics and plasmonics, covering the use of dielectric, semiconductor, and metal nanostructures to manipulate light at the nanometer scale. The presentation highlights similarities and advantages, and shows the common underlying physics, targets, and methodologies used for different materials (optically transparent materials for nanophotonics, vs opaque materials for plasmonics). Ultimately, the goal is to provide a basis for developing a unified platform for both fields. In addition to the fundamentals and detailed theoretical background, the book showcases the main device applications. Ching Eng (Jason) Png is Director of the Electronics and Photonics Department at the Institute of High Performance Computing, Agency for Science Technology and Research, Singapore. Yuriy A. Akimov is a scientist in the Electronics and Photonics Department at the Institute of High Performance Computing, Agency for Science Technology and Research, Singapore.

This book, edited by two of the most respected researchersin plasmonics, gives an overview of the current state inplasmonics and plasmonic-based metamaterials, with an emphasis onactive functionalities and an eye to future developments. This bookis multifunctional, useful for newcomers and scientists interestedin applications of plasmonics and metamaterials as well as forestablished researchers in this multidisciplinary area.

Plasmonics and Super-Resolution Imaging

Reviews in Plasmonics 2010

Plasmonics, Photonic Materials and Sub-Wavelength Resolution

Analysis and Applications

Nanophotonics and Plasmonics

Optical and Molecular Physics: Theoretical Principles and Experimental Methods addresses many important applications and advances in the field. This book is divided into 5 sections: Plasmonics and carbon dots physics with applications Optical films, fibers, and materials Optical properties of advanced materials Molecular physics and diffusion Macromolecular physics Weaving together science and engineering, this new volume addresses important applications and advances in optical and molecular physics. It covers plasmonics and carbon dots physics with applications; optical films, fibers, and materials; optical properties of advanced materials; molecular physics and diffusion; and macromolecular physics. This book looks at optical materials in the development of composite materials for the functionalization of glass, ceramic, and polymeric substrates to interact with electromagnetic radiation and presents state-of-the-art research in preparation methods, optical characterization, and usage of optical materials and devices in various photonic fields. The authors discuss devices and technologies used by the electronics, magnetics, and photonics industries and offer perspectives on the manufacturing technologies used in device fabrication.

Plasmonics is a rapidly developing field that combines fundamental research and applications ranging from areas such as physics to engineering, chemistry, biology, medicine, food sciences, and the environmental sciences. Plasmonics appeared in the 1950s with the discovery of surface plasmon polaritons. Plasmonics then went through a novel propulsion in the mid-1970s, when surface-enhanced Raman scattering was discovered. Nevertheless, it is in this last decade that a very significant explosion of plasmonics and its applications has occurred. Thus, this book provides a snapshot of the current advances in these various areas of plasmonics and its applications, such as engineering, sensing, surface-enhanced fluorescence, catalysis, and photovoltaic devices.

Intrinsically conducting polymers forms a category of doped conjugated polymers that can conduct electricity. Since their discovery in the late 1970s, they have been widely applied in many fields, ranging from optoelectronic devices to biosensors. The most common type of conducting polymers is poly(3,4-ethylenedioxythiophene), or PEDOT. PEDOT has been popularly used as electrodes for solar cells or light-emitting diodes, as channels for organic electrochemical transistors, and as p-type legs for organic thermoelectric generators. Although many studies have been dedicated to PEDOT-based materials, there has been a lack of a unified model to describe their optical properties across different spectral ranges. In addition, the interesting optical properties of PEDOT-based materials, benefiting from its semi-metallic character, have only been rarely studied and utilized, and could potentially enable new applications. Plasmonics is a research field focusing on interactions between light and metals, such as the noble metals (gold and silver). It has enabled various opportunities in fundamental photonics as well as practical applications, varying from biosensors to colour displays. This thesis explores highly conducting polymers as alternatives to noble metals and as a new type of active plasmonic materials. Despite high degrees of microstructural disorder, conducting polymers can possess electrical conductivity approaching that of poor metals, with particularly high conductivity for PEDOT deposited via vapour phase polymerization (VPP). In this thesis, we systematically studied the optical and structural properties of VPP PEDOT thin films and their nanostructures for plasmonics and other optical applications. We employed ultra-wide spectral range ellipsometry to characterize thin VPP PEDOT films and proposed an anisotropic Drude-Lorentz model to describe their optical conductivity, covering the ultraviolet, visible, infrared, and terahertz ranges. Based on this model, PEDOT doped with tosylate (PEDOT:Tos) presented negative real permittivity in the near infrared range. While this indicated optical metallic character, the material also showed comparably large imaginary permittivity and associated losses. To better understand the VPP process, we carefully examined films with a collection of microstructural and spectroscopic characterization methods and found a vertical layer stratification in these polymer films. We unveiled the cause as related to unbalanced transport of polymerization precursors. By selection of suitable counterions, e.g., trifluoromethane sulfonate (OTf), and optimization of reaction conditions, we were able to obtain PEDOT films with electrical conductivity exceeding 5000 S/cm. In the near infrared range from 1 to 5 μm, these PEDOT:OTf films provided a well-defined plasmonic regime, characterized by negative real permittivity and lower magnitude imaginary component. Using a colloidal lithography-based approach, we managed to fabricate nanodisks of PEDOT:OTf and showed that they exhibited clear plasmonic absorption features. The experimental results matched theoretical calculations and numerical simulations. Benefiting from their mixed ionic-electronic conducting characters, such organic plasmonic materials possess redox-tunable properties that make them promising as tuneable optical nanoantennas for spatiotemporally dynamic systems. Finally, we presented a low-cost and efficient method to create structural colour surfaces and images based on UV-treated PEDOT films on metallic mirrors. The concept generates beautiful and vivid colours through-out the visible range utilizing a synergistic effect of simultaneously modulating polymer absorption and film thickness. The simplicity of the device structure, facile fabrication process, and tunability make this proof-of-concept device a potential candidate for future low-cost backlight-free displays and labels.

Based on the '240' Conference held at the University of Chicago in September of 2012, this special volume of The Advances in Chemical Physics series celebrates scientific research contributions and careers of R. Stephen Berry, Stuart A. Rice and Joshua Jortner. In addition to continuing the chemical physics field with a forum for critical, authoritative evaluations of advances in the discipline, Volume 157 explores the following topics: The Emergence and Breakdown of Complexity Dynamics at Extremes Grand Questions Regarding Biomolecular Homochirality in the Origin and Evolution of Life The book: celebrates the scientific research contributions and careers of R. Stephen Berry, Stuart A. Rice and Joshua Jortner contributes to the only series available that presents the cutting edge of research in chemical physics includes contributions from experts in this field of research structured with an editorial framework that makes the book an excellent supplement to an advanced graduate class in physical chemistry or chemical physics

Plasmonics in Chemistry and Biology

World Scientific Handbook Of Metamaterials And Plasmonics (In 4 Volumes)

Theoretical Principles and Experimental Methods

Surface Plasmon Nanophotonics

Development of Next-generation Electrooptical Devices

Metamaterials represent a new emerging innovative field of research which has shown rapid acceleration over the last couple of years. In this handbook, we present the richness of the field of metamaterials in its widest sense, describing artificial media with sub-wavelength structure for control over wave propagation in four volumes. Volume 1 focuses on the fundamentals of electromagnetic metamaterials in all their richness, including metasurfaces and hyperbolic metamaterials. Volume 2 widens the picture to include elastic, acoustic, and seismic systems, whereas Volume 3 presents nonlinear and active photonic metamaterials. Finally, Volume 4 includes recent progress in the field of nanoplasmonics, used extensively for the tailoring of the unit cell response of photonic metamaterials. In its totality, we hope that this handbook will be useful for a wide spectrum of readers, from students to active researchers in industry, as well as teachers of advanced courses on wave propagation. Contents: Volume 1: Electromagnetic Metamaterials (Ekaterina Shamonina): PrefaceElectromagnetic Metamaterials: Homogenization and Effective Properties of Mixtures (Ari Sihvola)Effective Medium Theory of Electromagnetic and Quantum Metamaterials (Mário G Silveirinha)Hyperbolic Metamaterials (Igor I Smolyaninov)Circuit and Analytical Modelling of Extraordinary Transmission Metamaterials (Francisco Medina, Francisco Mesa, Raul Rodríguez-Berral and Carlos Molero)Electromagnetic Metasurfaces: Synthesis, Realizations and Discussions (Karim Achouri and Christophe Caloz)Metasurfaces for General Control of Reflection and Transmission (Sergei Tretyakov, Viktar Asadchy and Ana Díaz-Rubio)Scattering at the Extreme with Metamaterials and Plasmonics (Francesco Monticone and Andrea Alù)All-Dielectric Nanophotonics: Fundamentals, Fabrication, and Applications (Alexander Krasnok, Roman Savelev, Denis Baranov and Pavel Belov)Tunable Metamaterials (Ilya V Shadrivov and Dragomir N Neshev)Spatial Solitonic and Nonlinear Plasmonic Aspects of Metamaterials (Allan D Boardman, Alesandro Alberucci, Gaetano Assanto, Yu G Rapoport, Vladimir V Grimalsky, Vasyl M Ivchenko and Eugen N Tkachenko)Metamaterial Catheter Receivers for Internal Magnetic Resonance Imaging (Richard R A Syms, Ian R Young and Laszlo Solymar)Microwave Sensors Based on Symmetry Properties and Metamaterial Concepts (Jordi Naqui, Ali K Horestani, Christophe Fumeaux and Ferran Martín)Volume 2: Elastic, Acoustic, and Seismic Metamaterials (Richard Craster and Sébastien Guenneau): PrefaceDynamic Homogenization of Acoustic and Elastic Metamaterials and Phononic Crystals (Richard Craster, Tryfon Antonakakis and Sébastien Guenneau)Acoustic Metamaterial (Nicholas Fang, Jun Xu, Navid Nemati, Nicolas Viard and Denis Lafarge)Flat Lens Focusing of Flexural Waves in Thin Plates (Patrick Sebbah and Marc Dubois)Space–Time Cloaking (Martin W McCall and Paul Kinsler)Soda Cans Metamaterial: Homogenization and Beyond (Fabrice Lemoult, Geoffroy Lerosey, Nadège Kaïna and Mathias Fink)New Trends Toward Locally-Resonant Metamaterials at the Mesoscopic Scale (Philippe Roux, Matthieu Rupin, Fabrice Lemoult, Geoffroy Lerosey, Andrea Colombi, Richard Craster, Sébastien Guenneau, William A Kuperman and Earl G Williams)Seismic Metamaterials: Controlling Surface Rayleigh Waves Using Analogies with Electromagnetic Metamaterials (Stéphane Brûlé, Stefan Enoch, Sébastien Guenneau and

This book discusses the recent advances in the area of near-field Raman scattering, mainly focusing on tip-enhanced and surface-enhanced Raman scattering. Some of the key features covered here are the optical structuring and manipulations, single molecule sensitivity, analysis of single-walled carbon nanotubes, and analytic applications in chemistry, biology and material sciences. This book also discusses the plasmonic materials for better enhancement, and optical antennas. Further, near-field microscopy based on second harmonic generation is also discussed. Chapters have been written by some of the leading scientists in this field, who present some of their recent work in this field. ·Near-field Raman scattering ·Tip-enhanced Raman spectroscopy ·Surface-enhanced Raman spectroscopy ·Nano-photonics ·Nanoanalysis of Physical, chemical and biological materials beyond the diffraction limits ·Single molecule detection

This book deals with all aspects of plasmonics, basics, applications and advanced developments. Plasmonics is an emerging field of research dedicated to the resonant interaction of light with metals. The light/matter interaction is strongly enhanced at a nanometer scale which sparks a keen interest of a wide scientific community and offers promising applications in pharmacology, solar energy, nanocircuitry or also light sources. The major breakthroughs of this field of research originate from the recent advances in nanotechnology, imaging and numerical modelling. The book is divided into three main parts: extended surface plasmons polaritons propagating on metallic surfaces, surface plasmons localized on metallic particles, imaging and nanofabrication techniques. The reader will find in the book: Principles and recent advances of plasmonics, a complete description of the physics of surface plasmons, a historical survey with emphasize on the emblematic topic of Wood's anomaly, an overview of modern applications of molecular plasmonics and an extensive description of imaging and fabrications techniques.

Delving into the development of plasmonic nanosensors to detect toxic heavy metal ions in aqueous media, this book explores a significant and burgeoning branch of nanosensor technology based on plasmon resonance and serves as a guide for conducting research in this area. All types of nanosensors for water treatment and detection of heavy metals are also introduced. Plasmonic Nanosensors for Detection of Aqueous Toxic Metals provides up-to-date data upon which researchers and ecologists, industrialists, and academicians can build to create a variety of plasmonic nanosensors. This book also covers paper-based devices based on plasmon for quantifying toxic metals in water and considers important applications of different plasmon-based nanomaterials—graphene, core-shell, quantum dots, nanoporous membrane, carbon nanotubes, and nanofibers. It is an accessible resource for all those involved in the field of nanosensors and their applications and can pave the way for a better understanding of nanosensor technology with regard to toxic metals. Key features: Gives an in-depth account of the extraordinary optical property at the nanoscale and its use in sensing Offers up-to-date study and practical results for academia, researchers, and engineers working in water treatment and purification Provides sensing application of thematic nanomaterials such as quantum dots and core-shell

From Basics to Advanced Topics

Photon-Working Switches

Optics of Conducting Polymer Thin Films and Nanostructures

Plasmonics and its Applications

Active Plasmonics and Tuneable Plasmonic Metamaterials

This book summarizes the results of studies of molecules and molecular complexes using techniques based on surface plasmon resonance (SPR) in a novel scientific direction called molecular plasmonics. It presents the current state of investigations in the field of molecular plasmonics and discusses its two main physical phenomena: surface plasmon – polariton resonance (SPPR) and localized SPR (LSPR). Among the mathematical methods for the calculation of plasmonic systems response, the book emphasizes models based on the transfer-matrix method, Green function formalism, Mie scattering theory, and numerical methods. It considers the possibilities of the SPPR technique for registering conformational changes, surface plasmon – mediated photopolymerization, electrochemical processes, as well as reversible optoelectronic and physicochemical properties during investigation of molecular systems. It describes applications of the LSPR method, including creation of metamaterials, surface-enhanced fluorescence, and bio- and chemosensing using noble metal nanoparticles in colloidal, array, and composite polymeric film formats. It also highlights the development and applications of plasmonic nanochips.

Molecular PlasmonicsJohn Wiley & Sons

This second volume in the Handai Nanophotonics book series covers the area of Nanoplasmonics, a recent hot topic in the field of nanophotonics, impacting a diverse range of research disciplines from information technology and nanotechnology to the bio- and medical sciences. The interaction between photons and metal nanostructures leads to interesting and extraordinary scientific phenomena and produces new functions for nano materials and devices. Newly discovered physical phenomena include local mode of surface plasmon polariton excited in nanoparticles, hot spots on nano-rods and nano-cones, long range mode of surface plasmons excited on thin metal films, and dispersion relationship bandgaps of surface plasmons in periodic metal structures. These have been applied to, for example, single molecule detection and nano-imaging/spectroscopy, photon accumulation for lasing applications, optical nano-waveguides and nano-circuits. * interdisciplinary research text on the application of nanoplasmonics research and effects in devices for applications * bridges the gap between conventional photophysics & photochemistry and nanoscience * continuing the series that focuses on 'hot' areas of photochemistry, optics, material science and bioscience.

Plasmonics is an emerging field mainly developed within the past two decades. Due to its unique capabilities to manipulate light at deep subwavelength scales, plasmonics has been commonly treated as the most important part of nanophotonics. Plasmonic-assisted optical microscopy techniques, especially super-resolution microscopy, have shown tremendous potential and attracted much attention. This book aims to collect cutting-edge studies in various optical imaging technologies with advanced performances that are enabled or enhanced by plasmonics. The basic working principles, development details, and potential future direction and perspectives are discussed. Edited by Zhaowei Liu, a prominent researcher in the field of super-resolution microscopy, this book will be an excellent reference for anyone in the field of nanophotonics, plasmonics, and optical microscopy.

From Classical to Quantum Plasmonics in Three and Two Dimensions

Modern Plasmonics
Advanced Device Applications
From Fundamentals to Applications
Nanotechnology in Environmental Science, 2 Volumes

This book focuses on photoswitches. The objective of the book is to introduce researchers and graduate course students who are interested in "photon-working switches" not only to the fundamentals but also to the latest research being carried out in this field. Light can reach a target substrate without any physical contact to deliver energy. The energy can induce changes in the structure of the molecules included in the substrate so that its properties and functions are made switchable by light irradiation. When a substrate is able to revert to its original state, this system can be regarded as a "photon-working switch". The terms "photon-working switches" or "photoswitches" are almost equivalent in meaning to "photochromism"; however, they focus on the "switching of functions" of chemical species rather than their "reversible transformation". Most of the authors of this volume are members of PHENICS, an international research group on organic molecular photoswitches composed of research institutions from France, Japan, Russia, China and Germany. Since its inception in 2008, PHENICS has promoted active research to develop the field. This book commemorates the group's eighth year of collaborative research.

This thesis describes the controlled immobilization of molecules between two cuboidal metal nanoparticles by means of a self-assembly method to control the quantum plasmon resonances. It demonstrates that quantum-plasmonics is possible at length scales that are useful for real applications. Light can interact with certain metals and can be captured in the form of plasmons, which are collective, ultra-fast oscillations of electrons that can be manipulated at the nano-scale. Surface plasmons are considered as a promising phenomenon for potentially bridging the gap between fast-operating-speed optics and nano-scale electronics. Quantum tunneling has been predicted to occur across two closely separated plasmonic resonators at length scales (0.3 nm) that are not accessible using present-day nanofabrication techniques. Unlike top-down nanofabrication, the molecules between the closely-spaced metal nanoparticles could control the gap sizes down to sub-nanometer scales and act as the frequency controllers in the terahertz regime, providing a new control parameter in the fabrication of electrical circuits facilitated by quantum plasmon tunneling.

This book is meant as an introduction to graphene plasmonics and aims at the advanced undergraduate and graduate students entering the field of plasmonics in graphene. In it different theoretical methods are introduced, starting with an elementary description of graphene plasmonics and evolving towards more advanced topics. This book is essentially self-contained and brings together a number of different topics about the field that are scattered in the vast literature. The text is composed of eleven chapters and of a set of detailed appendices. It can be read in two different ways: Reading only the chapters to get acquainted with the field of plasmonics in graphene or reading the chapters and studying the appendices to get a working knowledge of the topic. The study of the material in this book will bring the students to the forefront of the research in this field. Errata(s) Errata (159 KB) Contents: IntroductionElectromagnetic Properties of Solids in a NutshellSurface Plasmon–Polaritons at Dielectric–Metal InterfacesGraphene Surface PlasmonsExcitation of Graphene Surface PlasmonsLaunching Plasmons Using a Metallic AntennaPlasmonics in Periodic Arrays of Graphene RibbonsPlasmons in Graphene Nanostructures and in One-dimensional ChannelsExcitation of Surface Plasmon–Polaritons Using Dielectric GratingsExcitation of Plasmons by an Emitting DipoleConcluding Remarks Readership: Advanced undergraduate and graduate students entering the field of graphene plasmonics.

Plasmonics is entering the curriculum of many universities, either as a stand alone subject, or as part of some course or courses. Nanotechnology institutes have been, and are being, established in universities, in which plasmonics is a significant topic of research. Modern Plasmonics book offers a comprehensive presentation of the properties of surface plasmon polaritons, in systems of different structures and various natures, e.g. active, nonlinear, graded, theoretical/computational and experimental techniques for studying them, and their use in a variety of applications. Contains material not found in existing books on plasmonics, including basic properties of these surface waves, theoretical/computational and experimental approaches, and new applications of them. Each chapter is written by an expert in the subject to which it is devoted. Emphasis on applications of plasmonics that have been realized, not just predicted or proposed.

Quantum Plasmonics
Plasmonics
Molecular Plasmonics
Quantum Photonics: Pioneering Advances and Emerging Applications
Science's Great Challenges

21st Century Nanoscience - A Handbook: Nanophotonics, Nanoelectronics, and Nanoplasmonics (Volume 6) will be the most comprehensive, up-to-date large reference work for the field of nanoscience. Handbook of Nanophysics by the same editor published in the fall of 2010 and was embraced as the first comprehensive reference to consider both fundamental and applied aspects of nanophysics. This follow-up project has been conceived as a necessary expansion and full update that considers the significant advances made in the field since 2010. It goes well beyond the physics as warranted by recent developments in the field. This sixth volume in a ten-volume set covers nanophotonics, nanoelectronics, and nanoplasmonics. Key Features: Provides the most comprehensive, up-to-date large reference work for the field. Chapters written by international experts in the field. Emphasises presentation and real results and applications. This handbook distinguishes itself from other works by its breadth of coverage, readability and timely topics. The intended readership is very broad, from students and instructors to engineers, physicists, chemists, biologists, biomedical researchers, industry professionals, governmental scientists, and others whose work is impacted by nanotechnology. It will be an indispensable resource in academic, government, and industry libraries worldwide. The fields impacted by nanophysics extend from materials science and engineering to biotechnology, biomedical engineering, medicine, electrical engineering, pharmaceutical science, computer technology, aerospace engineering, mechanical engineering, food science, and beyond.

Cluster Beam Deposition of Functional Nanomaterials and Devices, Volume 15, provides up-to-date information on the CBD of novel nanomaterials and devices. The book offers an overview of gas phase synthesis in a range of nanoparticles, along with discussions on the development of several devices and applications. Applications include, but are not limited to catalysis, smart nanocomposites, nanoprobes, electronic devices, gas sensors and biosensors. This is an important reference source for materials scientists and engineers who want to learn more about this sustainable, innovative manufacturing technology.

While several reviews and books on surface nanophotonics and fluorescence spectroscopy are available, an updated focus on molecular plasmonics, including both theoretical methods and experimental aspects, is still lacking. This handbook is a comprehensive overview on the physics of the plasmon–emitter interaction, ranging from electromagnetism to quantum mechanics, from metal-enhanced fluorescence to surface-enhanced Raman scattering, from optical microscopy to synthesis of metal nanoparticles, filling the gap in the literature of this merging field. It allows experimentalists to have a solid theoretical reference at a different level of accuracy, and theoreticians to find new stimuli for novel computational methods and emerging applications.

An overview of the current state of nanotechnology-based devices with applications in environmental science, focusing on nanomaterials and polymer nanocomposites. The handbook pays special attention to those nanotechnology-based approaches that promise easier, faster and cheaper processes in environmental monitoring and remediation. Furthermore, it presents up-to-date information on the economics, toxicity and regulations related to nanotechnology in detail. The book closes with a look at the role of nanotechnology for a green and sustainable future. With its coverage of existing and soon-to-be-realized devices this is an indispensable reference for both academic and corporate R&D.

Biomolecular Plasmonics
Plasmonics and Plasmonic Metamaterials
Tip Enhancement
Plasmonic Nanosensors for Detection of Aqueous Toxic Metals
Nano-Optics for Enhancing Light-Matter Interactions on a Molecular Scale

The development of integrated electronic and photonic circuits has led to remarkable data processing and transport capabilities that permeate almost every facet of our daily lives. Scaling these devices to smaller and smaller dimensions has enabled faster, more power efficient and inexpensive components but has also brought about a myriad of new challenges. One very important challenge is the growing size mismatch between electronic and photonic components. To overcome this challenge, we will need to develop radically new device technologies that can facilitate information transport between nanoscale components at optical frequencies and form a bridge between the world of nano-electronic and micro-photonics. Plasmonics is an exciting new field of science and technology that aims to exploit the unique optical properties of metallic nanostructures to gain a new level of control over light-matter interactions. The use of nanometallic (plasmonic) structures may help bridge the size gap between the two technologies and enable an increased synergy between chip-scale electronics and photonics. In the first part of this dissertation we analyze the performance of a surface plasmon-polariton all-optical switch that combines the unique physical properties of small molecules and metallic (plasmonic) nanostructures. The switch consists of a pair of gratings defined on an aluminum film coated with a thin layer of photochromic (PC) molecules. The first grating couples a signal beam consisting of free space photons to SPPs that interact effectively with the PC molecules. These molecules can reversibly be switched between transparent and absorbing states using a free space optical pump. In the transparent (signal "on") state, the SPPs freely propagate through the molecular layer, and in the absorbing (signal "off") state, the SPPs are strongly attenuated. The second grating serves to decouple the SPPs back into a free space optical beam, enabling measurement of the modulated signal with a far-field detector. We confirm and quantify the switching behavior of the PC molecules by using a surface plasmon resonance spectroscopy. The quantitative experimental and theoretical analysis of the nonvolatile switching behavior guides the design of future nanoscale optically or electrically pumped optical switches. In the second part of the dissertation we provide a critical assessment of the opportunities for use of plasmonic nanostructures in thin film solar cell technology. Thin-film solar cells have attracted significant attention as they provide a viable pathway towards reduced materials and processing costs. Unfortunately, the materials quality and resulting energy conversion efficiencies of such cells is still limiting their rapid large-scale implementation. The low efficiencies are a direct result of the large mismatch between electronic and photonic length scales in these devices; the absorption depth of light in popular PV semiconductors tends to be longer than the electronic (minority carrier) diffusion length in deposited thin-film materials. As a result, charge extraction from optically thick cells is challenging due to carrier recombination in the bulk of the semiconductor. We discuss how light absorption could be improved in ultra-thin layers of active material making use of large scattering cross sections of plasmonic structures. We present a combined computational-experimental study aimed at optimizing plasmon-enhanced absorption using periodic and non-periodic metal nanostructure arrays.

Manipulation of plasmonics from nano to micro scale. 1. Introduction. 2. Form-Birefringent metal and its plasmonic anisotropy. 3. Plasmonic photonic crystal. 4. Fourier plasmonics. 5. Nanoscale optical field localization. 6. Conclusions and outlook -- 11. Dielectric-loaded plasmonic waveguide components. 1. Introduction. 2. Design of waveguide dimensions. 3. Sample preparation and near-field characterization. 4. Excitation and propagation of guided modes. 5. Waveguide bends and splitters. 6. Coupling between waveguides. 7. Waveguide-ring resonators. 8. Bragg gratings. 9. Discussion-- 12. Manipulating nanoparticles and enhancing spectroscopy with surface plasmons. 1. Introduction. 2. Propulsion of gold nanoparticles with surface plasmon polaritons. 3. Double resonance substrates for surface-enhanced raman spectroscopy. 4. Conclusions and outlook -- 13. Analysis of light scattering by nanoobjects on a plane surface via discrete sources method. 1. Introduction. 2. Light scattering by a nanorod. 3. Light scattering by a nanoshell. 4. Summary -- 14. Computational techniques for plasmonic antennas and waveguides. 1. Introduction. 2. Time domain solvers. 3. Frequency domain solvers. 4. Plasmonic antennas. 5. Plasmonic waveguides. 6. Advanced structures. 7. Conclusions

This book brings together reviews by internationally renowned experts on quantum optics and photonics. It describes novel experiments at the limit of single photons, and presents advances in this emerging research area. It also includes reprints and historical descriptions of some of the first pioneering experiments at a single-photon level and nonlinear optics, performed before the inception of lasers and modern light detectors, often with the human eye serving as a single-photon detector. The book comprises 19 chapters, 10 of which describe modern quantum photonics results, including single-photon sources, direct measurement of the photon's spatial wave function, nonlinear interactions and non-classical light, nanophotonics for room-temperature single-photon sources, time-multiplexed methods for optical quantum information processing, the role of photon statistics in visual perception, light-by-light coherent control using metamaterials, nonlinear nanoplasmonics, nonlinear polarization optics, and ultrafast nonlinear optics in the mid-infrared.

Reviews in Plasmonics 2010, the first volume of the new book serial from Springer, serves as a comprehensive collection of current trends and emerging hot topics in the field of Plasmonics and closely related disciplines. It summarizes the year's progress in surface plasmon phenomena and its applications, with authoritative analytical reviews specialized enough to be attractive to professional researchers, yet also appealing to the wider audience of scientists in related disciplines of Plasmonics. Reviews in Plasmonics offers an essential reference material for any lab working in the Plasmonics field and related areas. All academics, bench scientists, and industry professionals wishing to take advantage of the latest and greatest in the continuously emerging field of Plasmonics will find it an invaluable resource. Key features: Accessible utility in a single volume reference. Chapters authored by known leading figures in the Plasmonics field. New volume publishes annually. Comprehensive coverage of the year's hottest and emerging topics. Reviews in Plasmonics 2011 topics include: Metal Nanoparticles for Molecular Plasmonics. Surface Plasmon Resonance based Fiber Optic Sensors. Elastic Light Scattering of Biopolymer/Gold Nanoparticles Fractal Aggregates. Influence of electron quantum confinement on the electronic response of metal/metal interfaces. Melting Transitions of DNA-Capped Gold Nanoparticle Assemblies. Nanomaterial Based Long Range Optical Ruler for Monitoring Biomolecular Activities. Plasmonic Gold and Silver Films: Selective Enhancement of Chromophore Raman Scattering or Plasmon-Assisted Fluorescence.

Fundamentals and Applications
An Introduction to Graphene Plasmonics
Active Plasmonic Nanomaterials
An Integrated View
Understanding Biophotonics

Over the past decade, plasmonic nanoparticles have been the subject of extensive research, owing to their remarkable optical properties. These properties arise from a collective oscillation of the conductive electrons at the nanoparticle surface under light irradiation, known as localized surface plasmon (LSP). LSP is characterized by (i) a strong absorption and scattering of the light depending on the geometrical parameters of the nanoparticles and (ii) a strong amplification of the local field in the vicinity of the nanoparticles. Quite recently, it was shown that the activation and the initiation of chemical reactions or physical processes can be facilitated using LSP excitation. Such exploitation presents two main advantages: an enhanced yield and a fine control of chemical reactions at the nanoscale. These topics have become very active and are in line with molecular plasmonics. This book explores this new field and provides a broad view on the exploitation of plasmonics in chemical and biological fields.

Adopting a novel approach, this book provides a unique "molecular perspective" on plasmonics, concisely presenting the fundamentals and applications in a way suitable for beginners entering this hot field as well as for experienced researchers and practitioners. It begins by introducing readers to the optical effects that occur at the nanoscale and particularly their modification in the presence of biomolecules, followed by a concise yet thorough overview of the different methods for the actual fabrication of nanooptical materials. Further chapters address the relevant nanooptics, as well as the various approaches to combining nanostructures and biomolecules to achieve certain desired functionalities for applications in the fields of probing, sensing and particle manipulation. For analytical biologists, physical chemists, materials scientists and medicinal chemists.

Decades of extensive research into metallic nanostructures have deepened our understanding of plasmonic phenomena. In turn, plasmonics have been utilized in various applications in a broad range of research fields. Plasmonic-aided biomolecular detection is highlighted due to its ability to obtain biomolecular fingerprint information in a non-invasive, in-situ, and single molecule resolution manner. However, its applicability to various fields still faces practical limitations such as reliable plasmonic structure fabrication, signal instability (or blinking), and signal variation amongst different plasmonic structures for the same molecule. In this respect, this thesis discusses the fundamentals of plasmonic phenomena and molecular interaction with excited plasmonic structures. Here we demonstrate the designs of plasmonic structures: eagle-beak nanoantenna, gold nanoflake on photonic crystal, and gold viruses. The first two are for large-area uniform substrates that enable single-molecule sensitivity. The last one is a mobile nanoparticle that continuously interacts with a cellular system with multiple functions including molecular imaging, targeting, and drug delivery. We also suggest preconcentration-based non-blinking single-molecule detection. Electric and temperature fields were considered in moving molecules towards excited nanostructures. By using an eagle-beak nanoantenna, we demonstrate single-molecule, non-blinking surface-enhance Raman scattering. Furthermore, variation of molecular scattering from a curved Poynting vector and depolarized scattering from nonparallel electron motion to incident light are discussed as a new molecular detection scheme. Lastly, we provide a design concept that utilizes temperature and a thermal gradient to activate carrier molecules on nanoparticles, in particular for

extrinsic gene delivery. By varying the thermal profile around plasmonic structures, diverse gene activation schemes are available for biological experiments. When the electric and thermal fields around excited plasmonic structures are considered in terms of gradients and vectors, we can enhance detection capabilities while conferring multiple functionalities to structures. We believe this series of new approaches to plasmonic-aided molecular detection can elevate molecular imaging potential in real fields, and further expand to other types of applications such as plasmonic energy harvest, optical communication and biomedical applications.

Plasmonic nanoparticles (NPs) represent an outstanding class of nanomaterials that have the capability to localize light at the nanoscale by exploiting a phenomenon called localized plasmon resonance. The book is aimed at reviewing recent efforts devoted to utilize NPs in many research fields, such as photonics, optics, and plasmonics. In this framework, particular interest is devoted to active plasmonics, a quite broad concept that indicates those applications in which NPs play an active role, like realization of gain-assisted means, utilization of NPs embedded in liquid crystalline and flexible materials, and exploitation of renewable solar energy. The book puts together contributions from outstanding research groups in the field of plasmonic nanomaterials all over the world. It provides basic and advanced knowledge in the fields of plasmonics, photonics, and optics and covers research on plasmonic nanomaterials for applications ranging from plasmonics to photonics.

21st Century Nanoscience – A Handbook

Nanoplasmonics

Metallic Nanostructures and Their Optical Properties

Theory and Applications

Handbook of Molecular Plasmonics

Biophotonics involves understanding how light interacts with biological matter, from molecules and cells, to tissues and even whole organisms. Light can be used to probe biomolecular events, such as gene expression and protein–protein interaction, with impressively high sensitivity and specificity. The spatial and temporal distribution of biochemical constituents can also be visualized with light and, thus, the corresponding physiological dynamics in living cells, tissues, and organisms in real time. Light can also be used to alter the properties and behaviors of biological matter, such as to damage cancerous cells by laser surgery or therapy, and manipulate the neuronal signaling in a brain network. Fueled by the innovations in photonic technologies in the past half century, biophotonics continues to play a ubiquitous role in revolutionizing basic life science studies as well as biomedical diagnostics and therapies. Advancements in biophotonics in the past few decades can be seen not only in biochemistry and cell/molecular biology, but also in numerous preclinical applications. Researchers around the world are searching for ways to bring biophotonic technologies into real clinical practices, particularly cellular and molecular optical imaging. Meanwhile, emerging technologies, such as laser nanosurgery and nanoplasmonics, have created new insights for understanding, monitoring, and even curing diseases on a molecular basis. This book presents the essential basics of optics and biophotonics to newcomers (senior undergraduates or postgraduate researchers) who are interested in this multidisciplinary research field. With stellar contributions from leading experts, the book highlights the major advancements in preclinical diagnostics using optical microscopy and spectroscopy, including multiphoton microscopy, super-resolution microscopy, and endomicroscopy. It also introduces a number of emerging techniques and toolsets for biophotonics applications, such as nanoplasmonics, microresonators for molecular detection, and subcellular optical nanosurgery.

Nanophotonics, Nanoelectronics, and Nanoplasmonics (Volume Six)

Cluster Beam Deposition of Functional Nanomaterials and Devices

Fundamentals, Advances, and Applications

Proceedings of the 240 Conference

Reviews in Plasmonics 2017