



# Surface Plasmon Polaritons Physics And Applications

**Yongqian Li (Associate professor)**

## Surface Plasmon Polaritons Physics And Applications:

**Two-Photon Polymerization and application to Surface Plasmon Polaritons** Sven Passinger,2008 [Plasmonics](#)

Ki Young Kim,2012-10-24 The title of this book Plasmonics Principles and Applications encompasses theory technical issues and practical applications which are of interest for diverse classes of the plasmonics The book is a collection of the contemporary researches and developments in the area of plasmonics technology It consists of 21 chapters that focus on interesting topics of modeling and computational methods plasmonic structures for light transmission focusing and guiding emerging concepts and applications *Plasmonic Optics* Yongqian Li (Associate professor),2017 Plasmonic optics is an emerging research field that combines electronics and photonics with nanostructures This book presents the physics and applications of nanoscale photophysics Topics include surface plasmon polaritons local surface plasmon resonances extraordinary transmission scattering enhancement perfect absorption and light radiation *Hybrid Plasmonics for Energy Harvesting and Sensing of Radiation and Heat* Mina Shiran Chaharsoughi,2020-02-03 The special optical properties of subwavelength metallic structures have opened up for numerous applications in different fields The interaction of light with metal nanostructures leads to the excitation of collective oscillations of conduction band electrons known as plasmons These plasmon excitations are responsible for the high absorption and high scattering of light in metallic nanostructures High absorption of light and the subsequent temperature increase in the nanostructures make them suitable as point like heat sources that can be controlled remotely by light The research presented in this thesis focuses on the development and studies of hybrid devices that combine light induced heating in plasmonic nanostructures with other materials and systems Particular focus is put on hybrid organic inorganic systems for applications in energy harvesting as well as in heat and radiation sensing Harvesting energy from light fluctuations was achieved in a hybrid device consisting of plasmonic gold nanodisk arrays and a pyroelectric copolymer In this concept fast and efficient light induced heating in the gold nanodisks modulated the temperature of the pyroelectric layer which could be used to extract electrical energy from fluctuations in simulated sunlight Integrating plasmonic nanostructures with complementary materials can also provide novel hybrid sensors for monitoring of temperature heat flux and radiation In this thesis work a hybrid sensor was designed based on the combination of a plasmonic gold nanohole layer with a pyroelectric copolymer and an ionic thermoelectric gel The gold nanohole arrays acted both as broadband light absorbers in the visible to near infrared spectral range of the solar spectrum and also as one of the electrodes of the sensor In contrast to the constituent components when used separately the hybrid sensor could provide both fast and stable signals upon heat or radiation stimuli as well as enhanced equilibrium signals Furthermore a concept for heat and radiation mapping was developed that was highly sensitive and stable despite its simple structure The concept consisted of a gel like electrolyte connecting two separated metal nanohole electrodes on a substrate Resembling traditional thermocouples this concept could autonomously detect temperature changes but with several orders

of magnitudes higher sensitivity Owing to its promising sensing properties as well as its compatibility with inexpensive mass production methods on flexible substrates such concept may be particularly interesting for electronic skin applications for health monitoring and for humanoid robotics Finally we improved the possibilities for the temperature mapping of the concept by modifying the structure from lateral to vertical form Similar to the lateral device the vertical temperature sensor showed high temperature sensitivity and stability in producing signals upon temperature changes *Plasmonic Optics* Yongqian Li (Associate professor), 2017 Plasmonic optics is an emerging research field that combines electronics and photonics with nanostructures This book presents the physics and applications of nanoscale photophysics Topics include surface plasmon polaritons local surface plasmon resonances extraordinary transmission scattering enhancement perfect absorption and light radiation

**Electromagnetic and Photonic Simulation for the Beginner: Finite-Difference Frequency-Domain in MATLAB®** Raymond C. Rumpf, 2022-01-31 This book teaches the finite difference frequency domain FDFD method from the simplest concepts to advanced three dimensional simulations It uses plain language and high quality graphics to help the complete beginner grasp all the concepts quickly and visually This single resource includes everything needed to simulate a wide variety of different electromagnetic and photonic devices The book is filled with helpful guidance and computational wisdom that will help the reader easily simulate their own devices and more easily learn and implement other methods in computational electromagnetics Special techniques in MATLAB are presented that will allow the reader to write their own FDFD programs Key concepts in electromagnetics are reviewed so the reader can fully understand the calculations happening in FDFD A powerful method for implementing the finite difference method is taught that will enable the reader to solve entirely new differential equations and sets of differential equations in mere minutes Separate chapters are included that describe how Maxwell's equations are approximated using finite differences and how outgoing waves can be absorbed using a perfectly matched layer absorbing boundary With this background a chapter describes how to calculate guided modes in waveguides and transmission lines The effective index method is taught as way to model many three dimensional devices in just two dimensions Another chapter describes how to calculate photonic band diagrams and isofrequency contours to quickly estimate the properties of periodic structures like photonic crystals Next a chapter presents how to analyze diffraction gratings and calculate the power coupled into each diffraction order This book shows that many devices can be simulated in the context of a diffraction grating including guided mode resonance filters photonic crystals polarizers metamaterials frequency selective surfaces and metasurfaces Plane wave sources Gaussian beam sources and guided mode sources are all described in detail allowing devices to be simulated in multiple ways An optical integrated circuit is simulated using the effective index method to build a two dimensional model of the 3D device and then launch a guided mode source into the circuit A chapter is included to describe how the code can be modified to easily perform parameter sweeps such as plotting reflection and transmission as a function of frequency wavelength angle of incidence or a

dimension of the device The last chapter is advanced and teaches FDFD for three dimensional devices composed of anisotropic materials It includes simulations of a crossed grating a doubly periodic guided mode resonance filter a frequency selective surface and an invisibility cloak The chapter also includes a parameter retrieval from a left handed metamaterial The book includes all the MATLAB codes and detailed explanations of all programs This will allow the reader to easily modify the codes to simulate their own ideas and devices The author has created a website where the MATLAB codes can be downloaded errata can be seen and other learning resources can be accessed This is an ideal book for both an undergraduate elective course as well as a graduate course in computational electromagnetics because it covers the background material so well and includes examples of many different types of devices that will be of interest to a very wide audience

*Plasmonics: Fundamentals and Applications* Stefan Alexander Maier,2007-05-16 Considered a major field of photonics plasmonics offers the potential to confine and guide light below the diffraction limit and promises a new generation of highly miniaturized photonic devices This book combines a comprehensive introduction with an extensive overview of the current state of the art Coverage includes plasmon waveguides cavities for field enhancement nonlinear processes and the emerging field of active plasmonics studying interactions of surface plasmons with active media

*Recent Advances in Plasmonic Probes* Rajib Biswas,Nirmal Mazumder,2022-06-21 This book gives a comprehensive overview of recent advancements in both theory and practical implementation of plasmonic probes Encompassing multiple disciplines the field of plasmonics provides a versatile and flexible platform for nanoscale sensing and imaging Despite being a relatively young field plasmonic probes have come a long way with applications in chemical biological civil and architectural fields as well as enabling many analytical schemes such as immunoassay biomarkers environmental indexing and water quality sensing to name but a few The objective of the book is to present in depth analysis of the theory and applications of novel probes based on plasmonics with a broad selection of specially invited chapters on the development fabrication functionalization and implementation of plasmonic probes as well as their integration with current technologies and future outlook This book is designed to cater to the needs of novice seasoned researchers and practitioners in academia and industry as well as medical and environmental fields

**Wireless Technology** Subal Kar,2024-11-13 The text contains all the essential elements of communication principles devices circuits antennas and systems covering the electromagnetic spectrum from KHz to MHz of radio frequency RF that was developed in the formative stage of wireless technology Also the digital revolution that has changed the landscape of modern electronics for wireless technology has been discussed emphasizing the fundamentals including digital computers The presentation of the book is in a concise yet complete way and stresses the physical and technical aspects with application viewpoints but using minimum possible mathematics The book Discusses the historical background of different developments of wireless technology from KHz to MHz and going through the GHz to THz in due perspective to provide a holistic view of the development of wireless technology from its inception to contemporary times Contains in brief the basic concepts of

electromagnetism like Maxwell's wave equation evanescent waves surface waves plasmonic waves that are used in wireless technology in some form or the other Highlights the need for modulation and covers various modulation techniques such as continuous wave and pulse analogue modulation and modulation demodulation systems that were developed in the formative stage of the development of wireless technology in the RF frequency range of KHz to MHz Discusses the physical concepts and application viewpoints of active devices RF transmission lines antennas and systems used at KHz to MHz frequency domain of wireless technology Covers the digital revolution that has changed the wholesale electronic systems of modern wireless technology and the development of digital computers has also been discussed with a brief overview of laptops supercomputers and upcoming quantum computers This overall scenario of historical perspective of wireless technology from KHz to THz and technical developments from KHz to MHz in the RF domain during the formative stage of development of wireless technology including fundamental developments related to digital revolution is expected to attract the interest of the entry level students research scholars professionals and even the general readers alike with a new vision to have a quick yet in depth glimpse of the progress of wireless technology since its inception till today It is primarily written for junior undergraduate students in the fields of electrical engineering electronics and communication engineering wireless communication telecommunication and computer engineering Research scholars and professionals can also refresh their idea of the developments of wireless technology during its formative stage and can get a flavour of the route to modern developments that have taken place henceforth

### **Plasmonics and its Applications** Grégory Barbillon, 2019-06-05

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

### **Handbook of Nanophysics** Klaus D. Sattler, 2010-09-17

Handbook of Nanophysics Functional Nanomaterials illustrates the importance of tailoring nanomaterials to achieve desired functions in applications Each peer reviewed chapter contains a broad based introduction and enhances understanding of the state of the art scientific content through fundamental equations and illustrations some in color This

### **Encyclopedia of Interfacial Chemistry**, 2018-03-29

Encyclopedia of Interfacial Chemistry Surface Science and Electrochemistry Seven Volume Set summarizes current fundamental knowledge of interfacial chemistry bringing readers the latest developments in the field As the chemical and physical properties and processes at solid and liquid interfaces are the scientific basis of so many technologies which enhance our lives and create new opportunities its important to highlight how these technologies enable the design and

optimization of functional materials for heterogeneous and electro catalysts in food production pollution control energy conversion and storage medical applications requiring biocompatibility drug delivery and more This book provides an interdisciplinary view that lies at the intersection of these fields Presents fundamental knowledge of interfacial chemistry surface science and electrochemistry and provides cutting edge research from academics and practitioners across various fields and global regions

### **Ultrathin Two-Dimensional Semiconductors for Novel Electronic Applications**

Mohammad Karbalaei Akbari,Serge Zhuiykov,2020-07-30 Offering perspective on both the scientific and engineering aspects of 2D semiconductors Ultrathin Two Dimensional Semiconductors for Novel Electronic Applications discusses how to successfully engineer 2D materials for practical applications It also covers several novel topics regarding 2D semiconductors which have not yet been discussed in any other publications Features Provides comprehensive information and data about wafer scale deposition of 2D semiconductors ranging from scientific discussions up to the planning of experiments and reliability testing of the fabricated samples Precisely discusses wafer scale ALD and CVD of 2D semiconductors and investigates various aspects of deposition techniques Covers the new group of 2D materials synthesized from surface oxide of liquid metals and also explains the device fabrication and post treatment of these 2D nanostructures Addresses a wide range of scientific and practical applications of 2D semiconductors and electronic and optoelectronic devices based on these nanostructures Offers novel coverage of 2D heterostructures and heterointerfaces and provides practical information about fabrication and application of these heterostructures Introduces the latest advancement in fabrication of novel memristors artificial synapses and sensorimotor devices based on 2D semiconductors This work offers practical information valuable for engineering applications that will appeal to researchers academics and scientists working with and interested in developing an array of semiconductor electronic devices

### **Plasmonics and Plasmonic Metamaterials**

G. Shvets,Igor Tsukerman,2012 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

*Plasmonics* Stefan Enoch,Nicolas Bonod,2012-06-30 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

**Oxide-Based Materials and Structures** Rada Savkina, Larysa Khomenkova, 2020-05-07 Oxide based materials and structures are becoming increasingly important in a wide range of practical fields including microelectronics photonics spintronics power harvesting and energy storage in addition to having environmental applications This book provides readers with a review of the latest research and an overview of cutting edge patents received in the field It covers a wide range of materials techniques and approaches that will be of interest to both established and early career scientists in nanoscience and nanotechnology surface and material science and bioscience and bioengineering in addition to graduate students in these areas Features Contains the latest research and developments in this exciting and emerging field Explores both the fundamentals and applications of the research Covers a wide range of materials techniques and approaches

**Journal of the Physical Society of Japan**, 2017 *Plasmonic Metamaterials* Yongmin Liu, 2009 **Evanescence**  
**Waves in Optics** Mario Bertolotti, Concita Sibilia, Angela M. Guzman, 2017-10-30 This monograph provides an introductory discussion of evanescent waves and plasmons describes their properties and uses and shows how they are fundamental when operating with nanoscale optics Far field optics is not suitable for the design description and operation of devices at this nanometre scale Instead one must work with models based on near field optics and surface evanescent waves The new discipline of plasmonics has grown to encompass the generation and application of plasmons both as a travelling excitation in a nanostructure and as a stationary enhancement of the electrical field near metal nanosurfaces The book begins with a brief review of the basic concepts of electromagnetism then introduces evanescent waves through reflection and refraction and shows how they appear in diffraction problems before discussing the role that they play in optical waveguides and sensors The application of evanescent waves in super resolution devices is briefly presented before plasmons are introduced The surface plasmon polaritons SPPs are then treated highlighting their potential applications also in ultra compact circuitry The book concludes with a discussion of the quantization of evanescent waves and quantum information processing The book is intended for students and researchers who wish to enter the field or to have some insight into the matter It is not a textbook

but simply an introduction to more complete and in depth discussions The field of plasmonics has exploded in the last ten years and most of the material treated in this book is scattered in original or review papers A short comprehensive treatment is missing this book is intended to provide just that **Device Applications of Long Range Surface Plasmons** John David Richards,1993

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