

Light And Matter Electromagnetism Optics Spectroscopy And Lasers Light And Matter

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Semiconductor Optics 1

Demonstrational Optics presents a new didactical approach to the study of optics. Emphasizing the importance of elaborate new experimental demonstrations, pictorial illustrations, computer simulations and models of optical phenomena in order to ensure a deeper understanding of the general and statistical optics. It includes problems focused on the pragmatic needs of students, secondary school teachers, university professors and optical engineers. This volume aims to present improved teaching methods and practical explanations of optical phenomena. An important feature is the inclusion of elaborate pictorial approach to explaining optical phenomena in parallel to a general mathematical description. The modern approach developed here is also used to illustrate many basic phenomena, complimenting the existing literature. The volume contains a valuable compendium of optical experiments for university, college and senior-school physics teachers. Experiments and modern computer simulations are described within the volume in sufficient detail to allow successful reproduction in a classroom or lecture theatre.

Theoretical Optics

This revised and updated edition of the well-received book by C. Klingshirn

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provides an introduction to and an overview of all aspects of semiconductor optics, from IR to visible and UV. It has been split into two volumes and rearranged to offer a clearer structure of the course content. Inserts on important experimental techniques as well as sections on topical research have been added to support research-oriented teaching and learning. Volume 1 provides an introduction to the linear optical properties of semiconductors. The mathematical treatment has been kept as elementary as possible to allow an intuitive approach to the understanding of results of semiconductor spectroscopy. Building on the phenomenological model of the Lorentz oscillator, the book describes the interaction of light with fundamental optical excitations in semiconductors (phonons, free carriers, excitons). It also offers a broad review of seminal research results augmented by concise descriptions of the relevant experimental techniques, e.g., Fourier transform IR spectroscopy, ellipsometry, modulation spectroscopy and spatially resolved methods, to name a few. Further, it picks up on hot topics in current research, like quantum structures, mono-layer semiconductors or Perovskites. The experimental aspects of semiconductor optics are complemented by an in-depth discussion of group theory in solid-state optics. Covering subjects ranging from physics to materials science and optoelectronics, this book provides a lively and comprehensive introduction to semiconductor optics. With over 120 problems, more than 480 figures, abstracts to each chapter, as well as boxed inserts and a detailed index, it is intended for use in graduate courses in physics and neighboring sciences like material science and electrical engineering. It is also a

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valuable reference resource for doctoral and advanced researchers.

Optical Near Fields

The Scattering of Light and other Electromagnetic Radiation covers the theory of electromagnetic scattering and its practical applications to light scattering. This book is divided into 10 chapters that particularly present examples of practical applications to light scattering from colloidal and macromolecular systems. The opening chapters survey the physical concept of electromagnetic waves and optics. The subsequent chapters deal with the theory of scattering by spheres and infinitely long cylinders. These topics are followed by discussions on the application of light scattering to the determination of the size distribution of colloidal particles. The last chapters are devoted to the Rayleigh-Debye scattering and the scattering by liquids, as well as the concept of anisotropy. These chapters also describe the effect upon light scattering of partial orientation of anisotropic particles in electrical and magnetic fields and in viscous flow. This book is of value to physical chemists and physical chemistry researchers, teachers, and students.

Elements of Quantum Optics

Ultrashort Laser Pulse Phenomena, Second Edition serves as an introduction to the

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phenomena of ultra short laser pulses and describes how this technology can be used to examine problems in areas such as electromagnetism, optics, and quantum mechanics. Ultrashort Laser Pulse Phenomena combines theoretical backgrounds and experimental techniques and will serve as a manual on designing and constructing femtosecond ("faster than electronics") systems or experiments from scratch. Beyond the simple optical system, the various sources of ultrashort pulses are presented, again with emphasis on the basic concepts and how they apply to the design of particular sources (dye lasers, solid state lasers, semiconductor lasers, fiber lasers, and sources based on frequency conversion). Provides an easy to follow guide through "faster than electronics" probing and detection methods THE manual on designing and constructing femtosecond systems and experiments Discusses essential technology for applications in micro-machining, femtochemistry, and medical imaging

Introduction to Color Imaging Science

Contemporary Nonlinear Optics discusses the different activities in the field of nonlinear optics. The book is comprised of 10 chapters. Chapter 1 presents a description of the field of nonlinear guided-wave optics. Chapter 2 surveys a new branch of nonlinear optics under the heading optical solitons. Chapter 3 reviews recent progress in the field of optical phase conjugation. Chapter 4 discusses ultrafast nonlinear optics, a field that is growing rapidly with the ability of

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generating and controlling femtosecond optical pulses. Chapter 5 examines a branch of nonlinear optics that may be termed nonlinear quantum optics. Chapter 6 reviews the new field of photorefractive adaptive neural networks. Chapter 7 presents a discussion of recent successes in the development of nonlinear optical media based on organic materials. Chapter 8 reviews the field of nonlinear optics in quantum confined structures. Chapter 9 reviews the field of nonlinear laser spectroscopy, with emphasis on advances made during the 1980s. Finally, Chapter 10 reviews the field of nonlinear optical dynamics by considering nonlinear optical systems that exhibit temporal, spatial, or spatio-temporal instabilities. This book is a valuable source for physicists and other scientists interested in optical systems and neural networks.

Optical Nano and Micro Actuator Technology

A complete basic undergraduate course in modern optics for students in physics, technology, and engineering. The first half deals with classical physical optics; the second, quantum nature of light. Solutions.

Light and Matter

Using the thin film of light, the optical near field, that is localized on the surface of

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a nanometric material has removed the diffraction limit as a barrier to imaging on the nano- and atomic scales. But a paradigm shift in the concepts of optics and optical technology is required to understand the intrinsic nature of the near fields and how best to exploit them. Professors Ohstu and Kobayashi crafted Optical Near Fields on the basis of their hypothesis that the full potential for utilizing optical near fields can be realized only with novel nanometric processing, functions, and manipulation, i.e., by controlling the intrinsic interaction between nanometer-sized optical near fields and material systems, and further, atoms. The book presents physically intuitive concepts and theories for students, engineers, and scientists engaged in research in nanophotonics and atom photonics.

Semiconductor Optics

Colour imaging technology has become almost ubiquitous in modern life in the form of monitors, liquid crystal screens, colour printers, scanners, and digital cameras. This book is a comprehensive guide to the scientific and engineering principles of colour imaging. It covers the physics of light and colour, how the eye and physical devices capture colour images, how colour is measured and calibrated, and how images are processed. It stresses physical principles and includes a wealth of real-world examples. The book will be of value to scientists and engineers in the colour imaging industry and, with homework problems, can also be used as a text for graduate courses on colour imaging.

Contemporary Nonlinear Optics

This thorough and self-contained introduction to modern optics covers, in full, the three components: ray optics, wave optics and quantum optics. Examples of modern applications in the current century are used extensively.

Physics of Light and Optics (Black & White)

The principle of tomography is to explore the structure and composition of objects non-destructively along spatial and temporal dimensions, using penetrating radiation, such as X- and gamma-rays, or waves, such as electromagnetic and acoustic waves. Based on computer-assisted image reconstruction, tomography provides maps of parameters that characterize the emission of the employed radiation or waves, or their interaction with the examined objects, for one or several cross-sections. Thus, it gives access to the inner structure of inert objects and living organisms in their full complexity. In this book, multidisciplinary specialists explain the foundations and principles of tomographic imaging and describe a broad range of applications. The content is organized in five parts, which are dedicated to image reconstruction, microtomography, industrial tomography, morphological medical tomography and functional medical tomography.

Quantum Optics : An Introduction

The present monograph represents itself as a tutorial to the field of optical properties of thin solid films. It is neither a handbook for the thin film practitioner, nor an introduction to interference coatings design, nor a review on the latest developments in the field. Instead, it is a textbook which shall bridge the gap between ground level knowledge on optics, electrodynamics, quantum mechanics, and solid state physics on one hand, and the more specialized level of knowledge presumed in typical thin film optical research papers on the other hand. In writing this preface, I feel it makes sense to comment on three points, which all seem to me equally important. They arise from the following (usually interconnected) three questions: 1. Who can benefit from reading this book? 2. What is the origin of the particular material selection in this book? 3. Who encouraged and supported me in writing this book? Let me start with the first question, the intended readership of this book. It should be of use for anybody, who is involved into the analysis of optical spectra of a thin film sample, no matter whether the sample has been prepared for optical or other applications. Thin film spectroscopy may be relevant in semiconductor physics, solar cell development, physical chemistry, optoelectronics, and optical coatings development, to give just a few examples. The book supplies the reader with the necessary theoretical apparatus for understanding and modelling the features of the recorded transmission and reflection spectra.

Electromagnetics and Optics

This volume describes the increasing role of in situ optical diagnostics in thin film processing for applications ranging from fundamental science studies to process development to control during manufacturing. The key advantage of optical diagnostics in these applications is that they are usually noninvasive and nonintrusive. Optical probes of the surface, film, wafer, and gas above the wafer are described for many processes, including plasma etching, MBE, MOCVD, and rapid thermal processing. For each optical technique, the underlying principles are presented, modes of experimental implementation are described, and applications of the diagnostic in thin film processing are analyzed, with examples drawn from microelectronics and optoelectronics. Special attention is paid to real-time probing of the surface, to the noninvasive measurement of temperature, and to the use of optical probes for process control. Optical Diagnostics for Thin Film Processing is unique. No other volume explores the real-time application of optical techniques in all modes of thin film processing. The text can be used by students and those new to the topic as an introduction and review of the subject. It also serves as a comprehensive resource for engineers, technicians, researchers, and scientists already working in the field. The only volume that comprehensively explores in situ, real-time, optical probes for all types of thin film processing Useful as an introduction to the subject or as a resource handbook Covers a wide range of thin film processes including plasma etching, MBE, MOCVD, and rapid thermal

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processing Examples emphasize applications in microelectronics and optoelectronics Introductory chapter serves as a guide to all optical diagnostics and their applications Each chapter presents the underlying principles, experimental implementation, and applications for a specific optical diagnostic

Optics

Nano-Optics for Enhancing Light-Matter Interactions on a Molecular Scale

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 metamaterials, plasmonics and sub-wavelength resolution to the more applicative, such as detection of single molecules, tomography on a microchip, 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

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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.

The Light Fantastic

Light and Matter: Electromagnetism, Optics, Spectroscopy and Lasers provides comprehensive coverage of the interaction of light and matter and resulting outcomes. Covering theory, practical consequences and applications, this modern text serves to bridge the gap between electromagnetism, optics, spectroscopy and lasers. The book introduces the reader to the nature of light, explains key procedures which occur as light travels through matter and delves into the effects and applications, exploring spectroscopy, lasers, nonlinear optics, fiber optics, quantum optics and light scattering. Extensive examples ensure clarity of meaning while the dynamic structure allows sections to be studied independently of one another. * covers both fundamentals and applications * features numerous examples * dynamic structure allows sections to be studied independently of one another * in depth coverage of modern topics. This is an essential text for students of electromagnetism and optics, optoelectronics and lasers, quantum electronics spectroscopy, as well as being an invaluable reference for researchers.

Introduction to Modern Optics

Covering a number of important subjects in quantum optics, this textbook is an excellent introduction for advanced undergraduate and beginning graduate students, familiarizing readers with the basic concepts and formalism as well as the most recent advances. The first part of the textbook covers the semi-classical approach where matter is quantized, but light is not. It describes significant phenomena in quantum optics, including the principles of lasers. The second part is devoted to the full quantum description of light and its interaction with matter, covering topics such as spontaneous emission, and classical and non-classical states of light. An overview of photon entanglement and applications to quantum information is also given. In the third part, non-linear optics and laser cooling of atoms are presented, where using both approaches allows for a comprehensive description. Each chapter describes basic concepts in detail, and more specific concepts and phenomena are presented in 'complements'.

Introduction to Quantum Optics

This widely-acclaimed serial contains authoritative reviews that address all aspects of organometallic chemistry, a field which has expanded enormously since the publication of Volume 1 in 1964. Almost all branches of chemistry and material

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science now interface with organometallic chemistry--the study of compounds containing carbon-metal bonds. Organometallic compounds range from species which are so reactive that they only have a transient existence at ambient temperatures to species which are thermally very stable. Organometallics are used extensively in the synthesis of useful compounds on both large and small scales. Industrial processes involving plastics, polymers, electronic materials, and pharmaceuticals all depend on advancements in organometallic chemistry. In basic research, organometallics have contributed inter alia to: * Metal cluster chemistry * Surface chemistry * The stabilization of highly reactive species by metal coordination * Chiral synthesis * The formulation of multiple bonds between carbon and the other elements and between the elements themselves This book is an essential reference work for the academic and industrial chemist and will provide up-to-date material at the cutting edge of chemistry research. In basic research, organometallics have contributed inter alia to: Metal cluster chemistry Surface chemistry The stabilization of highly reactive species by metal coordination Chiral synthesis The formulation of multiple bonds between carbon and the other elements and between the elements themselves

Demonstrational Optics

The various phenomena caused by refraction and diffraction of polarized elementary particles in matter have opened up a new research area in the particle

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physics: nuclear optics of polarized particles. Effects similar to the well-known optical phenomena such as birefringence and Faraday effects, exist also in particle physics, though the particle wavelength is much less than the distance between atoms of matter. Current knowledge of the quasi-optical effects, which exist for all particles in any wavelength range (and energies from low to extremely high), will enable us to investigate different properties of interacting particles (nuclei) in a new aspect. This pioneering book will provide detailed accounts of quasi-optical phenomena in the particle polarization, and will interest physicists and professionals in experimental particle physics.

Ultrashort Laser Pulse Phenomena

With a new chapter on quantum entanglement and quantum information, as well as added discussions of the quantum beam splitter, electromagnetically induced transparency, slow light and the input-output formalism, this fourth edition of the brilliant work on quantum optics has been much updated. It still gives a self-contained and broad coverage of the basic elements necessary to understand and carry out research in laser physics and quantum optics, including a review of basic quantum mechanics and pedagogical introductions to system-reservoir interactions and to second quantization. The text reveals the close connection between many seemingly unrelated topics, such as probe absorption, four-wave mixing, optical instabilities, resonance fluorescence and squeezing.

Tying Light in Knots

The Second Edition of this successful textbook provides a clear, well-written introduction to both the fundamental principles of optics and the key aspects of photonics to show how the subject has developed in the last few decades, leading to many modern applications. Optics and Photonics: An Introduction, Second Edition thus provides a complete undergraduate course on optics in a single integrated text, and is an essential resource for all undergraduate physics, science and engineering students taking a variety of optics based courses. Specific changes for this edition include: New material on modern optics and photonics Rearrangement of chapters to give a logical progression, comprising groups of chapters on geometric optics, wave optics and photonics Many more worked examples and problems Substantial revisions to chapters on Holography, Lasers and the Interaction of Light with Matter Solutions can be found at: www.booksupport.wiley.com

Tomography

A beloved introductory physics textbook, now including exercises and an answer key, accessibly explains electromagnetism, optics, and quantum mechanics R. Shankar is a well-known physicist and contagiously enthusiastic educator, whose

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popular online introductory-physics video lectures have been viewed over a million times. In this second book based on his online courses, Shankar explains electromagnetism, optics, and quantum mechanics, developing the basics and reinforcing the fundamentals. With the help of problem sets and answer keys, students learn about the most interesting findings of today's research while gaining a firm foundation in the principles and methods of physics.

The Scattering of Light and Other Electromagnetic Radiation

Optics clearly explains the principles of optics using excellent pedagogy to support student learning. Beginning with introductory ideas and equations, K.K. Sharma takes the reader through the world of optics by detailing problems encountered, advanced subjects, and actual applications. Elegantly written, this book rigorously examines optics with over 300 illustrations and several problems in each chapter. The book begins with light propagation in anisotropic media considered much later in most books. Nearly one third of the book deals with applications of optics. This simple idea of merging the sometimes overwhelming and dry subject of optics with real world applications will create better future engineers. It will make 'optics' jump off the page for readers and they will see it take shape in the world around them. In presenting optics practically, as well as theoretically, readers will come away not only with a complete knowledge base but a context in which to place it. This book is recommended for optical engineers, libraries, senior undergraduate students,

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graduate students, and professors. Strong emphasis on applications to demonstrate the relevance of the theory Includes chapter on problem solving of ray deviations, focusing errors, and distortion Problems are included at the end of each chapter for thorough understanding of this dense subject matter

Light - The Physics of the Photon

The emerging field of semiconductor quantum optics combines semiconductor physics and quantum optics, with the aim of developing quantum devices with unprecedented performance. In this book researchers and graduate students alike will reach a new level of understanding to begin conducting state-of-the-art investigations. The book combines theoretical methods from quantum optics and solid-state physics to give a consistent microscopic description of light-matter- and many-body-interaction effects in low-dimensional semiconductor nanostructures. It develops the systematic theory needed to treat semiconductor quantum-optical effects, such as strong light-matter coupling, light-matter entanglement, squeezing, as well as quantum-optical semiconductor spectroscopy. Detailed derivations of key equations help readers learn the techniques and nearly 300 exercises help test their understanding of the materials covered. The book is accompanied by a website hosted by the authors, containing further discussions on topical issues, latest trends and publications on the field. The link can be found at www.cambridge.org/9780521875097.

Optics and Photonics

From the early wave-particle arguments to the mathematical theory of electromagnetism to Einstein's work on the quantization of light, different descriptions of what constitutes light have existed for over 300 years. Light - The Physics of the Photon examines the photon phenomenon from several perspectives. It demonstrates the importance of studyin

The Current Trends of Optics and Photonics

New possibilities have recently emerged for producing optical beams with complex and intricate structures, and for the non-contact optical manipulation of matter. Structured Light and Its Applications fully describes the electromagnetic theory, optical properties, methods and applications associated with this new technology. Detailed discussions are given of unique beam characteristics, such as optical vortices and other wavefront structures, the associated phase properties and photonic aspects, along with applications ranging from cold atom manipulation to optically driven micromachines. Features include: Comprehensive and authoritative treatments of the latest research in this area of nanophotonics, written by the leading researchers Accounts of numerous microfluidics, nanofabrication, quantum informatics and optical manipulation applications

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Coverage that fully spans the subject area, from fundamental theory and simulations to experimental methods and results Graduate students and established researchers in academia, national laboratories and industry will find this book an invaluable guide to the latest technologies in this rapidly developing field. Comprehensive and definitive source of the latest research in nanotechnology written by the leading people in the field From theory to applications - all is presented in detail Editor is Chair of the SPIE Nanotechnology Technical Group and is leading the way in generation and manipulation of complex beams

Optics, Light and Lasers

This book draws together the essential elements of classical electrodynamics, surface wave physics, plasmonic materials, and circuit theory of electrical engineering to provide insight into the essential physics of nanoscale light-matter interaction and to provide design methodology for practical nanoscale plasmonic devices. A chapter on classical and quantal radiation also highlights the similarities (and differences) between the classical fields of Maxwell's equations and the wave functions of Schrödinger's equation. The aim of this chapter is to provide a semiclassical picture of atomic absorption and emission of radiation, lending credence and physical plausibility to the "rules" of standard wave-mechanical calculations. The structure of the book is designed around five principal chapters,

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but many of the chapters have extensive "complements" that either treat important digressions from the main body or penetrate deeper into some fundamental issue. Furthermore, at the end of the book are several appendices to provide readers with a convenient reference for frequently-occurring special functions and explanations of the analytical tools, such as vector calculus and phasors, needed to express important results in electromagnetics and waveguide theory.

Light-Matter Interaction

This book draws together the principal ideas that form the basis of atomic, molecular, and optical science and engineering. It covers the basics of atoms, diatomic molecules, atoms and molecules in static and electromagnetic fields and nonlinear optics. Exercises and bibliographies supplement each chapter, while several appendices present such important background information as physics and math definitions, atomic and molecular data, and tensor algebra. Accessible to advanced undergraduates, graduate students, or researchers who have been trained in one of the conventional curricula of physics, chemistry, or engineering but who need to acquire familiarity with adjacent areas in order to pursue their research goals.

Light-Matter Interaction

Optics and photonics offer new and vibrant approaches to meeting the challenges of the 21st century concerning energy conservation, education, agriculture, personal health and the environment. One of the most effective ways to address these global problems is to provide updated and reliable content on light-based technologies. Optical thin films and meta-materials, lasers, optical communications, light-emitting diodes, solar cells, liquid crystal technology, nanophotonics and biophotonics all play vital roles in enriching our lives. We hope to raise readers' awareness of how optical technologies are now promoting sustainable development and providing reliable solutions to basic human needs. Furthermore, in order to broaden new research fields, we hope to inspire them to pursue further cutting-edge breakthroughs on the basis of the accomplishments that have already been made.

The Physics of Thin Film Optical Spectra

This volume focuses on fundamental aspects of nano-electro-optics. Starting with fiber probes and related devices for generating and detecting the optical near-field with high efficiency and resolution, the next chapter addresses the modulation of an electron beam by optical near-fields. Further topics include: fluorescence

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spectroscopy, in which sample molecules are excited by the evanescent surface plasmon field close to metallic surfaces; spatially resolved near-field photoluminescence spectroscopy of semiconductor quantum dots, which will become an essential issue in future electro-optical devices and systems; and, finally, the quantum theory of the optical near-field. This latter theory accounts for all the essential features of the interaction between optical near-fields and nanomaterials, atoms and molecules. Together these overviews will be a valuable resource for engineers and scientists working in the field of nano-electro-optics.

Advances in Organometallic Chemistry

This new, updated and enlarged edition of the successful and exceptionally well-structured textbook features new chapters on such hot topics as optical angular momentum, microscopy beyond the resolution limit, metamaterials, femtocombs, and quantum cascade lasers. It provides comprehensive and coherent coverage of fundamental optics, laser physics, and important modern applications, while equally including some traditional aspects for the first time, such as the Collins integral or solid immersion lenses. Written for newcomers to the topic who will benefit from the author's ability to explain difficult theories and effects in a straightforward and readily comprehensible way.

Advances in Condensed Matter Optics

Starting from the concepts of classical optics, *Optics, Light and Lasers* introduces in detail the phenomena of linear and nonlinear light matter interaction, the properties of modern laser sources, and the concepts of quantum optics. Several examples taken from the scope of modern research are provided to emphasize the relevance of optics in current developments within science and technology. The text has been written for newcomers to the topic and benefits from the author's ability to explain difficult sequences and effects in a straightforward and easily comprehensible way. To this second, completely updated and enlarged edition, new chapters on quantum optics, quantum information, matter waves, photonic fibres and materials have been added, as well as more than 100 problems on laser physics and applied optics.

Structured Light and Its Applications

In *Optical Nano and Micro Actuator Technology*, leading engineers, material scientists, chemists, physicists, laser scientists, and manufacturing specialists offer an in-depth, wide-ranging look at the fundamental and unique characteristics of light-driven optical actuators. They discuss how light can initiate physical movement and control a variety of mechanisms that perform mechanical work at

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the micro- and nanoscale. The book begins with the scientific background necessary for understanding light-driven systems, discussing the nature of light and the interaction between light and NEMS/MEMS devices. It then covers innovative optical actuator technologies that have been developed for many applications. The book examines photoresponsive materials that enable the design of optically driven structures and mechanisms and describes specific light-driven technologies that permit the manipulation of micro- and nanoscale objects. It also explores applications in optofluidics, bioMEMS and biophotonics, medical device design, and micromachine control. Inspiring the next generation of scientists and engineers to advance light-driven technologies, this book gives readers a solid grounding in this emerging interdisciplinary area. It thoroughly explains the scientific language and fundamental principles, provides a holistic view of optical nano and micro actuator systems, and illustrates current and potential applications of light-driven systems.

Fundamentals of Physics II

This compact but exhaustive textbook, now in its significantly revised and expanded second edition, provides an essential introduction to the field quantization of light and matter with applications to atomic physics and strongly correlated systems. Following an initial review of the origins of special relativity and quantum mechanics, individual chapters are devoted to the second

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quantization of the electromagnetic field and the consequences of light field quantization for the description of electromagnetic transitions. The spin of the electron is then analyzed, with particular attention to its derivation from the Dirac equation. Subsequent topics include the effects of external electric and magnetic fields on the atomic spectra and the properties of systems composed of many interacting identical particles. The book also provides a detailed explanation of the second quantization of the non-relativistic matter field, i.e., the Schrödinger field, which offers a powerful tool for the investigation of many-body problems, and of atomic quantum optics and entanglement. Finally, two new chapters introduce the finite-temperature functional integration of bosonic and fermionic fields for the study of macroscopic quantum phenomena: superfluidity and superconductivity. Several solved problems are included at the end of each chapter, helping readers put into practice all that they have learned.

Semiconductor Quantum Optics

Light-Matter Interaction

The authors of this book, all with a background in condensed matter physics, have carried out advanced researches in recent years to study the optical and magneto-

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optical properties of many kinds of new functional materials, including metal-based metamaterials, narrow-to-wide-bandgap semiconductors, thin films, and magnetic and magneto-optical materials by using different types of optical methods and instruments. This book describes some of the more recent progresses and developments in the study of condensed matter optics in both theoretic and experimental fields. It will help readers, especially graduate students and scientists who are studying and working in the nano-photonics field, to understand more deeply the characteristics of light waves propagated in nano-structure-based materials with potential applications in the future.

Optical Diagnostics for Thin Film Processing

The book addresses the natural link between electromagnetics and optics. The electromagnetic origin of optical phenomena is sought through a dual approach to optics which is based on the wave equation and ray theory. A review of the underlying principles, as well as mechanisms of wave/ray interactions with matter are presented first. An examination of guided propagation of light through various dielectric waveguides follows. Aspects of resonant light propagation, such as Gaussian beams, resonators and lasers, are treated next. The basic theory of light processing by optical elements is presented in the fourth part which covers Fourier optics, the scalar theory of diffraction and holography. The book further refers to miscellaneous topics, such as optical radiation, remote sensing and nonlinear

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phenomena.

High-energy Nuclear Optics of Polarized Particles

Topology is the study of properties of geometrical objects that remain invariant as the object is bent, twisted, or otherwise continuously deformed. It has been an indispensable tool in particle physics and solid state physics for decades, but in recent years it has become increasingly relevant in classical and quantum optics as well. It makes appearances through such diverse phenomena as Pancharatnam-Berry phases, optical vortices and solitons, and optical simulations of solid-state topological phenomena. This book concisely provides the necessary mathematical background needed to understand these developments and to give a rapid survey of some of the optical applications where topological issues arise.

Optics, Light and Lasers

This book draws together the principal ideas that form the basis of atomic, molecular, and optical science and engineering. It covers the basics of atoms, diatomic molecules, atoms and molecules in static and electromagnetic fields and nonlinear optics. Exercises and bibliographies supplement each chapter, while several appendices present such important background information as physics and

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math definitions, atomic and molecular data, and tensor algebra. Accessible to advanced undergraduates, graduate students, or researchers who have been trained in one of the conventional curricula of physics, chemistry, or engineering but who need to acquire familiarity with adjacent areas in order to pursue their research goals.

Progress in Nano-Electro-Optics I

Starting from basic electrodynamics, this volume provides a solid, yet concise introduction to theoretical optics, containing topics such as nonlinear optics, light-matter interaction, and modern topics in quantum optics, including entanglement, cryptography, and quantum computation. The author, with many years of experience in teaching and research, goes way beyond the scope of traditional lectures, enabling readers to keep up with the current state of knowledge. Both content and presentation make it essential reading for graduate and PhD students as well as a valuable reference for researchers.

Quantum Physics of Light and Matter

Semiconductor Optics provides an introduction to and an overview of semiconductor optics from the IR through the visible to the UV, including linear and

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nonlinear optical properties, dynamics, magneto- and electrooptics, high-excitation effects, some applications, experimental techniques and group theory. Mathematics is kept as elementary as possible, enough for an intuitive understanding of the experimental results and techniques treated. The subjects covered extend from physics to materials science and optoelectronics.

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