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Colloidal Quantum Dot Optoelectronics and Photovoltaics - Gerasimos Konstantatos 2013-11-07
Captures the most up-to-date research in the field, written in an accessible style by the world's leading experts.
Microcavities - Alexey Kavokin 2011-04-27
Rapid development of microfabrication and assembly of nanostructures has opened up many opportunities to miniaturize structures that confine light, producing unusual and extremely interesting optical properties. This book addresses the large variety of optical phenomena taking place in confined solid state structures: microcavities. Realisations include planar and pillar microcavities, whispering gallery modes, and photonic crystals. The microcavities represent a unique laboratory for quantum optics and photonics. They exhibit a number of beautiful effects including lasing, superfluidity, superradiance, entanglement etc. Written by four practitioners strongly involved in experiments and theories of microcavities, it is addressed to any interested reader having a general physical background, but in particular to undergraduate and graduate students at physics faculties.
Electronic States and Optical Transitions in Semiconductor Heterostructures - Fedor T. Vasko 2012-12-06
The theoretical basis and the relevant experimental knowledge underlying our present understanding of the electrical and optical properties of semiconductor heterostructures. Although such structures have been known since the 1940s, it was

only in the 1980s that they moved to the forefront of research. The resulting structures have remarkable properties not shared by bulk materials. The text begins with a description of the electronic properties of various types of heterostructures, including discussions of complex band-structure effects, localised states, tunnelling phenomena, and excitonic states. The focus of the remainder of the book is on optical properties, including intraband absorption, luminescence and recombination, Raman scattering, subband optical transitions, nonlinear effects, and ultrafast optical phenomena. The concluding chapter presents an overview of some of the applications that make use of the physics discussed. Appendices provide background information on band structure theory, kinetic theory, electromagnetic modes, and Coulomb effects.

Semiconductor and Metal Nanocrystals - Victor I. Klimov 2003-11-07

The vast technological potential of nanocrystalline materials, as well as current intense interest in the physics and chemistry of nanoscale phenomena, has led to explosive growth in research on semiconductor nanocrystals, also known as nanocrystal quantum dots, and metal nanoparticles. Semiconductor and Metal Nanocrystals addresses current topics impacting the field including synthesis and assembly of nanocrystals, theory and spectroscopy of interband and intraband optical transitions, single-nanocrystal optical and tunneling spectroscopies, electrical transport in nanocrystal assemblies, and physical and engineering aspects of nanocrystal-based devices. Written by experts who have contributed pioneering research, this reference comprises key advances in the field of semiconductor nanocrystal quantum dots and metal

nanoparticles over the past several years. Focusing specifically on nanocrystals generated through chemical techniques, Semiconductor and Metal Nanocrystals Merges investigative frontiers in physics, chemistry, and engineering Documents advances in nanocrystal synthesis and assembly Explores the theory of electronic excitations in nanoscale particles Presents comprehensive information on optical spectroscopy of interband and intraband optical transitions Reviews data on single-nanocrystal optical and tunneling spectroscopies Weighs controversies related to carrier relaxation dynamics in ultrasmall nanoparticles Discusses charge carrier transport in nanocrystal assemblies Provides examples of lasing and photovoltaic nanocrystal-based devices Semiconductor and Metal Nanocrystals is a must read for scientists, engineers, and upper-level undergraduate and graduate students interested in the physics and chemistry of nanoscale semiconductor and metal particles, as well as general nanoscale science. About the Editor: VICTOR I. KLIMOV is Team Leader, Softmatter Nanotechnology and Advanced Spectroscopy Team, Chemistry Division, Los Alamos National Laboratory, New Mexico. The recipient of the Los Alamos Fellows Prize (2000), he is a Fellow of the Alexander von Humboldt Foundation, leader of the Nanophotonics and Nanoelectronics Thrust of the Center for Integrated Nanotechnologies (U.S. Department of Energy), a member of the Los Alamos Board of Governors of the Institute for Complex Adaptive Matter, and a member of the Steering Committee for the Los Alamos Quantum Institute. He received the M.S. (1978), Ph.D. (1981), and Dr. Sci. (1993) degrees from Moscow State University, Russia.

Semiconductor Physics and

Applications - M. Balkanski 2000-08-31
"The textbook combines a thorough theoretical treatment of the basic physics of semiconductors with applications to practical devices by putting special emphasis on the physical principles upon which these devices operate. - "Graduate students and lecturers in semiconductor physics, condensed matter physics, electromagnetic theory, and quantum mechanics will find this a useful textbook and reference work."--Jacket.

Plasmonic Catalysis - Emiliano Cortés 2021-05-24
Explore this comprehensive discussion of the foundational and advanced topics in plasmonic catalysis from two leaders in the field Plasmonic Catalysis: From Fundamentals to Applications delivers a thorough treatment of plasmonic catalysis, from its theoretical foundations to myriad applications in industry and academia. In addition to the fundamentals, the book covers the theory, properties, synthesis, and various reaction types of plasmonic catalysis. It also covers its applications in reactions including oxidation, reduction, nitrogen fixation, CO2 reduction, and more. The book characterizes plasmonic catalytic systems and describes their properties, tackling the integration of conventional methods as well as new methods able to unravel the optical, electronic, and chemical properties of these systems. It also describes the fundamentals of controlled synthesis of metal nanoparticles relevant to plasmonic catalysis, as well as practical examples thereof. Plasmonic Catalysis covers a wide variety of other practical topics in the field, including hydrogenation reactions and the harvesting of LSPR-excited charge carriers. Readers will also benefit from the inclusion of: A thorough introduction to plasmonic catalysis, a theory

of plasmons for catalysis and mechanisms, as well as optical properties of plasmonic-catalytic nanostructures An exploration of the synthesis of plasmonic nanoparticles for photo and electro catalysis, as well as plasmonic catalysis towards oxidation reactions and hydrogenation reactions Discussions of plasmonic catalysis for multi-electron processes and artificial photosynthesis and N2 fixation An examination of control over reaction selectivity in plasmonic catalysis Perfect for catalytic chemists, materials scientists, photochemists, and physical chemists, Plasmonic Catalysis: From Fundamentals to Applications will also earn a place in the libraries of physicists who seek a one-stop resource to enhance their understanding of applications in plasmonic catalysis.

Coherent Semiconductor Optics - Torsten Meier 2007-02-13

This book introduces the basic theoretical concepts required for the analysis of the optical response of semiconductor systems in the coherent regime. It is the most instructive textbook on the theory and optical effects of semiconductors. The entire presentation is based on a one-dimensional tight-binding model. Starting with discrete-level systems, increasing complexity is added gradually to the model by including band-structure and many-particle interaction. Various linear and nonlinear optical spectra and temporal phenomena are studied. The analysis of many-body effects in nonlinear optical phenomena covers a major part of the book.

Semiconductor Physics - Karl W. Böer 2023-02-02

This handbook gives a complete and detailed survey of the field of semiconductor physics. It addresses every fundamental principle, the most important research topics and results, as well as conventional

and emerging new areas of application. Additionally it provides all essential reference material on crystalline bulk, low-dimensional, and amorphous semiconductors, including valuable data on their optical, transport, and dynamic properties. This updated and extended second edition includes essential coverage of rapidly advancing areas in semiconductor physics, such as topological insulators, quantum optics, magnetic nanostructures and spintronic systems. Richly illustrated and authored by a duo of internationally acclaimed experts in solar energy and semiconductor physics, this handbook delivers in-depth treatment of the field, reflecting a combined experience spanning several decades as both researchers and educators. Offering a unique perspective on many issues, Semiconductor Physics is an invaluable reference for physicists, materials scientists and engineers throughout academia and industry.

III-Nitride Based Semiconductor Electronics and Optical Devices - F. Ren 2001

Optical Properties of Semiconductor Nanocrystals - S. V. Gaponenko 1998-10-28

Examines the optical properties of low-dimensional semiconductor structures, a hot research area - for graduate students and researchers.

Optical Transitions in Amorphous Semiconductors - Farida Orapunt 2012

Electronic and Optoelectronic Properties of Semiconductor Structures - Jasprit Singh 2007-03-26

A graduate textbook presenting the underlying physics behind devices that drive today's technologies. The book covers important details of structural properties, bandstructure, transport, optical and

magnetic properties of semiconductor structures. Effects of low-dimensional physics and strain - two important driving forces in modern device technology - are also discussed. In addition to conventional semiconductor physics the book discusses self-assembled structures, mesoscopic structures and the developing field of spintronics. The book utilizes carefully chosen solved examples to convey important concepts and has over 250 figures and 200 homework exercises. Real-world applications are highlighted throughout the book, stressing the links between physical principles and actual devices. Electronic and Optoelectronic Properties of Semiconductor Structures provides engineering and physics students and practitioners with complete and coherent coverage of key modern semiconductor concepts. A solutions manual and set of viewgraphs for use in lectures are available for instructors, from solutions@cambridge.org.

Semiconductor and Metal Nanocrystals - Victor I. Klimov 2003-11-07

The vast technological potential of nanocrystalline materials, as well as current intense interest in the physics and chemistry of nanoscale phenomena, has led to explosive growth in research on semiconductor nanocrystals, also known as nanocrystal quantum dots, and metal nanoparticles. Semiconductor and Metal Nanocrystals addresses current topics impacting the field including synthesis and assembly of nanocrystals, theory and spectroscopy of interband and intraband optical transitions, single-nanocrystal optical and tunneling spectroscopies, electrical transport in nanocrystal assemblies, and physical and engineering aspects of nanocrystal-based devices. Written by experts who have contributed pioneering

research, this reference comprises key advances in the field of semiconductor nanocrystal quantum dots and metal nanoparticles over the past several years. Focusing specifically on nanocrystals generated through chemical techniques, Semiconductor and Metal Nanocrystals Merges investigative frontiers in physics, chemistry, and engineering Documents advances in nanocrystal synthesis and assembly Explores the theory of electronic excitations in nanoscale particles Presents comprehensive information on optical spectroscopy of interband and intraband optical transitions Reviews data on single-nanocrystal optical and tunneling spectroscopies Weighs controversies related to carrier relaxation dynamics in ultrasmall nanoparticles Discusses charge carrier transport in nanocrystal assemblies Provides examples of lasing and photovoltaic nanocrystal-based devices Semiconductor and Metal Nanocrystals is a must read for scientists, engineers, and upper-level undergraduate and graduate students interested in the physics and chemistry of nanoscale semiconductor and metal particles, as well as general nanoscale science.

Compound Semiconductors 1999 - K Ploog 2000-01-01

An international perspective on the latest research, Compound Semiconductors 1999 presents an overview of important developments in all III-V compound semiconductors such as GaAs, InP, and GaN; II-VI compounds such as ZnS, ZnSe, and CdTe; IV-IV compounds such as SiC and SiGe; and IV-VI compounds such as PbTe and SnTe. The book emphasizes piezoelectric (or potentially smart) material heterostructures (Ga, Al, In)N, which will influence future research and development funding. As the preeminent forum for

research in compound materials and their applications in devices, this essential library reference is invaluable reading for all researchers in semiconductor physics, and electronic and electrical engineering.

Electronic States and Optical Transitions in Bulk and Quantum Well Structures of III-V Compound Semiconductors - Yong Hee Cho 2015

In this work we apply the methods of band structure calculation combined with self-consistent treatment of the light-matter interaction to a variety of problems in bulk semiconductors and semiconductor heterostructures as well as in new optoelectronic devices. In particular, we utilize the 30- and 8-band k · p band structure calculation methods to study the electronic, magnetic, and optical properties of the diluted magnetic semiconductor, GaMnAs, in the mean-field Zener model. We calculate the anisotropic dielectric response of GaMnAs in the metallic regime and show that our model produces a good agreement with the experimental results of magneto-optical Kerr spectroscopy in the interband transition region. We also discuss the advantages of the 30-band k · p model for spin-polarized ferromagnetic GaMnAs. We present new methods for calculating electronic states in low-dimensional semiconductor heterostructures based on the real-space Hamiltonian. The formalism provides extreme simplicity of the numerical implementation and superior accuracy of the results. They are applicable to a general n-band k · p model and specifically tested in the 6- and 8-band k · p models, and a simple parabolic one band model. The transparency of the new method allows us to investigate the origin and elimination of spurious solutions in the unified manner. Spurious solutions have long been a major issue in low- dimensional band structure

calculations. As an application of nonlinear optical interactions in two-dimensional semiconductor heterostructures, we calculate the upper limits on the efficiency of the passive terahertz difference frequency generation based on the intersubband resonant nonlinearity. Our approach incorporates electronic states together with propagating coupled fields through the self-consistent calculation of the Poisson equation, density matrix equations, and coupled wave equations. We develop optimal device geometries and systematically study the device performance as a function of various parameters. The results are compared with a simplified analytic solution. The electronic version of this dissertation is accessible from http://hdl.handle.net/1969.1/152436

24th International Conference on the Physics of Semiconductors - David Gershoni 1999

The proceedings of this important conference consist of plenary and invited papers published in hard copy and CD-ROM versions. The contributed oral and poster presentations are included in the CD-ROM version only.

Nanocrystal Quantum Dots - Victor I. Klimov 2017-12-19

A review of recent advancements in colloidal nanocrystals and quantum-confined nanostructures, Nanocrystal Quantum Dots is the second edition of Semiconductor and Metal Nanocrystals: Synthesis and Electronic and Optical Properties, originally published in 2003. This new title reflects the book's altered focus on semiconductor nanocrystals. Gathering contributions from leading researchers, this book contains new chapters on carrier multiplication (generation of multiexcitons by single photons), doping of semiconductor nanocrystals, and applications of

nanocrystals in biology. Other updates include: New insights regarding the underlying mechanisms supporting colloidal nanocrystal growth A revised general overview of multiexciton phenomena, including spectral and dynamical signatures of multiexcitons in transient absorption and photoluminescence Analysis of nanocrystal-specific features of multiexciton recombination A review of the status of new field of carrier multiplication Expanded coverage of theory, covering the regime of high-charge densities New results on quantum dots of lead chalcogenides, with a focus studies of carrier multiplication and the latest results regarding Schottky junction solar cells Presents useful examples to illustrate applications of nanocrystals in biological labeling, imaging, and diagnostics The book also includes a review of recent progress made in biological applications of colloidal nanocrystals, as well as a comparative analysis of the advantages and limitations of techniques for preparing biocompatible quantum dots. The authors summarize the latest developments in the synthesis and understanding of magnetically doped semiconductor nanocrystals, and they present a detailed discussion of issues related to the synthesis, magneto-optics, and photoluminescence of doped colloidal nanocrystals as well. A valuable addition to the pantheon of literature in the field of nanoscience, this book presents pioneering research from experts whose work has led to the numerous advances of the past several years.

Optical Properties of Solids - Frederick Wooten 2013-10-22

Optical Properties of Solids covers the important concepts of intrinsic optical properties and photoelectric emission. The book starts by providing an introduction to

the fundamental optical spectra of solids. The text then discusses Maxwell's equations and the dielectric function; absorption and dispersion; and the theory of free-electron metals. The quantum mechanical theory of direct and indirect transitions between bands; the applications of dispersion relations; and the derivation of an expression for the dielectric function in the self-consistent field approximation are also encompassed. The book further tackles current-current correlations; the fluctuation-dissipation theorem; and the effect of surface plasmons on optical properties and photoemission. People involved in the study of the optical properties of solids will find the book invaluable.

Ultrafast Dynamics and Laser Action of Organic Semiconductors - Zeev Valy Vardeny 2009-01-21

Spurred on by extensive research in recent years, organic semiconductors are now used in an array of areas, such as organic light emitting diodes (OLEDs), photovoltaics, and other optoelectronics. In all of these novel applications, the photoexcitations in organic semiconductors play a vital role. Exploring the early stages of photoexcitations that follow photon absorption, Ultrafast Dynamics and Laser Action of Organic Semiconductors presents the latest research investigations on photoexcitation ultrafast dynamics and laser action in pi-conjugated polymer films, solutions, and microcavities. In the first few chapters, the book examines the interplay of charge (polarons) and neutral (excitons) photoexcitations in pi-conjugated polymers, oligomers, and molecular crystals in the time domain of 100 fs–2 ns. Summarizing the state of the art in lasing, the final chapters introduce the phenomenon of laser action in organics and cover the latest optoelectronic applications that use lasing based on a variety of

cavities, such as distributed feedback-type cavity. With contributions from a host of renowned international experts, this book explores the underlying processes in both existing and potential organic optoelectronic applications. It provides a broad overview of the scientific debate in the field of photophysics in organic semiconductors.

Spectroscopy of Systems with Spatially Confined Structures - Baldassare di Bartolo 2012-12-06

Nanometer scale physics is progressing rapidly: the top-down approach of semiconductor technology will soon encounter the scale of the bottom-up approaches of supramolecular chemistry and spatially localized excitations in ionic crystals. Advances in this area have already led to applications in optoelectronics. More may be expected. This book deals with the role of structure confinement in the spectroscopic characteristics of physical systems. It examines the fabrication, measurement and understanding of the relevant structures. It reports progress in the theory and in experimental techniques, starting with the consideration of fundamental principles and leading to the frontiers of research. The subjects dealt with include such spatially resolved structures as quantum wells, quantum wires, quantum dots, and luminescence, in both theoretical and practical terms.

Bands and Photons in III-V Semiconductor Quantum Structures - Igor Vurgaftman 2021-01-03

This book takes the reader from the very basics of III-V semiconductors (some preparation in quantum mechanics and electromagnetism is helpful) and shows how seemingly obscure results such as detailed forms of the Hamiltonian, optical transition strengths, and recombination mechanisms follow.

Highlights Of Light Spectroscopy On Semiconductors Holsos 95 - Proceedings Of The Workshop - D'andrea A 1996-08-30

The renal failure and hemodialysis dependent population is increasing worldwide. Hemodialysis access is the life-line of these patients. Hemodialysis access related surgical and interventional procedures form a major demand to the healthcare services in many developed and developing countries. As such, the proper clinical decision, planning and performance of these procedures will greatly benefit the hemodialysis patients and reduce unnecessary healthcare costs. This book is a practical guide for clinicians and nurses creating, treating or managing hemodialysis accesses for renal failure patients. Basic principles to manage common or difficult situations of hemodialysis access are discussed and illustrative clinical cases are shown as examples. This book is an essential reading material for healthcare professionals in their early phase of developing the hemodialysis access program, while providing useful tips and tricks to established clinicians that will broaden their armamentarium.

Solid State Physics - D. W. Snoke 2020-01-09

Focuses on the essential concepts needed for an intuitive understanding of modern solid state theory and its experimental applications.

Nanoscale Compound Semiconductors and their Optoelectronics Applications - Vijay B. Pawade 2022-01-21

Nanoscale Compound Semiconductors and their Optoelectronics Applications provides the basic and fundamental properties of nanoscale compound semiconductors and their role in modern technological products. The book discusses all important properties of this important category of materials such

as their optical properties, size-dependent properties, and tunable properties. Key methods are reviewed, including synthesis techniques and characterization strategies. The role of compound semiconductors in the advancement of energy efficient optoelectronics and solar cell devices is also discussed. The book also touches on the photocatalytic property of the materials by doping with graphene oxides--an emerging and new pathway. Covers all relevant types of nanoscale compound semiconductors for optoelectronics, including their synthesis, properties and applications Provides historical context and review of emerging trends in semiconductor technology, particularly emphasizing advances in non-toxic semiconductor materials for green technologies Reviews emerging applications of nanoscale compound semiconductor-based devices in optoelectronics, energy and environmental sustainability

Fundamentals of Solid State Engineering - Manijeh Razeghi 2007-05-08
Fundamentals of Solid State Engineering is structured in two major parts. It first addresses the basic physics concepts, which are at the base of solid state matter in general and semiconductors in particular. The second part reviews the technology for modern Solid State Engineering. This includes a review of compound semiconductor bulk and epitaxial thin films growth techniques, followed by a description of current semiconductor device processing and nano-fabrication technologies. A few examples of semiconductor devices and a description of their theory of operational are then discussed, including transistors, semiconductor lasers, and photodetectors.

Semiconductors and Semimetals - 1984-08-28
Semiconductors and Semimetals

Spectroscopy of Semiconductors - Wei Lu

2018-07-31

The science and technology related to semiconductors have received significant attention for applications in various fields including microelectronics, nanophotonics, and biotechnologies. Understanding of semiconductors has advanced to such a level that we are now able to design novel system complexes before we go for the proof-of-principle experimental demonstration. This book explains the experimental setups for optical spectral analysis of semiconductors and describes the experimental methods and the basic quantum mechanical principles underlying the fast-developing nanotechnology for semiconductors. Further, it uses numerous case studies with detailed theoretical discussions and calculations to demonstrate the data analysis. Covering structures ranging from bulk to the nanoscale, it examines applications in the semiconductor industry and biomedicine. Starting from the most basic physics of geometric optics, wave optics, quantum mechanics, solid-state physics, it provides a self-contained resource on the subject for university undergraduates. The book can be further used as a toolbox for researching and developing semiconductor nanotechnology based on spectroscopy.

Progress in Electron Properties of Solids - E. Doni 2012-12-06

This volume on the novelties in the electronic properties of solids appears in occasion of Franco Bassani sixtieth birthday, and is dedicated to honour a scientific activity which has contributed so much of the development of this very active area of research. It is re markable that this book can cover so large a part of the current research on electronic properties of solids by contributions from Bassani's former students, collaborators at different stages of

his scientific life, and physicists from all over the world who have been in close scientific relationship with him. A personal flavour therefore accompanies a number of the papers of this volume, which are both up-to-date reports on present research and original recollections of the early events of modern solid state physics. The volume begins with a few contributions dealing with theoretical procedures for electronic energy levels, a primary step toward the interpretation of structural and optical properties of extended and confined systems. Other papers concern the interacting state of electrons with light (polaritons) and the effect of the coupling of electrons with lattice vibrations, with emphasis on the thermal behaviour of the electron levels and on such experimental procedures as piezospectroscopy. Electron-lattice interaction in external magnetic field and transport-related properties due to high light excitation are also con sidered. The impact of synchroton radiation on condensed matter spectroscopy is dis cussed in a topical contribution, and optical measurements are presented for extended and impurity levels.

Fundamentals of Solid State Engineering - M. Razeghi 2002

"Fundamentals of Solid State Engineering, 2nd Edition, provides a multi-disciplinary introduction to solid state engineering, combining concepts from physics, chemistry, electrical engineering, materials science and mechanical engineering. Revised throughout, this third edition includes new topics such as electron-electron and electron-phonon interactions, in addition to the Kane effective mass method. A chapter devoted to quantum mechanics has been expanded to cover topics such as the harmonic oscillator, the hydrogen atom, the quantum mechanical

description of angular momentum and the origin of spin. This textbook also features an improved transport theory description, which now goes beyond Drude theory, discussing the Boltzmann approach. Introducing students to the rigorous quantum mechanical way of thinking about and formulating transport processes, this textbook presents the basic physics concepts and thorough treatment of semiconductor characterization technology, designed for solid state engineers."--Publisher's website

Semiconductor Nanocrystal Quantum Dots - Andrey Rogach 2008-09-02

This is the first book to specifically focus on semiconductor nanocrystals, and address their synthesis and assembly, optical properties and spectroscopy, and potential areas of nanocrystal-based devices. The enormous potential of nanoscience to impact on industrial output is now clear. Over the next two decades, much of the science will transfer into new products and processes. One emerging area where this challenge will be very successfully met is the field of semiconductor nanocrystals. Also known as colloidal quantum dots, their unique properties have attracted much attention in the last twenty years.

Physics Of Semiconductors, The - Proceedings Of The 24th International Conference (With Cd-rom) - Gershoni David 1999-03-12

The proceedings of this important conference consist of plenary and invited papers published in hard copy and CD-ROM versions. The contributed oral and poster presentations are included in the CD-ROM version only.

NASA Thesaurus - 1982

Quantum Physics of Semiconductor Materials and Devices - Debdeep Jena

2022-05-26

”Quantum Phenomena do not occur in a Hilbert space. They occur in a laboratory”. - Asher Peres Semiconductor physics is a laboratory to learn and discover the concepts of quantum mechanics and thermodynamics, condensed matter physics, and materials science, and the payoffs are almost immediate in the form of useful semiconductor devices. Debdeep Jena has had the opportunity to work on both sides of the fence - on the fundamental materials science and quantum physics of semiconductors, and in their applications in semiconductor electronic and photonic devices. In Quantum Physics of Semiconductors and Nanostructures, Jena uses this experience to make each topic as tangible and accessible as possible to students at all levels. Consider the simplest physical processes that occur in semiconductors: electron or hole transport in bands and over barriers, collision of electrons with the atoms in the crystal, or when electrons and holes annihilate each other to produce a photon. The correct explanation of these processes require a quantum mechanical treatment. Any shortcuts lead to misconceptions that can take years to dispel, and sometimes become roadblocks towards a deeper understanding and appreciation of the richness of the subject. A typical introductory course on semiconductor physics would then require prerequisites of quantum mechanics, statistical physics and thermodynamics, materials science, and electromagnetism. Rarely would a student have all this background when (s)he takes a course of this nature in most universities. Jena's work fills in these gaps and gives students the background and deeper understanding of the quantum physics of semiconductors and nanostructures.

Intersubband Transitions In Quantum Structures - Roberto Paiella 2010-05-05
Advances in epitaxial growth and nanofabrication technology in the past several years have made it possible to engineer sophisticated semiconductor quantum devices with unprecedented control of their electronic and optical properties. A particularly important class of such devices is based on intersubband transitions, i.e. optical transitions between quantized electronic states in semiconductor heterostructures. Most notably, mid-infrared quantum-well infrared photodetectors (QWIPs) and quantum cascade lasers nowadays offer superior performance for applications such as thermal imaging, spectroscopy, and biochemical sensing, and have recently become commercially available. Intersubband devices also have the potential for a revolutionary impact in the fields of silicon photonics, terahertz sensing, and ultra-high-bandwidth fiber-optic communications, and extensive research is ongoing to fulfill this promise. Joined by an international group of world experts, Paiella describes the basic device physics and applications of intersubband transitions, as well as the more recent and important developments in this exciting area of semiconductor nanotechnology.
Confined Electrons and Photons - Elias Burstein 2012-12-06
The optical properties of semiconductors have played an important role since the identification of semiconductors as "small" bandgap materials in the thinies, due both to their fundamental interest as a class of solids baving specific optical propenies and to their many important applications. On the former aspect we can cite the fundamental edge absorption and its assignment to direct or indirect transitions, many-body effects as

revealed by exciton formation and photoconductivity. On the latter aspect, large-scale applications sucb as LEDs and lasers, photovoltaic converters, photodetectors, electro-optics and non-linear optic devices, come to mind. The eighties saw a revitalization of the whole field due to the advent of heterostructures of lower-dimensionality, mainly two-dimensional quantum wells, which through their enhanced photon-matter interaction yielded new devices with unsurpassed performance. Although many of the basic phenomena were evidenced through the seventies, it was this impact on applications which in turn led to such a massive investment in fabrication tools, thanks to which many new structures and materials were studied, yielding funher advances in fundamental physics.

Ultrafast Phenomena in Semiconductors - Kong-Thon Tsen 2012-12-06

There are many books in the market devoted to the review of certain fields. This book is different from those in that authors not only provide reviews of the fields but also present their own important contributions to the fields in a tutorial way. As a result, researchers who are already in the field of ultrafast dynamics in semicon ductors and its device applications as well as researchers and graduate students just entering the field will benefit from it. This book is made up of recent new developments in the field of ultrafast dynamics in semiconductors. It consists of nine chapters. Chapter 1 reviews a mi croscopic many-body theory which allows one to compute the linear and non-linear optical properties of semiconductor superlattices in the presence of homogeneous electric fields. Chapter 2 deals with ultrafast intersubband dynamics in quantum wells and device structures.

Chapter 3 is devoted to Bloch oscillations in semicon ductors and their applications. Chapter 4 discusses transient electron transport phe nomena, such as electron ballistic transport and electron velocity overshoot phe nomena as well as non-equilibrium phonon dynamics in nanostructure semicon ductors. Chapter 5 reviews experimental and theoretical work on the use of the phase properties of one or more ultrashort optical pulses to generate and control electrical currents in semiconductors.

Devices Based on Low-Dimensional Semiconductor Structures - M. Balkanski 2012-12-06

Low-dimensional semiconductor quantum structures are a major, high-technological development that has a considerable industrial potential. The field is developing extremely rapidly and the present book represents a timely guide to the latest developments in device technology, fundamental properties, and some remarkable applications. The content is largely tutorial, and the book could be used as a textbook. The book deals with the physics, fabrication, characteristics and performance of devices based on low-dimensional semiconductor structures. It opens with fabrication procedures. The fundamentals of quantum structures and electro-optical devices are dealt with extensively. Nonlinear optical devices are discussed from the point of view of physics and applications of exciton saturation in MQW structures. Waveguide-based devices are also described in terms of linear and nonlinear coupling. The basics of pseudomorphic HEMT technology, device physics and materials layer design are presented. Each aspect is reviewed from the elementary basics up to the latest developments. Audience: Undergraduates in

electrical engineering, graduates in physics and engineering schools. Useful for active scientists and engineers wishing to update their knowledge and understanding of recent developments.

Semiconductor Optics - Claus F. Klingshirn 2007-03-07

The updated and enlarged new edition of this book provides an introduction to and an overview of semiconductor optics from the IR through the visible to the UV. It includes coverage of linear and nonlinear optical properties, dynamics, magneto- and electrooptics, high-excitation effects, some applications, experimental techniques and group theory. The mathematics is kept as elementary as possible. The subjects covered extend from physics to materials science and optoelectronics. New or updated chapters add coverage of current topics, while the chapters on bulk materials have been revised and updated.

Characterization of Semiconductor Heterostructures and Nanostructures - S. Sanguinetti 2013-04-11

Microcavities - Alexey V. Kavokin 2017-04-28

Microcavities are semiconductor, metal, or dielectric structures providing optical confinement in one, two or three dimensions. At the end of the 20th century, microcavities have attracted attention due to the discovery of a strong exciton-light coupling regime allowing for the formation of superposition light-matter quasiparticles: exciton-polaritons. In the following century several remarkable effects have been discovered in microcavities, including the Bose-Einstein condensation of exciton-polaritons, polariton lasing, superfluidity, optical spin Hall and spin Meissner effects, amongst other discoveries. Currently, polariton devices exploiting the bosonic

stimulation effects at room temperature are being developed by laboratories across the world. This book addresses the physics of microcavities: from classical to quantum optics, from a Boltzmann gas to a superfluid. It provides the theoretical background needed for understanding the complex phenomena in coupled light-matter systems, and it presents a broad overview of experimental progress in the physics of microcavities.