

Low Dimensional Semiconductors Structures Fundamentals And Device Applications 1st Edition

[#low dimensional semiconductors](#) [#semiconductor device applications](#) [#quantum structures fundamentals](#) [#nanoscale electronics](#) [#semiconductor physics](#)

This comprehensive resource delves into the fundamental principles and cutting-edge device applications of low dimensional semiconductor structures. It covers the theoretical underpinnings of quantum confinement and explores their practical implementation in advanced electronics, serving as an essential guide for researchers, engineers, and students in semiconductor technology and materials science.

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Low-Dimensional Semiconductor Structures

Low-Dimensional Semiconductor Structures provides a seamless, atoms-to-devices introduction to the latest quantum heterostructures. It covers their fabrication, their electronic, optical and transport properties, their role in exploring physical phenomena, and their utilization in devices. The authors begin with a detailed description of the epitaxial growth of semiconductors. They then deal with the physical behaviour of electrons and phonons in low-dimensional structures. A discussion of localization effects and quantum transport phenomena is followed by coverage of the optical properties of quantum wells. They then go on to discuss non-linear optics in quantum heterostructures. The final chapters deal with semiconductor lasers, mesoscopic devices, and high-speed heterostructure devices. The book contains many exercises and comprehensive references. It is suitable as a textbook for graduate-level courses in electrical engineering and applied physics. It will also be of interest to engineers involved in the development of semiconductor devices.

Low-Dimensional Semiconductor Structures

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The Physics of Low-dimensional Semiconductors

The composition of modern semiconductor heterostructures can be controlled precisely on the atomic scale to create low-dimensional systems. These systems have revolutionised semiconductor physics, and their impact on technology, particularly for semiconductor lasers and ultrafast transistors, is widespread and burgeoning. This book provides an introduction to the general principles that underlie low-dimensional semiconductors. As far as possible, simple physical explanations are used, with reference to examples from actual devices. The author shows how, beginning with fundamental results from quantum mechanics and solid-state physics, a formalism can be developed that describes the properties of low-dimensional semiconductor systems. Among numerous examples, two key systems are studied in detail: the two-dimensional electron gas, employed in field-effect transistors, and the quantum well, whose optical properties find application in lasers and other opto-electronic devices. The book includes many exercises and will be invaluable to undergraduate and first-year graduate physics or electrical engineering students taking courses in low-dimensional systems or heterostructure device physics.

Low-dimensional Semiconductors

This text is a first attempt to pull together the whole of semiconductor science and technology since 1970 in so far as semiconductor multilayers are concerned. Material, technology, physics and device issues are described with approximately equal emphasis, and form a single coherent point of view. The subject matter is the concern of over half of today's active semiconductor scientists and technologists, the remainder working on bulk semiconductors and devices. It is now routine to design and the prepare semiconductor multilayers at a time, with independent control over the dropping and composition in each layer. In turn these multilayers can be patterned with features that as small as a few atomic layers in lateral extent. The resulting structures open up many new areas of exciting solid state and quantum physics. They have also led to whole new generations of electronic and optoelectronic devices whose superior performance relates back to the multilayer structures. The principles established in the field have several decades to go, advancing towards the ultimate of materials engineering, the design and preparation of solids atom by atom. The book should appeal equally to physicists, electronic engineers and materials scientists.

Quantum Semiconductor Structures

A review of the fundamentals of quantified semiconductor structures (first seen as an introductory chapter in Volume 24 of "Semiconductors and Semimetals"), which covers the basics of electronic states, optical interactions and quantum transport in two-dimensional quantified systems.

Advanced Electronic Technologies and Systems Based on Low-Dimensional Quantum Devices

This volume on Advanced Electronic Technologies and Systems based on Low Dimensional Quantum Devices closes a three years series of NATO -ASI' s. The first year was focused on the fundamental properties and applications. The second year was devoted to Devices Based on Low-Dimensional Semiconductor Structures. The third year is covering Systems Based on Low-Dimensional Quantum Semiconductor Devices. The three volumes containing the lectures given at the three successive NATO -ASI's constitute a complete review on the latest advances in semiconductor Science and Technology from the methods of fabrication of the quantum structures through the fundamental physics and basic knowledge of properties and projection of performances to the technology of devices and systems. In the first volume: " Fabrication, Properties and Application of Low Dimensional Semiconductors" are described the practical ways in which quantum structures are produced, the present status of the technology, difficulties encountered, and advances to be expected. The basic theory of Quantum Wells, Double Quantum Wells and Superlattices is introduced and the fundamental aspects of their optical properties are presented. The effect of reduction of dimensionality on lattice dynamics of quantum structures is also discussed. In the second volume: " Devices Based on Low Dimensional Structures" the fundamentals of quantum structures and devices in the two major fields: Electro-Optical Devices and Pseudomorphic High Electron Mobility Transistors are extensively discussed.

Fabrication, Properties and Applications of Low-Dimensional Semiconductors

A recent major development in high technology, and one which bears considerable industrial potential, is the advent of low-dimensional semiconductor quantum structures. The research and development activity in this field is moving fast and it is thus important to afford scientists and engineers the opportunity to get updated by the best experts in the field. The present book draws together the

latest developments in the fabrication technology of quantum structures, as well as a competent and extensive review of their fundamental properties and some remarkable applications. The book is based on a set of lectures that introduce different aspects of the basic knowledge available, it has a tutorial content and could be used as a textbook. Each aspect is reviewed, from elementary concepts up to the latest developments. Audience: Undergraduates and graduates in electrical engineering and physics schools. Also for active scientists and engineers, updating their knowledge and understanding of the frontiers of the technology.

Low-dimensional Semiconductors

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.

Devices Based on Low-Dimensional Semiconductor Structures

This book describes most recent progress in the properties, synthesis, characterization, modelling, and applications of nanomaterials and nanodevices. It begins with the review of the modelling of the structural, electronic and optical properties of low dimensional and nanoscale semiconductors, methodology of synthesis, and characterization of quantum dots and nanowires, with special attention towards Dirac materials, whose electrical conduction and sensing properties far exceed those of silicon-based materials, making them strong competitors. The contributed reviews presented in this book touch on broader issues associated with the environment, as well as energy production and storage, while highlighting important achievements in materials pertinent to the fields of biology and medicine, exhibiting an outstanding confluence of basic physical science with vital human endeavor. The subjects treated in this book are attractive to the broader readership of graduate and advanced undergraduate students in physics, chemistry, biology, and medicine, as well as in electrical, chemical, biological, and mechanical engineering. Seasoned researchers and experts from the semiconductor/device industry also greatly benefit from the book's treatment of cutting-edge application studies.

Progress in Nanoscale and Low-Dimensional Materials and Devices

This book provides in-depth knowledge about the fundamental physical properties of bulk and low dimensional semiconductors (LDS). It also explains their applications to optoelectronic devices. The book incorporates two major themes. The first theme, starts from the fundamental principles governing the classification of solids according to their electronic properties and leads to a detailed analysis of electronic band structure and electronic transport in solids. It then focuses on the electronic transport and optical properties of semiconductor compounds, size quantization and the analysis of abrupt p-n junctions where a full analysis of the fundamental properties of intrinsic and doped semiconductors is given. The second theme is device-oriented. It aims to provide the reader with understanding of the design, fabrication and operation of optoelectronic devices based on novel semiconductor materials, such as high-speed photo detectors, light emitting diodes, multi-mode and single-mode lasers and high efficiency solar cells. The book appeals to researchers and high-level undergraduate students.

Low-dimensional Structures in Semiconductors

Starting with the first transistor in 1949, the world has experienced a technological revolution which has permeated most aspects of modern life, particularly over the last generation. Yet another such revolution looms up before us with the newly developed capability to control matter on the nanometer scale. A truly extraordinary research effort, by scientists, engineers, technologists of all disciplines, in nations large and small throughout the world, is directed and vigorously pressed to develop a full understanding of

the properties of matter at the nanoscale and its possible applications, to bring to fruition the promise of nanostructures to introduce a new generation of electronic and optical devices. The physics of low dimensional semiconductor structures, including heterostructures, superlattices, quantum wells, wires and dots is reviewed and their modeling is discussed in detail. The truly exceptional material, Graphene, is reviewed; its functionalization and Van der Waals interactions are included here. Recent research on optical studies of quantum dots and on the physical properties of one-dimensional quantum wires is also reported. Chapters on fabrication of nanowire – based nanogap devices by the dielectrophoretic assembly approach. The broad spectrum of research reported here incorporates chapters on nanoengineering and nanophysics. In its presentation of tutorial chapters as well as advanced research on nanostructures, this book is ideally suited to meet the needs of newcomers to the field as well as experienced researchers interested in viewing colleagues' recent advances.

Semiconductors for Optoelectronics

This volume investigates the theory of the effect of static electric fields on one-electron states in nanocylindrical and nanospherical heterolayers and quantized semiconductor films. Homogeneous external electrostatic field for all these structures has been considered as a "universal" modulating factor. For structures with radial symmetry, a study on the influence of radial static field and the electric field of a charged ring on one-electron states is presented. Chapters focusing on homogeneous field effect on low-dimensional excitonic states in the quantized films and quantum wires - in both wide bandgap and narrowband semiconductors - are also included. Other contents include calculations weak, moderate and strong electric fields, quantum-mechanical approximation and perturbation theory, the quasi-classical approximation (WKB method). Readers will benefit from the varied methodological to the subject which gives them a concrete analytical framework to solve problems related to nanoscale semiconductor design. The reference should prove to be useful to academics and professionals working in semiconductor nanoelectronics research and development.

Low Dimensional Semiconductor Structures

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.

Effect of Static Electric Fields on The Electronic And Optical Properties of Layered Semiconductor Nanostructures

Semiconductors are at the heart of modern living. Almost everything we do, be it work, travel, communication, or entertainment, all depend on some feature of semiconductor technology. Comprehensive Semiconductor Science and Technology, Six Volume Set captures the breadth of this important field, and presents it in a single source to the large audience who study, make, and exploit semiconductors. Previous attempts at this achievement have been abbreviated, and have omitted important topics. Written and Edited by a truly international team of experts, this work delivers an objective yet cohesive global review of the semiconductor world. The work is divided into three sections. The first section is concerned with the fundamental physics of semiconductors, showing how the electronic features and the lattice dynamics change drastically when systems vary from bulk to a low-dimensional structure and further to a nanometer size. Throughout this section there is an emphasis on the full understanding of the underlying physics. The second section deals largely with the transformation of the conceptual framework of solid state physics into devices and systems which require the growth of extremely high purity, nearly defect-free bulk and epitaxial materials. The last section is devoted to exploitation of the knowledge described in the previous sections to highlight the spectrum of devices we see all around us. Provides a comprehensive global picture of the semiconductor world Each of the work's three sections

presents a complete description of one aspect of the whole Written and Edited by a truly international team of experts

Semiconductor Quantum Optics

Ultra-wide Bandgap Semiconductors (UWBG) covers the most recent progress in UWBG materials, including sections on high-Al-content AlGa_N, diamond, B-Ga₂O₃, and boron nitrides. The coverage of these materials is comprehensive, addressing materials growth, physics properties, doping, device design, fabrication and performance. The most relevant and important applications are covered, including power electronics, RF electronics and DUV optoelectronics. There is also a chapter on novel structures based on UWBG, such as the heterojunctions, the low-dimensional structures, and their devices. This book is ideal for materials scientists and engineers in academia and R&D searching for materials superior to silicon carbide and gallium nitride. Provides a one-stop resource on the most promising ultra-wide bandgap semiconducting materials, including high-Al-content AlGa_N, diamond, ²Ga₂O₃, boron nitrides, and low-dimensional materials Presents comprehensive coverage, from materials growth and properties, to device design, fabrication and performance Features the most relevant applications, including power electronics, RF electronics and DUV optoelectronics

Comprehensive Semiconductor Science and Technology

II-VI Semiconductor Materials and Their Applications deals with II-VI compound semiconductors and the status of the two areas of current optoelectronics applications: blue-green emitters and IR detectors. Specifically, the growth, characterization, materials and device issues for these two applications are described. Emphasis is placed on the wide bandgap emitters where much progress has occurred recently. The book also presents new directions that have potential, future applications in optoelectronics for II-VI materials. In particular, it discusses the status of dilute magnetic semiconductors for magneto-optical and electromagnetic devices, nonlinear optical properties, photorefractive effects and new materials and physics phenomena, such as self-organized, low-dimensional structures. II-VI Semiconductor Materials and Their Applications is a valuable reference book for researchers in the field as well as a textbook for materials science and applied physics courses.

Ultra-wide Bandgap Semiconductor Materials

The elastic constant (EC) is a very important mechanical property of these materials and its significance is already well known in literature. This first monograph solely deals with the quantum effects in EC of heavily doped (HD) low dimensional materials. The materials considered are HD quantum confined nonlinear optical, III-V, II-VI, IV-VI, GaP, Ge, PtSb₂, stressed materials, GaSb, Te, II-V, Bi₂Te₃, lead germanium telluride, zinc and cadmium diphosphides, and quantum confined III-V, II-VI, IV-VI, and HgTe/CdTe super-lattices with graded interfaces and effective mass super-lattices. The presence of intense light waves in optoelectronics and strong electric field in nano-devices changes the band structure of semiconductors in fundamental ways, which have also been incorporated in the study of EC in HD low dimensional optoelectronic compounds that control the studies of the HD quantum effect devices under strong fields. The importance of measurement of band gap in optoelectronic materials under intense external fields has also been discussed in this context. The influences of magnetic quantization, crossed electric and quantizing fields, electric field and light waves on the EC in HD semiconductors and super-lattices are discussed. The content of this book finds twenty-five different applications in the arena of nano-science and nano-technology. The authors have discussed the experimental methods of determining the Einstein Relation, screening length and EC in this context. This book contains circa 200 open research problems which form the integral part of the text and are useful for both PhD aspirants and researchers in the fields of condensed matter physics, materials science, solid state sciences, nano-science and technology and allied fields in addition to the graduate courses in semiconductor nanostructures.

II-VI Semiconductor Materials and their Applications

Optoelectronics and electronics of the years to come are likely to change dramatically. Most of the outdoor lighting systems will be replaced by light-emitting diodes that operate in the whole visible part of the electromagnetic spectrum. Transistors operating at high frequency and with high power are under development and likely to hit the market very rapidly. Compact solid-state lasers that operate in the near-ultraviolet range are going to be utilized for such widely used applications as read-write tasks in printer and CD drives. Ultraviolet detectors will be used at a wide scale for many applications, ranging

from flame detectors to medical instruments. This book concerns itself with the questions why nitride semiconductors are so promising over such a wide range of applications, what the current issues are in the research laboratories, and what the prospects of new electronic devices are in the dawn of the twenty-first century.

Low-dimensional Structures in Semiconductors

Provides a multidisciplinary introduction to quantum mechanics, solid state physics, advanced devices, and fabrication Covers wide range of topics in the same style and in the same notation Most up to date developments in semiconductor physics and nano-engineering Mathematical derivations are carried through in detail with emphasis on clarity Timely application areas such as biophotonics , bioelectronics

Integrated Optoelectronics

This volume contains a sequence of reviews presented at the NATO Advanced Study Institute on 'Low Dimensional Structures in Semiconductors ... from Basic Physics to Applications.' This was part of the International School of Materials Science and 1990 at the Ettore Majorana Centre in Sicily. Technology held in July Only a few years ago, Low Dimensional Structures was an esoteric concept, but now it is apparent they are likely to play a major role in the next generation of electronic devices. The theme of the School acknowledged this rapidly developing maturity.' The contributions to the volume consider not only the essential physics, but take a wider view of the topic, starting from material growth and processing, then progressing right through to applications with some discussion of the likely use of low dimensional devices in systems. The papers are arranged into four sections, the first of which deals with basic concepts of semiconductor and low dimensional systems. The second section is on growth and fabrication, reviewing MBE and MOVPE methods and discussing the achievements and limitations of techniques to reduce structures into the realms of one and zero dimensions. The third section covers the crucial issue of interfaces while the final section deals with devices and device physics.

Elastic Constants In Heavily Doped Low Dimensional Materials

This book focuses on the fundamental phenomena at nanoscale. It covers synthesis, properties, characterization and computer modelling of nanomaterials, nanotechnologies, bionanotechnology, involving nanodevices. Further topics are imaging, measuring, modeling and manipulating of low dimensional matter at nanoscale. The topics covered in the book are of vital importance in a wide range of modern and emerging technologies employed or to be employed in most industries, communication, healthcare, energy, conservation , biology, medical science, food, environment, and education, and consequently have great impact on our society.

Low-dimensional Nitride Semiconductors

Since its inception in 1966, the series of numbered volumes known as Semiconductors and Semimetals has distinguished itself through the careful selection of well-known authors, editors, and contributors. The Willardson and Beer series, as it is widely known, has succeeded in producing numerous landmark volumes and chapters. Not only did many of these volumes make an impact at the time of their publication, but they continue to be well-cited years after their original release. Recently, Professor Eicke R. Weber of the University of California at Berkeley joined as a co-editor of the series. Professor Weber, a well-known expert in the field of semiconductor materials, will further contribute to continuing the series' tradition of publishing timely, highly relevant, and long-impacting volumes. Some of the recent volumes, such as Hydrogen in Semiconductors, Imperfections in III/V Materials, Epitaxial Microstructures, High-Speed Heterostructure Devices, Oxygen in Silicon, and others promise that this tradition will be maintained and even expanded.

Fundamentals of Solid State Engineering

This book surveys recent experimental and theoretical studies on optical properties of low-dimensional materials, e.g., artificial crystals in zeolites, C60 and its related compounds, silicon nanostructures including porous Si, II-VI and III-V semiconductor quantum structures, and Pb-based natural quantum-well systems. The eight excellent detailed review articles are written by authorities on each field in Japan. All the materials introduced in this book yield new optical phenomena originating from their mesoscopic and low-dimensional characters contributing to a new research field of condensed matter and optical physics. Contents: Dimensionality and Optical Responses of Materials (T Ogawa) Ab initio

Calculation of Nonlinear Optical Susceptibility (T Nakayama) Wannier-Stark Localization in Semiconductor Superlattices (M Nakayama) Ultraviolet Laser Emission from ZnS-Based Quantum Wells (Y Yamada) Luminescence from Silicon Nanostructures (Y Kanemitsu) Optical Properties of Pb-Based Inorganic-Organic Perovskites (T Ishihara) Solid State Properties of C60 and Its Related Materials (Y Iwasa) Arrayed Nanoclusters in Zeolite Crystals (Y Nozue) Readership: Researchers in materials science, nanoscience, optics, semiconductors, condensed matter physics and applied physics. keywords: Low Dimension; Optical Property; Materials Science; Nanoscience; Quantum Confinement; Exciton; Phonon; Photon; Electronic Structure; Lattice Structure

Low-Dimensional Structures in Semiconductors

Written by one of the driving forces in the field, The MOCVD Challenge is a comprehensive review covering GaInAsP-InP, GaInAsP-GaAs, and related material for electronic and photonic device applications. These III-V semiconductor compounds have been used to realize the electronic, optoelectronic, and quantum devices that have revolutionized telecomm

Low-Dimensional and Nanostructured Materials and Devices

Raman scattering is now being applied with increasing success to a wide range of practical problems at the cutting edge of materials science. The purpose of this book is to make Raman spectroscopy understandable to the non-specialist and thus to bring it into the mainstream of routine materials characterization. The book is pedagogical in approach and focuses on technologically important condensed-matter systems in which the specific use of Raman spectroscopy yields new and useful information. Included are chapters on instrumentation, bulk semiconductors and alloys, heterostructures, high-Tc superconductors, catalysts, carbon-based materials, wide-gap and super-hard materials, and polymers.

Theory of Growth and Characterization of Low-dimensional Semiconductor Structures

This book discusses the basic physics of semiconductor macroatoms at the nanoscale as well as their potential application as building blocks for the realization of new-generation quantum devices. It provides a review on state-of-the art fabrication and characterization of semiconductor quantum dots aimed at implementing single-electron/exciton devices for quantum information processing and communication. After an introductory chapter on the fundamentals of quantum dots, a number of more specialized review articles presents a comprehensive picture of this rapidly developing field, specifically including strongly multidisciplinary topics such as state-of-the-art nanofabrication and optical characterization, fully microscopic theoretical modeling of nontrivial many-body processes, as well as design and optimization of novel quantum-device architectures. Contents: Fundamentals of Zero-Dimensional Nanostructures Growth and Characterization of Self-Assembled Semiconductor Macroatoms Ultrafast Coherent Spectroscopy of Single Semiconductor Quantum Dots Few-Particle Effects in Semiconductor Macroatoms/Molecules Electron-Phonon Interaction in Semiconductor Quantum Dots Phonon-Induced Decoherence in Semiconductor Quantum Dots All-Optical Schemes for Quantum Information Processing with Semiconductor Macroatoms Novel Devices for the Measurement of Electronic States in Semiconductor Quantum Dots Readership: Graduate students and academics in condensed matter physics, semiconductors and related area, and electron state in nanoscale systems. Key Features: Unique combination of introductory/review material on quantum-dot physics and most advanced research results in this rapidly developing field Strong and continuous link between nanodevice fabrication/characterization and theoretical modeling/simulation Cohesive and self-contained treatment of diverse issues related to semiconductor-device physics and nanotechnology Most of the scientific activity presented in the book is the result of a number of cross-collaborations within a large-scale European Project, thus the volume offers a cohesive perspective on the many research areas involved Keywords: Semiconductor Macroatoms; Quantum Dots; Quantum Devices; Quantum Information; Quantum Computation; Few-Electron Systems; Nanofabrication; Ultrafast Spectroscopy

Processing and Properties of Compound Semiconductors

This five-volume handbook focuses on processing techniques, characterization methods, and physical properties of thin films (thin layers of insulating, conducting, or semiconductor material). The editor has composed five separate, thematic volumes on thin films of metals, semimetals, glasses, ceramics, alloys, organics, diamonds, graphites, porous materials, noncrystalline solids, supramolecules, polymers, copolymers, biopolymers, composites, blends, activated carbons, intermetallics, chalcogenides, dyes,

pigments, nanostructured materials, biomaterials, inorganic/polymer composites, organoceramics, metallocenes, disordered systems, liquid crystals, quasicrystals, and layered structures. Thin films is a field of the utmost importance in today's materials science, electrical engineering and applied solid state physics; with both research and industrial applications in microelectronics, computer manufacturing, and physical devices. Advanced, high-performance computers, high-definition TV, digital camcorders, sensitive broadband imaging systems, flat-panel displays, robotic systems, and medical electronics and diagnostics are but a few examples of miniaturized device technologies that depend the utilization of thin film materials. The Handbook of Thin Films Materials is a comprehensive reference focusing on processing techniques, characterization methods, and physical properties of these thin film materials.

Optical Properties of Low-Dimensional Materials

Quantum mechanics transcends and supplants classical mechanics at the atomic and subatomic levels. It provides the underlying framework for many subfields of physics, chemistry and materials science, including condensed matter physics, atomic physics, molecular physics, quantum chemistry, particle physics, and nuclear physics. It is the only way we can understand the structure of materials, from the semiconductors in our computers to the metal in our automobiles. It is also the scaffolding supporting much of nanoscience and nanotechnology. The purpose of this book is to present the fundamentals of quantum theory within a modern perspective, with emphasis on applications to nanoscience and nanotechnology, and information-technology. As the frontiers of science have advanced, the sort of curriculum adequate for students in the sciences and engineering twenty years ago is no longer satisfactory today. Hence, the emphasis on new topics that are not included in older reference texts, such as quantum information theory, decoherence and dissipation, and on applications to nanotechnology, including quantum dots, wires and wells. This book provides a novel approach to Quantum Mechanics whilst also giving readers the requisite background and training for the scientists and engineers of the 21st Century who need to come to grips with quantum phenomena. The fundamentals of quantum theory are provided within a modern perspective, with emphasis on applications to nanoscience and nanotechnology, and information-technology. Older books on quantum mechanics do not contain the amalgam of ideas, concepts and tools necessary to prepare engineers and scientists to deal with the new facets of quantum mechanics and their application to quantum information science and nanotechnology. As the frontiers of science have advanced, the sort of curriculum adequate for students in the sciences and engineering twenty years ago is no longer satisfactory today. There are many excellent quantum mechanics books available, but none have the emphasis on nanotechnology and quantum information science that this book has.

Nanoscale Devices, Materials, and Biological Systems

This volume presents state-of-the-art information on several important material systems and device structures employed in modern semiconductor lasers. The first two chapters discuss several III-V, II-VI, and VI-VI compound semiconductor material systems employed in diode lasers whose emission spectra cover the range from the blue to the mid-infrared. Subsequent chapters describe the elaboration of special laser structures designed for achieving narrow spectral linewidths and wavelength tunability, as well as high power emission devices. The last chapter covers the development of surface emitting diode lasers, particularly vertical cavity structures. In all five chapters, the underlying device physics as well as the state-of-the-art and future trends are discussed. This book introduces the non-expert to the design and fabrication issues involved in the development of these important laser devices. In addition, it reviews the current status of the different material systems and cavity configurations for the benefit of readers engaged in research in this field. Useful background material related to the fundamentals of lasing in semiconductors can be found in the companion volume, Semiconductor Lasers I: Fundamentals. Covers important recent advances in materials, design, fabrication, and device structure of semiconductor lasers - aspects not covered in previously existing literature. Introduces the non-expert to the subject. Useful for professionals engaged in research and development. Numerous schematic and data-containing illustrations. Written by leading experts in the field.

The MOCVD Challenge

This book brings together concepts from semiconductor physics, nonlinear-dynamics and chaos to examine semiconductor transport phenomena.

Raman Scattering in Materials Science

Rarely do so many leading physicists attend one symposium. No less than nine Nobel laureates and some 40 other top researchers gathered for this symposium and this book contains the material presented in invited talks as well as the posters. The 34 papers are organised into three groups corresponding to various aspects of low dimensional physics of solids.

Semiconductor Macroatoms

This comprehensive tutorial guide to silicon nanomaterials spans from fundamental properties, growth mechanisms, and processing of nanosilicon to electronic device, energy conversion and storage, biomedical, and environmental applications. It also presents core knowledge with basic mathematical equations, tables, and graphs in order to provide the reader with the tools necessary to understand the latest technology developments. From low-dimensional structures, quantum dots, and nanowires to hybrid materials, arrays, networks, and biomedical applications, this Sourcebook is a complete resource for anyone working with this materials: Covers fundamental concepts, properties, methods, and practical applications. Focuses on one important type of silicon nanomaterial in every chapter. Discusses formation, properties, and applications for each material. Written in a tutorial style with basic equations and fundamentals included in an extended introduction. Highlights materials that show exceptional properties as well as strong prospects for future applications. Klaus D. Sattler is professor physics at the University of Hawaii, Honolulu, having earned his PhD at the Swiss Federal Institute of Technology (ETH) in Zurich. He was honored with the Walter Schottky Prize from the German Physical Society, and is the editor of the sister work also published by Taylor & Francis, Carbon Nanomaterials Sourcebook, as well as the acclaimed multi-volume Handbook of Nanophysics.

Handbook of Thin Films, Five-Volume Set

This work represents the account of a NATO Advanced Research Workshop on "Thin Film Growth Techniques for Low Dimensional Structures\

Quantum Mechanics with Applications to Nanotechnology and Information Science

Semiconductor Lasers II