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KEY=PHYSICS - DARIO OCONNELL

Physics of Quantum Well Devices

Springer Science & Business Media Quantum well devices have been the objects of intensive research during the last two decades. Some of the devices have matured into commercially useful products and form part of modern electronic circuits. Some others require further dev- opment, but have the promise of being useful commercially in the near future. Study of the devices is, therefore, gradually becoming compulsory for electronics specialists. The functioning of the devices, however, involve aspects of physics which are not dealt with in the available text books on the physics of semicond- tor devices. There is, therefore, a need for a book to cover all these aspects at an introductory level. The present book has been written with the aim of meeting this need. In fact, the book grew out of introductory lectures given by the author to graduate students and researchers interested in this rapidly developing area of electron devices. The book covers the subjects of heterostructure growth techniques, band-offset theory and experiments, electron states, electron-photon interaction and related phenomena, electron transport and the operation of electronic, opto-electronic and photonic quantum well devices. The theory as well as the practical aspects of the devices are discussed at length. The aim of the book is to provide a comprehensive treatment of the physics underlying the various devices. A reader after going through the book should find himself equipped to deal with all kinds of quantum well devices.

Physics of Quantum Electron Devices

Springer Science & Business Media The ability to engineer the bandstructure and the wavefunction over length scales previously inaccessible to technology using artificially structured materials and nanolithography has led to a new class of electron semiconductor devices whose operation is controlled by quantum effects. These structures not only represent exciting tools for investigating new quantum phenomena in semiconductors, but also offer exciting opportunities for applications. This book gives the first comprehensive treatment of the physics of quantum electron devices. This interdisciplinary field, at the junction between material science, physics and technology, has witnessed an explosive growth in recent years. This volume presents a detailed coverage of the physics of the underlying phenomena, and their device and circuit applications, together with fabrication and growth technology.

Physics of Quantum Well Devices

Springer Science & Business Media The book deals with the physics, operating principles and characteristics of the important quantum well devices, namely, the High Electron Mobility Transistor (HEMT), Resonant Tunneling Diode (RTD), Quantum Well Laser (QWL), Quantum Well Infrared Photodetector (QWIP), Modulator and Switch. The basic physical concepts on which these devices are based are discussed in detail with necessary diagrams and mathematical derivations. The growth of heterostructures, theories and experiments on band offset, theories and experimental results on electron states, optical interaction phenomena, and electron transport are discussed as the background material. Practical aspects and up-to-date developments and applications of the devices are also covered. This book will be of interest to researchers and specialists in the field of Solid State Technology, Optics and Optoelectronics. It can also serve as a textbook for graduate students and new entrants in the exciting field of quantum electronics. This book takes the reader from the introductory stage to the advanced level of the construction, principles of operation, and application of these devices.

Intersubband Transitions in Quantum Wells: Physics and Device Applications

Academic Press 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. Reflecting the truly interdisciplinary nature of the field that the series covers, the volumes in Semiconductors and Semimetals have been and will continue to be of great interest to physicists, chemists, materials scientists, and device engineers in modern industry.

Quantum Well Intersubband Transition Physics and Devices

Springer Science & Business Media Intersubband transitions in quantum wells have attracted tremendous attention in recent years, mainly due to the promise of applications in the mid and far-infrared regions (2--20 mum). Many of the papers presented in Quantum Well Intersubband Transition Physics and Devices are on the basic linear intersubband transition processes, detector physics and detector application, reflecting the current state of understanding and detector applications, where highly uniform, large focal plane arrays have been demonstrated. Other areas are still in their early stages, including infrared modulation, harmonic generation and emission.

Intersubband Transitions in Quantum Wells: Physics and Devices

Springer Science & Business Media The International Workshop on "Intersubband Transitions in Quantum Wells:: Physics and Applications," was held at National Cheng Kung University, in Tainan, Taiwan, December 15-18, 1997. The objective of the Workshop is to facilitate the presentation and discussion of the recent results in theoretical, experimental, and applied aspects of intersubband transitions in quantum wells and dots. The program followed the tradition initiated at the 1991 conference in Cargese-France, the 1993 conference in Whistler, B. C. Canada, and the 1995 conference in Kibbutz Ginosar, Israel. Intersubband transitions in quantum wells and quantum dots have attracted considerable attention in recent years, mainly due to the promise of various applications in the mid- and far-infrared regions (2-30 J. lm). Over 40 invited and contributed papers were presented in this four-day workshop, with topics covered most aspects of the intersubband transition phenomena including: the basic intersubband transition processes, multiquantum well infrared photodetector (QWIP) physics, large format (640x480) GaAs QWIP (with 9. 0 J. lffi cutoff) focal plane arrays (FPAs) for IR imaging camera applications, infrared modulation, intersubband emission including mid- and long- wavelength quantum cascade (QC) lasers such as short (A. "" 3. 4 J. lm) and long (A. "" 11. 5 J. lm) wavelength room temperature QC lasers, quantum fountain intersubband laser at 15. 5 J. lm wavelength in GaAs/AIGaAs quantum well, harmonic generation and nonlinear effects, ultra-fast phenomena such as terahertz (THz) intersubband emission and detection. The book divides into five Chapters.

Intersubband Transitions in Quantum Wells: Physics and Device Applications II

Academic Press Intersubband Transitions in Quantum Wells: Physics and Device Applications II

On the Device-Independent Approach to Quantum Physics

Advances in Quantum Nonlocality and Multipartite Entanglement Detection

Springer Science & Business Media Quantum physics started in the 1920's with wave mechanics and the wave-particle duality. However, the last 20 years have seen a second quantum revolution, centered around non-locality and quantum correlations between measurement outcomes. The associated key property, entanglement, is recognized today as the signature of quantumness. This second revolution opened the possibility of studying quantum correlations without any assumption on the internal functioning of the measurement apparata, the so-called Device-Independent Approach to

Quantum Physics. This thesis explores this new approach using the powerful geometrical tool of polytopes. Emphasis is placed on the study of non-locality in the case of three or more parties, where it is shown that a whole new variety of phenomena appear compared to the bipartite case. Genuine multiparty entanglement is also studied for the first time within the device-independent framework. Finally, these tools are used to answer a long-standing open question: could quantum non-locality be explained by influences that propagate from one party to the others faster than light, but that remain hidden so that one cannot use them to communicate faster than light? This would provide a way around Einstein's notion of action at a distance that would be compatible with relativity. However, the answer is shown to be negative, as such influences could not remain hidden.

Integrated Optics: Theory and Technology

Springer Our intent in producing this book was to provide a text that would be comprehensive enough for an introductory course in integrated optics, yet concise enough in its mathematical derivations to be easily readable by a practicing engineer who desires an overview of the field. The response to the first edition has indeed been gratifying; unusually strong demand has caused it to be sold out during the initial year of publication, thus providing us with an early opportunity to produce this updated and improved second edition. This development is fortunate, because integrated optics is a very rapidly progressing field, with significant new research being regularly reported. Hence, a new chapter (Chap. 17) has been added to review recent progress and to provide numerous additional references to the relevant technical literature. Also, thirty-five new problems for practice have been included to supplement those at the ends of chapters in the first edition. Chapters I through 16 are essentially unchanged, except for brief updating revisions and corrections of typographical errors. Because of the time limitations imposed by the need to provide an uninterrupted supply of this book to those using it as a course text, it has been possible to include new references and to briefly describe recent developments only in Chapter 17. However, we hope to provide details of this continuing progress in a future edition.

Heterostructures and Quantum Devices

Elsevier Heterostructure and quantum-mechanical devices promise significant improvement in the performance of electronic and optoelectronic integrated circuits (ICs). Though these devices are the subject of a vigorous research effort, the current literature is often either highly technical or narrowly focused. This book presents heterostructure and quantum devices to the nonspecialist, especially electrical engineers working with high-performance semiconductor devices. It focuses on a broad base of technical applications using semiconductor physics theory to develop the next generation of electrical engineering devices. The text covers existing technologies and future possibilities within a common framework of high-performance devices, which will have a more immediate impact on advanced semiconductor physics-particularly quantum effects-and will thus form the basis for longer-term technology development.

Technology of Quantum Devices

Springer Science & Business Media Technology of Quantum Devices offers a multi-disciplinary overview of solid state physics, photonics and semiconductor growth and fabrication. Readers will find up-to-date coverage of compound semiconductors, crystal growth techniques, silicon and compound semiconductor device technology, in addition to intersubband and semiconductor lasers. Recent findings in quantum tunneling transport, quantum well intersubband photodetectors (QWIP) and quantum dot photodetectors (QWDIP) are described, along with a thorough set of sample problems.

Hot Electrons in Semiconductors

Physics and Devices

Oxford University Press on Demand Under certain conditions electrons in a semiconductor become much hotter than the surrounding crystal lattice. When this happens, Ohm's Law breaks down: current no longer increases linearly with voltage and may even decrease. Hot electrons have long been a challenging problem in condensed matter physics and remain important in semiconductor research. Recent advances in technology have led to semiconductors with submicron dimensions, where electrons can be confined to two (quantum well), one (quantum wire), or zero (quantum dot) dimensions. In these devices small voltages heat electrons rapidly, inducing complex nonlinear behavior; the study of hot electrons is central to their further development. This book is the only comprehensive and up-to-date coverage of hot electrons. Intended for both established researchers and graduate students, it gives a complete account of the historical development of the subject, together with current research and future trends, and covers the physics of hot electrons in bulk and low-dimensional device technology. The contributions are from leading scientists in the field and are

grouped broadly into five categories: introduction and overview; hot electron-phonon interactions and ultra-fast phenomena in bulk and two-dimensional structures; hot electrons in quantum wires and dots; hot electron tunneling and transport in superlattices; and novel devices based on hot electron transport.

Ultrafast Quantum Well Optoelectronic Devices

This project investigated novel optoelectronic switching and gating devices. These are based on the use of quantum well structures and electronic diodes. The devices can be used as optically controlled optical gates, allowing one light signal to pass in response to the presence of another optical signal, with the gating controlled by applied or induced electrical biases. Though the devices are internally optoelectronic, an important feature is that the speed of operation of the device is governed by very fast internal electrical processes, not by external properties such as the resistive-capacitive time constant of the entire device or the external circuit. Another feature of the device is that the operating optical energies are relatively low. The project has successfully demonstrated several different generations of devices, including a version using one quantum well diode and an advanced structure using two separate diodes. This latter structure allowed higher speed switching because it avoided the necessity for photogenerated carriers to escape from the quantum wells. Device speeds in the picosecond range and burst repetition rates of approximately 50 GHz have been demonstrated The operation of the device has also been successfully modeled, including a novel multilayer modeling method.

Quantum Mechanics

An Introduction for Device Physicists and Electrical Engineers

CRC Press Quantum Mechanics: An Introduction for Device Physicists and Electrical Engineers, Third Edition provides a complete course in quantum mechanics for students of semiconductor device physics and electrical engineering. It provides the necessary background to quantum theory for those starting work on micro- and nanoelectronic structures and is particularly useful for those beginning work with modern semiconductors devices, lasers, and qubits. This book was developed from a course the author has taught for many years with a style and order of presentation of material specifically designed for this audience. It introduces the main concepts of quantum mechanics which are important in everyday solid-state physics and electronics. Each topic includes examples which have been carefully chosen to draw upon relevant experimental research. It also includes problems with solutions to test understanding of theory. Full updated throughout, the third edition contains the latest developments, experiments, and device concepts, in addition to three fully revised chapters on operators and expectations and spin angular momentum, it contains completely new material on superconducting devices and approaches to quantum computing.

Optical Computing

CRC Press Written by ten leading experts in the field, Optical Computing cover topics such as optical bistability, optical interconnects and circuits, photorefractive devices, spatial light modulators, associative memory, and optical computer architectures.

Physics of Submicron Devices

Springer Science & Business Media The purposes of this book are many. First, we must point out that it is not a device book, as a proper treatment of the range of important devices would require a much larger volume even without treating the important physics for submicron devices. Rather, the book is written principally to pull together and present in a single place, and in a (hopefully) uniform treatment, much of the understanding on relevant physics for submicron devices. Indeed, the understand ing that we are trying to convey through this work has existed in the literature for quite some time, but has not been brought to the full attention of those whose business is the making of submicron devices. It should be remarked that much of the important physics that is discussed here may not be found readily in devices at the 1.0-JLm level, but will be found to be dominant at the O.I-JLm level. The range between these two is rapidly being covered as technology moves from the 256K RAM to the 16M RAM chips.

Quantum Well Infrared Photodetectors

Physics and Applications

Springer Addressed to both students as a learning text and scientists/engineers as a reference, this book discusses the physics and applications of quantum-well infrared photodetectors (QWIPs). It is assumed that the reader has a basic background in quantum mechanics, solid-state physics, and semiconductor devices. To make this book as widely accessible as possible, the treatment and presentation of the materials is simple and straightforward. The topics for the book were chosen by the following criteria: they must be well-established and understood; and they should have been, or potentially will be, used in practical applications. The monograph discusses most aspects relevant for the field but omits, at the same time, detailed discussions of specialized topics such as the valence-band quantum wells.

Nonlinear Optical Materials and Devices for Applications in Information Technology

Springer Science & Business Media Nonlinear Optical Materials and Devices for Applications in Information Technology takes the reader from fundamental interactions of laser light in materials to the latest developments of digital optical information processing. The book emphasises nonlinear optical interactions in bulk and low-dimensional semiconductors, liquid crystals and optical fibres. After establishing the basic laser--material interactions in these materials, it goes on to assess applications in soliton propagation, integrated optics, smart pixel arrays and digital optical computing.

Device and Circuit Cryogenic Operation for Low Temperature Electronics

Springer Science & Business Media Device and Circuit Cryogenic Operation for Low Temperature Electronics is a first in reviewing the performance and physical mechanisms of advanced devices and circuits at cryogenic temperatures that can be used for many applications. The first two chapters cover bulk silicon and SOI MOSFETs. The electronic transport in the inversion layer, the influence of impurity freeze-out, the special electrical properties of SOI structures, the device reliability and the interest of a low temperature operation for the ultimate integration of silicon down to nanometer dimensions are described. The next two chapters deal with Silicon-Germanium and III-V Heterojunction Bipolar Transistors, as well as III-V High Electron Mobility Transistors (HEMT). The basic physics of the SiGe HBT and its unique cryogenic capabilities, the optimization of such bipolar devices, and the performance of SiGe HBT BiCMOS technology at liquid nitrogen temperature are examined. The physical effects in III-V semiconductors at low temperature, the HEMT and HBT static, high frequency and noise properties, and the comparison of various cooled III-V devices are also addressed. The next chapter treats quantum effect devices made of silicon materials. The major quantum effects at low temperature, quantum wires, quantum dots as well as single electron devices and applications are investigated. The last chapter overviews the performances of cryogenic circuits and their applications. The low temperature properties and performance of inverters, multipliers, adders, operational amplifiers, memories, microprocessors, imaging devices, circuits and systems, sensors and read-out circuits are analyzed. Device and Circuit Cryogenic Operation for Low Temperature Electronics is useful for researchers, engineers, Ph.D. and M.S. students working in the field of advanced electron devices and circuits, new semiconductor materials, and low temperature electronics and physics.

Heterojunction and Quantum Well Devices

Physics Engineering and Applications

Solid State Devices

A Quantum Physics Approach

Springer The changes which have taken place in electronics are truly astonishing. It is difficult to believe that within a single lifespan we have come from the cat's whisker diode, via the thermionic valve, to the 256K random access memory and beyond. These developments would not have come about without an increased understanding of the physics and technology of the solid state. Although the progression from Planck's quantum postulate to single chip electronic systems within eighty years has resulted in an increased level of specialisation of the fields of knowledge, solid state nevertheless continues to be a cross-disciplinary subject. The design and fabrication of solid state devices involve large elements of chemistry, physics and materials science. However, books on the subject tend to be written by specialists in one or other area. Thus a physics-based text is likely to have more details on quantum theory than is necessary for a technologist. Similarly, texts which concentrate on devices and their applications frequently ignore the fundamental background which is vital for a true understanding.

Quantum Wells, Wires and Dots

Theoretical and Computational Physics of Semiconductor Nanostructures

John Wiley & Sons Quantum Wells, Wires and Dots Second Edition: Theoretical and Computational Physics of Semiconductor Nanostructures provides all the essential information, both theoretical and computational, for complete beginners to develop an understanding of how the electronic, optical and transport properties of quantum wells, wires and dots are calculated. Readers are lead through a series of simple theoretical and computational examples giving solid foundations from which they will gain the confidence to initiate theoretical investigations or explanations of their own. Emphasis on combining the analysis and interpretation of experimental data with the development of theoretical ideas Complementary to the more standard texts Aimed at the physics community at large, rather than just the low-dimensional semiconductor expert The text present solutions for a large number of real situations Presented in a lucid style with easy to follow steps related to accompanying illustrative examples

Multi-quantum well devices-physics, engineering and applications

Colloquium : Papers

International Trends in Optics

Academic Press International Trends in Optics provides a broad view of work in the field of optics throughout the world. Topics range from quantum optoelectronics for optical processing to optics in telecommunications, along with microoptics, optical memories, and fiber-optic signal processing. Holographic optical elements for use with semiconductor lasers are also considered. Comprised of 34 chapters, this book begins with an introduction to some of the practical applications of integrated optical circuits, optoelectronic integrated circuits, and photonic integrated circuits. Subsequent chapters deal with quantum optoelectronics for optical processing; fiber-optic signal processing; holographic optical elements for use with semiconductor lasers; potential uses of photorefractives; and adaptive interferometry that makes use of photorefractive crystals. Water wave optics and diffraction are also examined, together with the essential journals of optics and the opposition effect in volume and surface scattering. The final chapter is devoted to optical computing, with emphasis on its processing functions and architecture. This monograph will be of interest to students, practitioners, and researchers in physics and electronics.

Unconventional Models of Computation

Springer Science & Business Media Covering recent research into unconventional methods of computing for disciplines in computer science, mathematics, biology, physics and philosophy, the subjects include: nonconventional computational methods, DNA computation, quantum computation, and beyong Turing computability; new methods of discrete computation; theoretical and conceptual new

computational paradigms; practical knowledge on new computing technologies.

Quantum Heterostructures

Microelectronics and Optoelectronics

Cambridge University Press Quantum Heterostructures provides a detailed description of the key physical and engineering principles of quantum semiconductor heterostructures. Blending important concepts from physics, materials science, and electrical engineering, it also explains clearly the behavior and operating features of modern microelectronic and optoelectronic devices. The authors begin by outlining the trends that have driven development in this field, most importantly the need for high-performance devices in computer, information, and communications technologies. They then describe the basics of quantum nanoelectronics, including various transport mechanisms. In the latter part of the book, they cover novel microelectronic devices, and optical devices based on quantum heterostructures. The book contains many homework problems and is suitable as a textbook for undergraduate and graduate courses in electrical engineering, physics, or materials science. It will also be of great interest to those involved in research or development in microelectronic or optoelectronic devices.

Fundamentals of Semiconductor Physics and Devices

World Scientific This book is an introduction to the principles of semiconductor physics, linking its scientific aspects with practical applications. It is addressed to both readers who wish to learn semiconductor physics and those seeking to understand semiconductor devices. It is particularly well suited for those who want to do both.Intended as a teaching vehicle, the book is written in an expository manner aimed at conveying a deep and coherent understanding of the field. It provides clear and complete derivations of the basic concepts of modern semiconductor physics. The mathematical arguments and physical interpretations are well balanced: they are presented in a measure designed to ensure the integrity of the delivery of the subject matter in a fully comprehensible form. Experimental procedures and measured data are included as well. The reader is generally not expected to have background in quantum mechanics and solid state physics beyond the most elementary level. Nonetheless, the presentation of this book is planned to bring the student to the point of research/design capability as a scientist or engineer. Moreover, it is sufficiently well endowed with detailed knowledge of the field, including recent developments bearing on submicron semiconductor structures, that the book also constitutes a valuable reference resource.In Chapter 1, basic features of the atomic structures, chemical nature and the macroscopic properties of semiconductors are discussed. The band structure of ideal semiconductor crystals is treated in Chapter 2, together with the underlying one-electron picture and other fundamental concepts. Chapter 2 also provides the requisite background of the tight binding method and the k.p-method, which are later used extensively. The electron states of shallow and deep centers, clean semiconductor surfaces, quantum wells and superlattices, as well as the effects of external electric and magnetic fields, are treated in Chapter 3. The one- or multi-band effective mass theory is used wherever this method is applicable. A summary of group theory for application in semiconductor physics is given in an Appendix. Chapter 4 deals with the statistical distribution of charge carriers over the band and localized states in thermodynamic equilibrium. Non-equilibrium processes in semiconductors are treated in Chapter 5. The physics of semiconductor junctions (pn-, hetero-, metal-, and insulator-) is developed in Chapter 6 under conditions of thermodynamic equilibrium, and in Chapter 7 under non-equilibrium conditions. On this basis, the most important electronic and opto-electronic semiconductor devices are treated, among them uni- and bi-polar transistors, photodetectors, solar cells, and injection lasers. A summary of group theory for applications in semiconductors is given in an Appendix.

Quantum Mesoscopic Phenomena and Mesoscopic Devices in Microelectronics

Springer Quantum mechanical laws are well documented at the level of a single or a few atoms and are here extended to systems containing 102 to 1010 electrons - still much smaller than the usual macroscopic objects, but behaving in a manner similar to a single atom. Besides the purely theoretical interest, such systems pose a challenge to the achievement of the ultimate microelectronic applications. The present volume presents an up-to-date account of the physics, technology and expected applications of quantum effects in solid-state mesoscopic structures. Physical phenomena include the Aharonov-Bohm effect, persistent currents, Coulomb blockade and Coulomb oscillations in single electron devices, Andreev reflections and the Josephson effect in superconductor/normal/superconductor systems, shot noise suppression in microcontacts and contact resistance quantisation, and overall quantum coherence in mesoscopic and nanoscopic structures related to the emerging physics of quantum computation in the solid-state environment.

Problem Solving in Quantum Mechanics

From Basics to Real-World Applications for Materials Scientists, Applied Physicists, and Devices Engineers

John Wiley & Sons "A topical and timely useful textbook dealing with the practical aspects of quantum mechanics, including discussions on a broad range of topics including recent technological developments in superconducting Josephson junctions, atomic cavities, lasers, gated quantum dots, optical measurements, non-linear optics, spintronic devices, etc."--

Semiconducting Chalcogenide Glass III

Applications of Chalcogenide Glasses

Elsevier Chalcogenide glass is made up of many elements from the Chalcogenide group. The glass is transparent to infrared light and is useful as a semiconductor in many electronic devices. For example, chalcogenide glass fibers are a component of devices used to perform laser surgery. Semiconducting Chalcogenide Glass III: Applications of Chalcogenide Glasses is a comprehensive overview of designs of various chalcogenide glass devices are presented, including switches, phase inverters, voltage stabilizers, oscillators, indicators and display control circuits, memory devices, and sensors. A special chapter is devoted to chalcogenide glass applications in optical fibers. This collective monograph is intended to survey the current state of chalcogenide glass applications to facilitate further development. The first collective monograph written by Eastern European scientists covering electrical and optical properties of chalcogenide vitreous semiconductors (CVS) Contributions by B.G. Kolomiets, who discovered the properties of chalcogenide glass in 1955! Provides evidence and discussion by authors from opposing positions

Semiconductor Macroatoms

Basic Physics and Quantum-device Applications

World Scientific 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.Sample Chapter(s)

Physical Models of Semiconductor Quantum Devices

Springer Science & Business Media The science and technology relating to nanostructures continues to receive significant attention for its applications to various fields including microelectronics, nanophotonics, and biotechnology. This book describes the basic quantum mechanical principles underlining this fast developing field. From the fundamental principles of quantum mechanics to nanomaterial properties, from device physics to research and development of new systems, this title is aimed at undergraduates, graduates, postgraduates, and researchers.

Colloquium on Multi-quantum Well Devices

Physics, Engineering and Applications : London, 8 December 1986

High Speed Heterostructure Devices

Academic Press Volume 41 includes an in-depth review of the most important, high-speed switches made with heterojunction technology. This volume is aimed at the graduate student or working researcher who needs a broad overview andan introduction to current literature. The first complete review of InP-based HFETs and complementary HFETs, which promise very low power and high speed Offers a complete, three-chapter review of resonant tunneling Provides an emphasis on circuits as well as devices

Multi-Band Effective Mass Approximations

Advanced Mathematical Models and Numerical Techniques

Springer This book addresses several mathematical models from the most relevant class of kp-Schrödinger systems. Both mathematical models and state-of-the-art numerical methods for adequately solving the arising systems of differential equations are presented. The operational principle of modern semiconductor nano structures, such as quantum wells, quantum wires or quantum dots, relies on quantum mechanical effects. The goal of numerical simulations using quantum mechanical models in the development of semiconductor nano structures is threefold: First they are needed for a deeper understanding of experimental data and of the operational principle. Secondly, they allow us to predict and optimize in advance the qualitative and quantitative properties of new devices in order to minimize the number of prototypes needed. Semiconductor nano structures are embedded as an active region in semiconductor devices. Thirdly and finally, the results of quantum mechanical simulations of semiconductor nano structures can be used with upscaling methods to deliver parameters needed in semi-classical models for semiconductor devices, such as quantum well lasers. This book covers in detail all these three aspects using a variety of illustrative examples. Readers will gain detailed insights into the status of the multiband effective mass method for semiconductor nano structures. Both users of the kp method as well as advanced researchers who want to advance the kp method further will find helpful information on how to best work with this method and use it as a tool for characterizing the physical properties of semiconductor nano structures. The book is primarily intended for graduate and Ph.D. students in applied mathematics, mathematical physics and theoretical physics, as well as all those working in quantum mechanical research or the semiconductor / opto-electronic industry who are interested in new mathematical aspects.

Quantum Confined Laser Devices

Optical Gain and Recombination in Semiconductors

Oxford University Press This title takes students, final year undergraduates and graduates, and researchers, along the path to understand quantum processes in semiconductors, and to enable them, as researchers, to contribute to further advances and inventions.

New Ternary Alloy Systems for Infrared Detectors

SPIE Press

Advances in Research and Development

Homojunction and Quantum-Well Infrared Detectors

Elsevier Physics of Thin Films is one of the longest running continuing series in thin film science, consisting of twenty volumes since 1963. The series contains quality studies of the properties of various thinfilms materials and systems. In order to be able to reflect the development of today's science and to cover all modern aspects of thin films, the series, starting with Volume 20, has moved beyond the basic physics of thin films. It now addresses the most important aspects of both inorganic and organic thin films, in both their theoretical as well as technological aspects. Therefore, in order to reflect the modern technology-oriented problems, the title has been slightly modified from Physics of Thin Films to Thin Films. Discusses the latest research about structure, physics, and infrared photoemissive behavior of heavily doped silicon homojunctions and Ge and GaAs-based alloy junctions Reviews the current status of SiGe/Si quantum wells for infrared detection Discusses key developments in the growing research on quantum-well infrared photodetectors (QWIPs) Reviews Chois development of a family of novel three-terminal, multi-quantum well devices designed to improve high-temperature IR detectivity at long wavelengths Describes recent studies aimed at using multi-quantum well structures to achieve higher performance in solar cell devices based on materials systems

Physics of Space-Related Effects in Multiple-Quantum Well Photonic Devices

The objective of this program is to understand the effects of space radiation on multiple-quantum-well (MQW) photonic devices through a coordinated program of experimental characterization, analysis, and modeling. The work has focused on MQW laser diodes. Photonic devices based on MQW technology are widespread in both commercial and military applications. Such devices and systems offer an ideal opportunity for understanding the effects of the space radiation environment on nano-structures and provide insight into the physics of radiation effects on a class of devices that will revolutionize future electronic and optoelectronic systems. In this program, we have looked at proton-irradiation effects in MQW laser diodes, quantum dots, and high-electron mobility transistors. Irradiation has been performed using high-energy protons because they produce both long-term ionization damage and displacement damage.

Physics of Semiconductor Devices

Springer Science & Business Media Physics of Semiconductor Devices covers both basic classic topics such as energy band theory and the gradual-channel model of the MOSFET as well as advanced concepts and devices such as MOSFET short-channel effects, low-dimensional devices and single-electron transistors. Concepts are introduced to the reader in a simple way, often using comparisons to everyday-life experiences such as simple fluid mechanics. They are then explained in depth and mathematical developments are fully described. Physics of Semiconductor Devices contains a list of problems that can be used as homework assignments or can be solved in class to exemplify the theory. Many of these problems make use of Matlab and are aimed at illustrating theoretical concepts in a graphical manner.