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Hybrid Phonons in Nanostructures - B. K. Ridley 2017

The book provides a technical account of the basic physics of nanostructures, which are the foundation of the hardware found in all manner of computers. It will be of interest to semiconductor physicists and electronic engineers and advanced research students. Crystalline nanostructures have special properties associated with electrons and lattice vibrations and their interaction. The result of spatial confinement of electrons is indicated in the nomenclature of nanostructures: quantum wells, quantum wires, quantum dots. Confinement also has a profound effect on lattice vibrations. The documentation of the confinement of acoustic modes goes back to Lord Rayleigh's work in the late nineteenth century, but no such documentation exists for optical modes. It is only comparatively recently that any theory of the elastic properties of optical modes exists, and a comprehensive account is given in this book. A model of the lattice dynamics of the diamond lattice is given that reveals the quantitative distinction between acoustic and optical modes and the difference of connection rules that must apply at an interface. The presence of interfaces in nanostructures forces the hybridization of longitudinally and transversely polarized modes, along with, in polar material, electromagnetic modes. Hybrid acoustic and optical modes are described, with an emphasis on polar-optical phonons and their interaction with electrons. Scattering rates in single heterostructures, quantum wells and quantum wires are described and the anharmonic interaction in quantum dots discussed. A description is given of the effects of dynamic screening of hybrid polar modes and the production of hot phonons.

Spintronics for Next Generation Innovative Devices - Katsuaki Sato 2015-07-22

Spintronics (short for spin electronics, or spin transport electronics) exploits both the intrinsic spin of the electron and its associated magnetic moment, in addition to its fundamental electronic charge, in solid-state devices. Controlling the spin of electrons within a device can produce surprising and substantial changes in its properties. Drawing from many cutting edge fields, including physics, materials science, and electronics device technology, spintronics has provided the key concepts for many next generation information processing and transmitting technologies. This book discusses all aspects of spintronics from basic science to applications and covers: • magnetic semiconductors • topological insulators • spin current science • spin caloritronics • ultrafast magnetization reversal • magneto-resistance effects and devices • spin transistors • quantum information devices This book provides a comprehensive introduction to Spintronics for researchers and students in academia and industry.

Fingerprints in the Optical and Transport Properties of Quantum Dots - Ameenah Al-Ahmadi 2012-06-13

The book "Fingerprints in the optical and transport properties of quantum dots" provides

novel and efficient methods for the calculation and investigating of the optical and transport properties of quantum dot systems. This book is divided into two sections. In section 1 includes ten chapters where novel optical properties are discussed. In section 2 involve eight chapters that investigate and model the most important effects of transport and electronics properties of quantum dot systems This is a collaborative book sharing and providing fundamental research such as the one conducted in Physics, Chemistry, Material Science, with a base text that could serve as a reference in research by presenting up-to-date research work on the field of quantum dot systems.

Handbook of Spin Transport and Magnetism - Evgeny Y. Tsymbal 2016-04-19

In the past several decades, the research on spin transport and magnetism has led to remarkable scientific and technological breakthroughs, including Albert Fert and Peter Grunberg's Nobel Prize-winning discovery of giant magnetoresistance (GMR) in magnetic metallic multilayers. Handbook of Spin Transport and Magnetism provides a comprehensive, bal

AI for Big Data-Based Engineering Applications from Security Perspectives - Balwinder Raj 2023-06-30

Artificial intelligence (AI), machine learning, and advanced electronic circuits involve learning from every data input and using those inputs to generate new rules for future business analytics. AI and machine learning are now giving us new opportunities to use big data that we already had, as well as unleash a whole lot of new use cases with new data types. With the increasing use of AI dealing with highly sensitive information such as healthcare, adequate security measures are required to securely store and transmit this information. This book provides a broader coverage of the basic aspects of advanced circuits design and applications. AI for Big Data-Based Engineering Applications from Security Perspectives is an integrated source that aims at understanding the basic concepts associated with the security of advanced circuits. The content includes theoretical frameworks and recent empirical findings in the field to understand the associated principles, key challenges, and recent real-time applications of advanced circuits, AI, and big data security. It illustrates the notions, models, and terminologies that are widely used in the area of Very Large Scale Integration (VLSI) circuits, security, identifies the existing security issues in the field, and evaluates the underlying factors that influence system security. This work emphasizes the idea of understanding the motivation behind advanced circuit design to establish the AI interface and to mitigate security attacks in a better way for big data. This book also outlines exciting areas of future research where already existing methodologies can be implemented. This material is suitable for students, researchers, and professionals with research interest in AI for big data–based engineering applications, faculty members across universities, and software developers.

A New Direction in Mathematics for Materials Science - Susumu Ikeda 2015-12-08

This book is the first volume of the SpringerBriefs in the Mathematics of Materials and provides a comprehensive guide to the interaction of mathematics with materials science. The anterior part of the book describes a selected history of materials science as well as the interaction between mathematics and materials in history. The emergence of materials science was itself a result of an interdisciplinary movement in the 1950s and 1960s. Materials science was formed by the integration of metallurgy, polymer science, ceramics, solid state physics, and related disciplines. We believe that such historical background helps readers to understand the importance of interdisciplinary interaction such as mathematics–materials science collaboration. The middle part of the book describes mathematical ideas and methods that can be applied to materials problems and introduces some examples of specific studies—for example, computational homology applied to structural analysis of glassy materials, stochastic models for the formation process of materials, new geometric measures for finite carbon nanotube molecules, mathematical technique predicting a molecular magnet, and network analysis of nanoporous materials. The details of these works will be shown in the subsequent volumes of this SpringerBriefs in the Mathematics of Materials series by the individual authors. The posterior section of the book presents how breakthroughs based on

mathematics–materials science collaborations can emerge. The authors' argument is supported by the experiences at the Advanced Institute for Materials Research (AIMR), where many researchers from various fields gathered and tackled interdisciplinary research.

Solid State Physics - Henry Ehrenreich 2004-07-17

Solid state physics is the branch of physics that is primarily devoted to the study of matter in its solid phase, especially at the atomic level. This prestigious serial presents timely and state-of-the-art reviews pertaining to all aspects of solid state physics.

Quantum Hall Effects - Zyun Francis Ezawa 2013-03-21

Enthusiasm for research on the quantum Hall effect (QHE) is unbounded. The QHE is one of the most fascinating and beautiful phenomena in all branches of physics. Tremendous theoretical and experimental developments are still being made in this sphere. Composite bosons, composite fermions and anyons were among distinguishing ideas in the original edition. In the 2nd edition, fantastic phenomena associated with the interlayer phase coherence in the bilayer system were extensively described. The microscopic theory of the QHE was formulated based on the noncommutative geometry. Furthermore, the unconventional QHE in graphene was reviewed, where the electron dynamics can be treated as relativistic Dirac fermions and even the supersymmetric quantum mechanics plays a key role. In this 3rd edition, all chapters are carefully reexamined and updated. A highlight is the new chapter on topological insulators. Indeed, the concept of topological insulator stems from the QHE. Other new topics are recent prominent experimental discoveries in the QHE, provided by the experimentalists themselves in Part V. This new edition presents an instructive and comprehensive overview of the QHE. It is also suitable for an introduction to quantum field theory with vividly described applications. Only knowledge of quantum mechanics is assumed. This book is ideal for students and researchers in condensed matter physics, particle physics, theoretical physics and mathematical physics.

Quantum Mechanics with Applications to Nanotechnology and Information Science - Yehuda B. Band 2013-01-10

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

Quantum Materials, Lateral Semiconductor Nanostructures, Hybrid Systems and Nanocrystals - Detlef Heitmann 2010-08-20

Semiconductor nanostructures are ideal systems

to tailor the physical properties via quantum effects, utilizing special growth techniques, self-assembling, wet chemical processes or lithographic tools in combination with tuneable external electric and magnetic fields. Such systems are called "Quantum Materials".The electronic, photonic, and phononic properties of these systems are governed by size quantization and discrete energy levels. The charging is controlled by the Coulomb blockade. The spin can be manipulated by the geometrical structure, external gates and by integrating hybrid ferromagnetic emitters.This book reviews sophisticated preparation methods for quantum materials based on III-V and II-VI semiconductors and a wide variety of experimental techniques for the investigation of these interesting systems. It highlights selected experiments and theoretical concepts and gives such a state-of-the-art overview about the wide field of physics and chemistry that can be studied in these systems.

Semiconductor Spintronics - Thomas Schäpers 2021-05-10

This revised and expanded edition of the first comprehensive introduction to the rapidly-evolving field of spintronics covers ferromagnetism in nano-electrodes, spin injection, spin manipulation, and the practical use of these effects in next-generation electronics. Moreover, the book now also includes spin-based optics, topological materials and insulators, and the quantum spin Hall effect.

III-Nitride Semiconductors and their Modern Devices - Bernard Gil 2013-08-22

This book is dedicated to GaN and its alloys AlGaInN (III-V nitrides), semiconductors with intrinsic properties well suited for visible and UV light emission and electronic devices working at high temperature, high frequency, and harsh environments. There has been a rapid growth in the industrial activity relating to GaN, with GaN now ranking at the second position (after Si) among all semiconductors. This is mainly thanks to LEDs, but also to the emergence of lasers and high power and high frequency electronics. GaN-related research activities are also diversifying, ranging from advanced optical sources and single electron devices to physical, chemical, and biological sensors, optical detectors, and energy converters. All recent developments of nitrides and of their technology are gathered here in a single volume, with chapters written by world leaders in the field. This third book of the series edited by B. Gil is complementary to the preceding two, and is expected to offer a modern vision of nitrides and of their devices to a large audience of readers.

Spin Current - Sadamichi Maekawa 2017

In a new branch of physics and technology, called spin-electronics or spintronics, the flow of electrical charge (usual current) as well as the flow of electron spin, the so-called "spin current", are manipulated and controlled together. This book is intended to provide an introduction and guide to the new physics and applications of spin current.

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.

From Bulk to Nano - Carmen-Gabriela Stefanita 2008-09-24

The inspiration for this book can be traced back many years to two major works that in?uenced the author’s outlook on applied physics: FerromagnetismusbyR. Becker,W. D¨ oring (Springer, Berlin 1939), and Ferromagnetism by R. M. Bozorth (IEEE Press, New York 1951). The former work is a collection of lectures held in the 1930s for ‘technicians’ attending a technical college. The German language in which the work was originally written was extremely convenient for the author of this present book, as it was for a long time the only comfortable technical language in an English speaking environment. Later on, upon encountering the work by Bozorth, it was a relief to see the clarity and eloquence of the subjects presented in English, despite the impressive thickness of the book. Bozorth’s work still constitutes a practical review for anyone in a multidisciplinary industry who comes across the various manifestations of magnetism. The popularity of both works is so enduring that they are regarded as highly academic, and yet extremely readable, a reference in their own right, still attracting many readers these days in

industry and academia. The ?eld of magnetism progressed immensely in the twentieth century, and shows no signs of slowing down in the present one. It has become so vast that it is quite often viewed only in its parts, rather than as a whole. In today’smyriadofapplications,especiallyonananoscale,andtheirchangeable implications mostly on a macroscale, it often seems that di?erent aspects of reported work on magnetism are scattered and unrelated.

Handbook of Nitride Semiconductors and Devices, Materials Properties, Physics and Growth - Hadis Morkoç 2009-07-30

The three volumes of this handbook treat the fundamentals, technology and nanotechnology of nitride semiconductors with an extraordinary clarity and depth. They present all the necessary basics of semiconductor and device physics and engineering together with an extensive reference section. Volume 1 deals with the properties and growth of GaN. The deposition methods considered are: hydride VPE, organometallic CVD, MBE, and liquid/high pressure growth. Additionally, extended defects and their electrical nature, point defects, and doping are reviewed.

Graphene Science Handbook - Mahmood Aliofkhazraei 2016-04-21

Size Up the Short- and Long-Term Effects of GrapheneThe Graphene Science Handbook is a six-volume set that describes graphene's special structural, electrical, and chemical properties. The book considers how these properties can be used in different applications (including the development of batteries, fuel cells, photovoltaic cells, and supercapac

Physical Effects of Geometric Phases - Qian Niu 2017-08-28

Berry phase has been widely used in condensed matter physics in the past two decades. This volume is a timely collection of essential papers in this important field, which is highlighted by 2016 Nobel Prize in physics and recent exciting developments in topological matters. Each chapter has an introduction, which helps readers to understand the reprints that follow.

Semiconductor Spintronics and Quantum Computation - D.D. Awschalom 2013-04-17

The past few decades of research and development in solid-state semicon ductor physics and electronics have witnessed a rapid growth in the drive to exploit quantum mechanics in the design and function of semiconductor devices. This has been fueled for instance by the remarkable advances in our ability to fabricate nanostructures such as quantum wells, quantum wires and quantum dots. Despite this contemporary focus on semiconductor "quantum devices," a principal quantum mechanical aspect of the electron - its spin has it accounts for an added quan largely been ignored (except in as much as tum mechanical degeneracy). In recent years, however, a new paradigm of electronics based on the spin degree of freedom of the electron has begun to emerge. This field of semiconductor "spintronics" (spin transport electron ics or spin-based electronics) places electron spin rather than charge at the very center of interest. The underlying basis for this new electronics is the intimate connection between the charge and spin degrees of freedom of the electron via the Pauli principle. A crucial implication of this relationship is that spin effects can often be accessed through the orbital properties of the electron in the solid state. Examples for this are optical measurements of the spin state based on the Faraday effect and spin-dependent transport measure ments such as giant magneto-resistance (GMR). In this manner, information can be encoded in not only the electron's charge but also in its spin state, i. e.

Semiconductor Spintronics - Jianbai Xia 2012

Semiconductor Spintronics, as an emerging research discipline and an important advanced field in physics, has developed quickly and obtained fruitful results in recent decades. This volume is the first monograph summarizing the physical foundation and the experimental results obtained in this field. With the culmination of the authors'' extensive working experiences, this book presents the developing history of semiconductor spintronics, its basic concepts and theories, experimental results, and the prospected future development. This unique book intends to provide a systematic and modern foundation for semiconductor spintronics aimed at researchers, professors, post-doctorates, and graduate students, and to help them master the overall knowledge of spintronics.a

Green Computing with Emerging Memory - Takayuki Kawahara 2012-05

This volume describes computing innovation using non-volatile memory for a sustainable world. The text presents methods of design and implementation for non-volatile memory, allowing devices to be turned off normally when not in use, yet operate with full performance when needed.

Spin Dynamics in Two-Dimensional Quantum Materials - Marc Vila Tusell 2021-11-10

This thesis focuses on the exploration of nontrivial spin dynamics in graphene-based devices and topological materials, using realistic theoretical models and state-of-the-art quantum transport methodologies. The main outcomes of this work are: (i) the analysis of the crossover from diffusive to ballistic spin transport regimes in ultraclean graphene nonlocal devices, and (ii) investigation of spin transport and spin dynamics phenomena (such as the (quantum) spin Hall effect) in novel topological materials, such as monolayer Weyl semimetals WeTe2 and MoTe2. Indeed, the ballistic spin transport results are key for further interpretation of ultraclean spintronic devices, and will enable extracting precise values of spin diffusion lengths in diffusive transport and guide experiments in the (quasi)ballistic regime. Furthermore, the thesis provides an in-depth theoretical interpretation of puzzling huge measured efficiencies of the spin Hall effect in MoTe2, as well as a prediction of a novel canted quantum spin Hall effect in WTe2 with spins pointing in the yz plane.

Advances in Non-volatile Memory and Storage Technology - Yoshio Nishi 2019-06-15

Advances in Nonvolatile Memory and Storage Technology, Second Edition, addresses recent developments in the non-volatile memory spectrum, from fundamental understanding, to technological aspects. The book provides up-to-date information on the current memory technologies as related by leading experts in both academia and industry. To reflect the rapidly changing field, many new chapters have been included to feature the latest in RRAM technology, STT-RAM, memristors and more. The new edition describes the emerging technologies including oxide-based ferroelectric memories, MRAM technologies, and 3D memory. Finally, to further widen the discussion on the applications space, neuromorphic computing aspects have been included. This book is a key resource for postgraduate students and academic researchers in physics, materials science and electrical engineering. In addition, it will be a valuable tool for research and development managers concerned with electronics, semiconductors, nanotechnology, solid-state memories, magnetic materials, organic materials and portable electronic devices. Discusses emerging devices and research trends, such as neuromorphic computing and oxide-based ferroelectric memories Provides an overview on developing nonvolatile memory and storage technologies and explores their strengths and weaknesses Examines improvements to flash technology, charge trapping and resistive random access memory

Spintronics Handbook, Second Edition: Spin Transport and Magnetism - Evgeny Y. Tsymbal 2019-05-20

The second edition offers an update on the single most comprehensive survey of the two intertwined fields of spintronics and magnetism, covering the diverse array of materials and structures, including silicon, organic semiconductors, carbon nanotubes, graphene, and engineered nanostructures. It focuses on seminal pioneering work, together with the latest in cutting-edge advances, notably extended discussion of two-dimensional materials beyond graphene, topological insulators, skyrmions, and molecular spintronics. The main sections cover physical phenomena, spin-dependent tunneling, control of spin and magnetism in semiconductors, and spin-based applications.

Manipulating Quantum Coherence in Solid State Systems - Michael E. Flatté 2007-05-31

This book features the proceedings of the NATO Advanced Study Institute "Manipulating Quantum Coherence in Solid State Systems", held in Cluj-Napoca, Romania, August 2005, which presented a fundamental introduction to solid-state approaches to achieving quantum computation. This proceedings volume describes the properties of quantum coherence in semiconductor spin-based systems and the behavior of quantum coherence in superconducting systems.

Design, Synthesis, and Application of Novel π-Conjugated Materials - Haichang Zhang 2021-02-11

Future Trends in Microelectronics - Serge Luryi 2007-06-22
In this book leading profesionals in the semiconductor microelectronics field discuss the future evolution of their profession. The following are some of the questions discussed: Does CMOS technology have a real problem? Do transistors have to be smaller or just better and made of better materials? What is to come after semiconductors? Superconductors or molecular conductors? Is bottom-up self-assembling the answer to the limitation of top-down lithography? Is it time for Optics to become a force in computer evolution? Quantum Computing, Spintronics? Where is the printable plastic electronics proposed 10 years ago? Are carbon nanotube transistors the CMOS of the future?

Electron & Nuclear Spin Dynamics in Semiconductor Nanostructures - M. M. Glazov 2018-09-27
In recent years, the physics community has experienced a revival of interest in spin effects in solid state systems. On one hand, the solid state systems, particularly, semiconductors and semiconductor nanosystems, allow us to perform benchtop studies of quantum and relativistic phenomena. On the other hand, this interest is supported by the prospects of realizing spin-based electronics, where the electron or nuclear spins may play a role of quantum or classical information carriers. This book looks in detail at the physics of interacting systems of electron and nuclear spins in semiconductors, with particular emphasis on low-dimensional structures. These two spin systems naturally appear in practically all widespread semiconductor compounds. The hyperfine interaction of the charge carriers and nuclear spins is particularly prominent in nanosystems due to the localization of the charge carriers, and gives rise to spin exchange between these two systems and a whole range of beautiful and complex physics of manybody and nonlinear systems. As a result, understanding of the intertwined spin systems of electrons and nuclei is crucial for in-depth studying and controlling the spin phenomena in semiconductors. The book addresses a number of the most prominent effects taking place in semiconductor nanosystems including hyperfine interaction, nuclear magnetic resonance, dynamical nuclear polarization, spin-Faraday and spin-Kerr effects, processes of electron spin decoherence and relaxation, effects of electron spin precession mode-locking and frequency focussing, as well as fluctuations of electron and nuclear spins.

Domain Walls - Dennis Meier 2020-09
As the first of its kind, this book identifies major questions and challenges that will influence research on domain walls in the years to come.

Nanofabrication Handbook - Stefano Cabrini 2012-02-24
While many books are dedicated to individual aspects of nanofabrication, there is no single source that defines and explains the total vision of the field. Filling this gap, Nanofabrication Handbook presents a unique collection of new and the most important established approaches to nanofabrication. Contributors from leading research facilities and

Exchange Bias - Surender Kumar Sharma 2017-09-22
This timely book covers basic mechanisms, characterization, theoretical simulations, and applications for exchange bias in granular nanosystems, thin films, and bulk systems. After an overview of the field and key principles, the next section covers nanogranular (core-shell) systems, followed by chapters on thin films, bilayers/multilayers nanostructures, dilute magnetic semiconductors, and multiferroic systems. A final section turns to bulk systems, such as those consisting of perovskite structures, rare earth-transition metal intermetallic, and ion implantations. Readers of this book will obtain A complete, modern overview on exchange bias phenomena, covering synthesis, characterization techniques, and applications An introduction to all the important phenomenological models proposed for thin films, bulk materials, and nanoparticles Detailed discussion of the importance of size, shape, cooling field, and temperature on exchange bias properties Understanding of novel applications of exchange bias systems

Comprehensive Semiconductor Science and Technology - 2011-01-28
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

Energy Efficient Computing & Electronics - Santosh K. Kurinec 2019-01-31

In our abundant computing infrastructure, performance improvements across most all application spaces are now severely limited by the energy dissipation involved in processing, storing, and moving data. The exponential increase in the volume of data to be handled by our computational infrastructure is driven in large part by unstructured data from countless sources. This book explores revolutionary device concepts, associated circuits, and architectures that will greatly extend the practical engineering limits of energy-efficient computation from device to circuit to system level. With chapters written by international experts in their corresponding field, the text investigates new approaches to lower energy requirements in computing. Features • Has a comprehensive coverage of various technologies • Written by international experts in their corresponding field • Covers revolutionary concepts at the device, circuit, and system levels

Eighteen[th] International Conference on High Magnetic Fields in Semiconductor Physics and Nanotechnology (HMF18), São Pedro, Brazil, 3-8 August 2008 - 2009

Introduction to Spintronics - Supriyo Bandyopadhyay 2015-09-18

Introduction to Spintronics provides an accessible, organized, and progressive presentation of the quantum mechanical concept of spin and the technology of using it to store, process, and communicate information. Fully updated and expanded to 18 chapters, this Second Edition: Reflects the explosion of study in spin-related physics, addressing seven important physical phenomena with spintronic device applications Discusses the recently discovered field of spintronics without magnetism, which allows one to manipulate spin currents by purely electrical means Explores lateral spin-orbit interaction and its many nuances, as well as the possibility to implement spin polarizers and analyzers using quantum point contacts Introduces the concept of single-domain-nanomagnet-based computing, an ultra-energy-efficient approach to compute and store information using nanomagnets, offering a practical rendition of single-spin logic architecture ideas and an alternative to transistor-based computing hardware Features many new drill problems, and includes a solution manual and figure slides with qualifying course adoption Still the only known spintronics textbook written in English, Introduction to Spintronics, Second Edition is a must read for those interested in the science and technology of storing, processing, and communicating information via the spin degree of freedom of electrons.

Spintronics - Kaiyou Wang 2022-07-25

Discover the latest advances in spintronic materials, devices, and applications In Spintronics: Materials, Devices and Applications, a team of distinguished researchers delivers a holistic introduction to spintronic effects within cutting-edge materials and applications. Containing the perfect balance of academic

research and practical application, the book discusses the potential—and the key limitations and challenges—of spintronic devices. The latest title in the Wiley Series in Materials for Electronic and Optoelectronic Applications, Spintronics: Materials, Devices and Applications explores giant magneto-resistance (GMR) and tunneling magnetic resistance (TMR) materials, spin-transfer torque and spin-orbit torque materials, spin oscillators, and spin materials for use in artificial neural networks. Applications in multi-ferroelectric and antiferromagnetic materials are presented as well. This book also includes: A thorough introduction to recent research developments in the fields of spintronic materials, devices, and applications Comprehensive explorations of skymions, magnetic semiconductors, and antiferromagnetic materials Practical discussions of spin-transfer torque materials and devices for magnetic random-access memory In-depth examinations of giant magneto-resistance materials and devices for magnetic sensors Perfect for advanced students and researchers in materials science, physics, electronics, and computer science, Spintronics: Materials, Devices and Applications will also earn a place in the libraries of professionals working in the manufacture of optics, photonics, and nanometrology equipment.
Nanoscience and Technology -

Principles and Methods of Quantum Information Technologies - Yoshihisa Yamamoto 2015-12-30
This book presents the research and development-related results of the “FIRST” Quantum Information Processing Project, which was conducted from 2010 to 2014 with the support of the Council for Science, Technology and Innovation of the Cabinet Office of the Government of Japan. The project supported 33 research groups and explored five areas: quantum communication, quantum metrology and sensing, coherent computing, quantum simulation, and quantum computing. The book is divided into seven main sections. Parts I through V, which consist of twenty chapters, focus on the system and architectural aspects of quantum information technologies, while Parts VI and VII, which consist of eight chapters, discuss the superconducting quantum circuit, semiconductor spin and molecular spin technologies. Readers will be introduced to new quantum computing schemes such as quantum annealing machines and coherent Ising machines, which have now arisen as alternatives to standard quantum computers and are designed to successfully address NP-hard/NP-complete combinatorial optimization problems, which are ubiquitous and relevant in our modern life. The book offers a balanced mix of theory-based and experimentation-based chapters written by leading researchers. Extensive information is provided on Quantum simulation, which focuses on the implementation of various many-body Hamiltonians in a well-controlled physical system, Quantum key distribution, Quantum repeaters and quantum teleportation, which are indispensable technologies for building quantum networks with various advanced applications and require far more sophisticated experimental techniques to implement.
Nano Devices and Sensors - Juin J. Liou 2016-04-25
The chapters in this edited book are written by some authors who have presented very high quality papers at the 2015 International Symposium of Next-Generation Electronics (ISNE 2015) held in Taipei, Taiwan. The ISNE 2015 was intended to provide a common forum for researchers, scientists, engineers, and practitioners throughout the world to present their latest research findings, ideas, developments, and applications in the general areas of electron devices, integrated circuits, and microelectronic systems and technologies. The scope of the conference includes the following topics: A. Green Electronics B. Microelectronic Circuits and Systems C. Integrated Circuits and Packaging Technologies D. Computer and Communication Engineering E. Electron Devices F. Optoelectronic and Semiconductor Technologies The technical program consisted of 4 plenary talks, 23 invited talks, and more than 250 contributed oral and poster presentations. Plenary speakers were recognized experts in their fields, and their talks focused on leading-edge technologies including: "The Future Lithographic Technology for Semiconductor Fabrication" by Dr. Alek C. Chen, Asia ASML, Taiwan. "Detection of Single Traps and Characterization of Individual Traps: Beginning of Atomistic Reliability Physics" by Prof. Toshiaki

Tsuchiya, Shimane University, Japan. "The Art and Science of Packaging High-Coupling Photonics Devices and Modules", by Prof. Wood-Hi Cheng, National Chung-Hsing University, Taiwan. "Prospect and Outlook of Electrostatic Discharge (ESD) Protection in Emerging Technologies", by Prof. Juin J. Liou, University of Central Florida, USA. After a rigorous review process, the ISNE 2015 technical program committee has selected 10 outstanding presentations and invited the authors to prepare extended chapters for inclusion in this edited book. Of the 10 chapters, five are focused on the subject of electronic devices, and the other covers the circuit designs for various applications. The authors are working at the academia in Austria, United States, Korea, and Taiwan. The guest editors would like to take this opportunity to express our sincere gratitude to all the members of the ISNE 2015 technical program committees for reviewing the papers and selecting the manuscripts for the edited book. We also thank all the authors for their valuable and excellent contributions to the book.

Microcavities - Alexey Kavokin 2017

Both rich fundamental physics of microcavities and their intriguing potential applications are addressed in this work, oriented to undergraduate and postgraduate students as well as to physicists and engineers