

Electron-Phonon Interactions in Low-Dimensional Structures

Edited by
Lawrence Challis



Electron Phonon Interactions In Low Dimensional Structures

**Benoît Deveaud, Antonio
Quattropiani, Paolo
Schwendimann, Società italiana di
fisica**

Electron Phonon Interactions In Low Dimensional Structures:

Electron-phonon Interactions in Low Dimensional Structures David Romwald Leadley, 1989

Electron-phonon

Interactions in Low-dimensional Structures Lawrence John Challis, 2003 The study of electrons and holes confined to two one and even zero dimensions has uncovered a rich variety of new physics and applications This book describes the interaction between these confined carriers and the optic and acoustic phonons within and around the confined regions Phonons provide the principal channel of energy transfer between the carriers and their surroundings and also the main restriction to their room temperature mobility But they have many other roles they provide for example an essential feature of the operation of the quantum cascade laser Since their momenta at relevant energies are well matched to those of electrons they can also be used to probe electronic properties such as the confinement width of 2D electron gases and the dispersion curve of quasiparticles in the fractional quantum Hall effect The book describes both the physics of the electron phonon interaction in the different confined systems and the experimental and theoretical techniques that have been used in its investigation The experimental methods include optical and transport techniques as well as techniques in which phonons are used as the experimental probe The aim of the book is to provide an up to date review of the physics and its significance in device performance It is also written to be explanatory and accessible to graduate students and others new to the field

Electron-phonon Interactions in Low-dimensional Structures Lawrence John Challis, 2003 The study of electrons and holes confined to two one and even zero dimensions has uncovered a rich variety of new physics and applications This book describes the interaction between these confined carriers and the optic and acoustic phonons within and around the confined regions

Isotope Low-Dimensional Structures Vladimir G. Plekhanov, 2012-05-08 This Briefs volume describes the properties and structure of elementary excitations in isotope low dimensional structures Without assuming prior knowledge of quantum physics the present book provides the basic knowledge needed to understand the recent developments in the sub disciplines of nanoscience isotopetronics novel device concepts and materials for nanotechnology It is the first and comprehensive interdisciplinary account of the newly developed scientific discipline isotopetronics

Phonons in Low Dimensional Structures Vasilios N. Stavrou, 2018-12-12 The field of low dimensional structures has been experiencing rapid development in both theoretical and experimental research Phonons in Low Dimensional Structures is a collection of chapters related to the properties of solid state structures dependent on lattice vibrations The book is divided into two parts In the first part research topics such as interface phonons and polaron states carrier phonon non equilibrium dynamics directional projection of elastic waves in parallel array of N elastically coupled waveguides collective dynamics for longitudinal and transverse phonon modes and elastic properties for bulk metallic glasses are related to semiconductor devices and metallic glasses devices The second part of the book contains among others topics related to superconductor phononic crystal carbon nanotube devices such as phonon dispersion calculations using density functional

theory for a range of superconducting materials phononic crystal based MEMS resonators absorption of acoustic phonons in the hyper sound regime in fluorine modified carbon nanotubes and single walled nanotubes phonon transport in carbon nanotubes quantization of phonon thermal conductance and phonon Anderson localization Spin Current Sadamichi Maekawa, Sergio O. Valenzuela, Eiji Saitoh, Takashi Kimura, 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

Quantum Dot Lasers Victor Mikhailovich Ustinov, 2003 The book addresses issues associated with physics and technology of injection lasers based on self organized quantum dots Fundamental and technological aspects of quantum dot edge emitting lasers and VCSELs their current status and future prospects are summarized and reviewed Basic principles of QD formation using self organization phenomena are reviewed Structural and optical properties of self organized QDs are considered with a number of examples in different material systems Recent achievements in controlling the QD properties including the effects of vertical stacking changing the matrix bandgap and the surface density of QDs are reviewed The authors focus on the use of self organized quantum dots in laser structures fabrication and characterization of edge and surface emitting diode lasers their properties and optimization with special attention paid to the relationship between structural and electronic properties of QDs and laser characteristics The threshold and power characteristics of the state of the art QD lasers are demonstrated Issues related to the long wavelength 1.3 μm lasers on a GaAs substrate are also addressed and recent results on InGaAsN based diode lasers presented for the purpose of comparison

Physics of Semiconductors in High Magnetic Fields Noboru Miura, 2008 This book summarizes most of the fundamental physical phenomena which semiconductors and their modulated structures exhibit in high magnetic fields Readers can learn not only the basic theoretical background but also the present state of the art from the most advanced data in this rapidly growing research area

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

Plasmonic Effects in Metal-semiconductor

Nanostructures Alexey A. Toropov, Tatiana V. Shubina, 2015 One of the most promising trends in modern nanophotonics is the employment of plasmonic effects in the engineering of advanced device nanostructures This book implements the binocular vision of such a complex metal semiconductor system examining both the constituents and reviewing the characteristics of promising constructive materials Length-Scale Dependent Phonon Interactions Subhash L. Shindé, Gyaneshwar P. Srivastava, 2013-10-29 This book presents a comprehensive description of phonons and their interactions in systems with different dimensions and length scales Internationally recognized leaders describe theories and measurements of phonon interactions in relation to the design of materials with exotic properties such as metamaterials nano mechanical systems next generation electronic photonic and acoustic devices energy harvesting optical information storage and applications of phonon lasers in a variety of fields The emergence of techniques for control of semiconductor properties and geometry has enabled engineers to design structures in which functionality is derived from controlling electron behavior As manufacturing techniques have greatly expanded the list of available materials and the range of attainable length scales similar opportunities now exist for designing devices whose functionality is derived from controlling phonon behavior However progress in this area is hampered by gaps in our knowledge of phonon transport across and along arbitrary interfaces the scattering of phonons with crystal defects interface roughness and mass mixing delocalized electrons collective electronic excitations and solid acoustic vibrations when these occur in structures with small physical dimensions This book provides a comprehensive description of phonons and their interactions in systems with different dimensions and length scales Theories and measurements of phonon interactions are described in relation to the design of materials with exotic properties such as metamaterials nano mechanical systems next generation electronic photonic and acoustic devices energy harvesting optical information storage and applications of phonon lasers in a variety of fields **Quantum-based Electronic Devices And Systems, Selected Topics In Electronics And Systems, Vol 14** Mitra Dutta, 1998-10-23 This volume includes highlights of the theories and experimental findings that underlie essential phenomena occurring in quantum based devices and systems as well as the principles of operation of selected novel quantum based electronic devices and systems A number of the emerging approaches to creating new types of quantum based electronic devices and systems are also discussed *Physics of Low-Dimensional Semiconductor Structures* Paul N. Butcher, Norman H. March, Mario P. Tosi, 2013-11-11 Presenting the latest advances in artificial structures this volume discusses in depth the structure and electron transport mechanisms of quantum wells superlattices quantum wires and quantum dots It will serve as an invaluable reference and review for researchers and graduate students in solid state physics materials science and electrical and electronic engineering *Nanoelectronics with a background in Nanotechnology* Dr Dalvinder Singh Grewal, **Low-dimensional Nitride Semiconductors** Bernard Gil, 2002 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 application 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

Focus on Condensed Matter Physics Research John V. Chang, 2005 Condensed matter is one of the most active fields of physics with a stream of discoveries in areas from superfluidity and magnetism to the optical electronic and mechanical properties of materials such as semiconductors polymers and carbon nanotubes It includes the study of well characterised solid surfaces interfaces and nanostructures as well as studies of molecular liquids molten salts ionic solutions liquid metals and semiconductors and soft matter systems colloidal suspensions polymers surfactants foams liquid crystals membranes biomolecules etc including glasses and biological aspects of soft matter This book presents state of the art research in this exciting field

Optoelectronic Devices: III Nitrides Mohamed Henini, M Razeghi, 2004-12-17 Tremendous progress has been made in the last few years in the growth doping and processing technologies of the wide bandgap semiconductors As a result this class of materials now holds significant promise for semiconductor electronics in a broad range of applications The principal driver for the current revival of interest in III V Nitrides is their potential use in high power high temperature high frequency and optical devices resistant to radiation damage This book provides a wide number of optoelectronic applications of III V nitrides and covers the entire process from growth to devices and applications making it essential reading for those working in the semiconductors or microelectronics Broad review of optoelectronic applications of III V nitrides

Quantum Kinetic Theory and Applications Fedir T. Vasko, Oleg E. Raichev, 2006-06-08

Physical kinetics is the natural section of the course of theoretical physics in its standard presentation It stays at the boundary between general theories and their applications solid state theory theory of gases plasma and so on because the treatment of kinetic phenomena always depends on specific structural features of materials On the other hand the physical kinetics as a part of the quantum theory of macroscopic systems is far from being complete A number of its fundamental issues such as the problem of irreversibility and mechanisms of chaotic responses are now attracting considerable attention Other important sections for example kinetic phenomena in disordered and or strongly non equilibrium systems and in particular phase transitions in these systems are currently under investigation The quantum theory of measurements and quantum information processing actively developing in the last decade are based on the quantum kinetic theory Because a deductive theoretical exposition of the subject is not convenient the authors restrict themselves to a lecture style presentation Now the physical kinetics seems to be at the stage of development when according to Newton studying examples is more instructive than learning

ing rules In view of these circumstances the methods of the kinetic theory are presented here not in a general form but as applications for description of specific systems and treatment of particular kinetic phenomena The quantum features of kinetic phenomena can arise for several reasons

Electron and Photon Confinement in Semiconductor Nanostructures

Benoît Deveaud, Antonio Quattropani, Paolo Schwendimann, Società italiana di fisica, 2003 The purpose of this course was to give an overview of the physics of artificial semiconductor structures confining electrons and photons It furnishes the background for several applications in particular in the domain of optical devices lasers light emitting diodes or photonic crystals The effects related to the microactivity polaritons which are mixed electromagnetic radiation exciton states inside a semiconductor microactivity are covered The study of the characteristics of such states shows strong relations with the domain of cavity quantum electrodynamics and thus with the investigation of some fundamental theoretical concepts

Properties of III-V Quantum Wells and Superlattices

P. K. Bhattacharya, Pallab Bhattacharya, 1996 A finely structured state of the art review on controlled building of atomic scale multilayers where nanometric structures based on III V semiconductors have attracted particular attention

Electron Phonon Interactions In Low Dimensional Structures Book Review: Unveiling the Magic of Language

In an electronic digital era where connections and knowledge reign supreme, the enchanting power of language has become much more apparent than ever. Its power to stir emotions, provoke thought, and instigate transformation is actually remarkable. This extraordinary book, aptly titled "**Electron Phonon Interactions In Low Dimensional Structures**," compiled by a highly acclaimed author, immerses readers in a captivating exploration of the significance of language and its profound effect on our existence. Throughout this critique, we will delve into the book's central themes, evaluate its unique writing style, and assess its overall influence on its readership.

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