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# Electron-Phonon Interactions in Low-Dimensional Structures

*Edited by*  
Lawrence Challis

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# Electron Phonon Interaction In Low Dimensional Structures Series On Semiconductor Science And Technology

**Rose Arny**



## **Electron Phonon Interaction In Low Dimensional Structures Series On Semiconductor Science And Technology:**

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

**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

Hot Electrons in Semiconductors N. Balkan, 1998 Since the arrival of the transistor in 1947 research in hot electrons like any field in semiconductor research has grown at a stunning rate From a physicist's point of view the understanding of hot electrons and their interactions with the lattice has always been a challenging problem of condensed matter physics Recently with the advent of novel fabrication techniques such as electron beam or plasma etching and the advanced growth techniques such as the molecular beam epitaxy MBE and metallo organic chemical vapour deposition MOCVD it has become possible to fabricate semiconductor devices with sub micron dimensions where the electrons are confined to two quantum well one quantum wire or zero quantum dot dimensions In devices of such dimensions a few volts applied to the device result in the setting up of very high electric fields hence a substantial heating of electrons Thus electronic transport in the device becomes non linear and can no longer be described using the simple equations of Ohm's law The understanding of the operations of such devices and the realisations of more advanced ones make it necessary to understand the dynamics of hot electrons There is an obvious lack of good reference books on hot electrons in semiconductors The few that exist either cover a very narrow field or are becoming quite outdated This book is therefore written with the aim of filling the vacuum in an area where there is much demand for a comprehensive reference book The book is intended for both established researchers and graduate students and gives a complete account of the historical

development of the subject together with current research interests and future trends The contributions are written by leading scientists in the field They cover the physics of hot electrons in bulk and low dimensional device technology The material is organised into subject area that can be classified broadly into five groups 1 introduction and overview 2 hot electron phonon interactions and the ultra fast phenomena in bulk and two dimensional structures 3 hot electrons in both long and short quantum wires and quantum dots 4 hot electron tunnelling and hot electron transport in superlattices and 5 novel devices based on hot electron transport The chapters are grouped according to subject matter as far as possible However although there is much overlap of ideas and concepts each chapter is essentially independent of the others

**Concepts in Spin Electronics** Sadamichi Maekawa, 2006-01-26 Nowadays information technology is based on semiconductor and ferromagnetic materials Information processing and computation are based on electron charge in semiconductor transistors and integrated circuits and information is stored on magnetic high density hard disks based on the physics of the electron spins Recently a new branch of physics and nanotechnology called magneto electronics spintronics or spin electronics has emerged which aims at simultaneously exploiting both the charge and the spin of electrons in the same device A broader goal is to develop new functionality that does not exist separately in a ferromagnet or a semiconductor The aim of this book is to present new directions in the development of spin electronics in both the basic physics and the technology which will become the foundation of future electronics [Intense Terahertz Excitation of Semiconductors](#)

Sergey Ganichev, Willi Prettl, 2006 This work presents the first comprehensive treatment of high power terahertz applications to semiconductors and low dimensional semiconductor structures Terahertz properties of semiconductors are in the centre of scientific activities because of the need of high speed electronics **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  $\mu$ m lasers on a GaAs substrate are also addressed and recent results on InGaAsN based diode lasers presented for the purpose of comparison **Spin Current** Sadamichi Maekawa, Sergio O. Valenzuela, Eiji Saitoh, 2012-07-26

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 application of spin current

**Domain Walls** Dennis Meier, Jan Seidel, Marty Gregg, Ramamoorthy Ramesh, 2020-08-07 Technological evolution and revolution are both driven by the discovery of new functionalities new materials and the design of yet smaller faster and more energy efficient components Progress is being made at a breathtaking pace stimulated by the rapidly growing demand for more powerful and readily available information technology High speed internet and data streaming home automation tablets and smartphones are now necessities for our everyday lives Consumer expectations for progressively more data storage and exchange appear to be insatiable Oxide electronics is a promising and relatively new field that has the potential to trigger major advances in information technology Oxide interfaces are particularly intriguing Here low local symmetry combined with an increased susceptibility to external fields leads to unusual physical properties distinct from those of the homogeneous bulk In this context ferroic domain walls have attracted recent attention as a completely new type of oxide interface In addition to their functional properties such walls are spatially mobile and can be created moved and erased on demand This unique degree of flexibility enables domain walls to take an active role in future devices and hold a great potential as multifunctional 2D systems for nanoelectronics With domain walls as reconfigurable electronic 2D components a new generation of adaptive nano technology and flexible circuitry becomes possible that can be altered and upgraded throughout the lifetime of the device Thus what started out as fundamental research at the limit of accessibility is finally maturing into a promising concept for next generation technology

Hot Carriers in Semiconductors, Proceedings of the 7th INT Conference on Hot Carriers in Semiconductors (HCIS-7) 1-5 July 1991, Nara, Japan Chihiro Hamaguchi, Masataka Inoue, 1992-04-23 The proceedings of the 7th International Conference on title held in Nara Japan July 1992 comprise three plenary 25 invited and 148 contributed papers in the areas of electron phonon interaction confined phonon modes optical study of ultrafast processes heterostructures low dimensional transport hot carrier scattering and relaxation tr

**Phonons in Semiconductor Nanostructures** J.P. Leburton, J. Pascual, Clivia M. Sotomayor Torres, 2012-12-06 In the last ten years the physics and technology of low dimensional structures has experienced a tremendous development Quantum structures with vertical and lateral confinements are now routinely fabricated with feature sizes below 100 nm While quantization of the electron states in mesoscopic systems has been the subject of intense investigation the effect of confinement on lattice vibrations and its influence on the electron phonon interaction and energy dissipation in nanostructures received attention only recently This NATO Advanced Research Workshop on Phonons in Semiconductor Nanostructures was a forum for discussion on the latest developments in the physics of phonons and their impact on the electronic properties of low dimensional structures Our goal was to bring together specialists in lattice dynamics and nanostructure physics to assess the increasing importance of phonon effects on the physical properties of one 1D and zero dimensional 0D structures The Workshop addressed various

issues related to phonon physics in III V II VI and IV semiconductor nanostructures The following topics were successively covered Models for confined phonons in semiconductor nanostructures latest experimental observations of confined phonons and electron phonon interaction in two dimensional systems elementary excitations in nanostructures phonons and optical processes in reduced dimensionality systems phonon limited transport phenomena hot electron effects in quasi 1D structures carrier relaxation and phonon bottleneck in quantum dots

*Scientific and Technical Aerospace Reports* ,1995    *Current Research in Britain* ,1990    *Who's who in European Research and Development* ,1997    **Forthcoming Books** Rose Arny,2003    **Journal of the Physical Society of Japan** ,2015    The British National Bibliography Arthur James Wells,2004    **Soviet Physics** ,1991    *Physics Briefs* ,1994    **Acta Physica Sinica** ,1995    **INIS Atomindex** ,1995

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