

# **Long wave polar modes in semiconductor heterostructures**

**C. Trallero-Giner,  
R. Pérez-Alvarez  
and F. García-Moliner**

# Long Wave Polar Modes In Semiconductor Heterostructures

**Amalia Patane, Naci Balkan**



## **Long Wave Polar Modes In Semiconductor Heterostructures:**

Long Wave Polar Modes in Semiconductor Heterostructures C. Trallero-Giner, R. Pérez-Alvarez, F.

García-Moliner, 1998-01-01 Long Wave Polar Modes in Semiconductor Heterostructures is concerned with the study of polar optical modes in semiconductor heterostructures from a phenomenological approach and aims to simplify the model of lattice dynamics calculations. The book provides useful tools for performing calculations relevant to anyone who might be interested in practical applications. The main focus of Long Wave Polar Modes in Semiconductor Heterostructures is planar heterostructures, quantum wells or barriers, superlattices, double barrier structures, etc., but there is also discussion on the growing field of quantum wires and dots. Also to allow anyone reading the book to apply the techniques discussed for planar heterostructures, the scope has been widened to include cylindrical and spherical geometries. The book is intended as an introductory text which guides the reader through basic questions and expands to cover state of the art professional topics. The book is relevant to experimentalists wanting an instructive presentation of a simple phenomenological model and theoretical tools to work with and also to young theoreticians by providing discussion of basic issues and the basis of advanced theoretical formulations. The book also provides a brief respite on the physics of piezoelectric waves as a coupling to polar optical modes.

Long Wave Polar Modes in Semiconductor Heterostructures C. Trallero-Giner, R. Pérez-Alvarez, F.

García-Moliner, 1998-05-21 Long Wave Polar Modes in Semiconductor Heterostructures is concerned with the study of polar optical modes in semiconductor heterostructures from a phenomenological approach and aims to simplify the model of lattice dynamics calculations. The book provides useful tools for performing calculations relevant to anyone who might be interested in practical applications. The main focus of Long Wave Polar Modes in Semiconductor Heterostructures is planar heterostructures, quantum wells or barriers, superlattices, double barrier structures, etc., but there is also discussion on the growing field of quantum wires and dots. Also to allow anyone reading the book to apply the techniques discussed for planar heterostructures, the scope has been widened to include cylindrical and spherical geometries. The book is intended as an introductory text which guides the reader through basic questions and expands to cover state of the art professional topics. The book is relevant to experimentalists wanting an instructive presentation of a simple phenomenological model and theoretical tools to work with and also to young theoreticians by providing discussion of basic issues and the basis of advanced theoretical formulations. The book also provides a brief respite on the physics of piezoelectric waves as a coupling to polar optical modes.

Transfer Matrix, Green Function and Related Techniques Rolando Pérez-Alvarez, Federico

García-Moliner, 2004 Els autors presenten diferents tipus de matrius de transferència i sistematitzen les propietats matemàtiques formals i les relacionen amb diferents tipus de matrius de scattering. En definitiva aporten als investigadors les tècniques que s'han d'utilitzar en l'estudi d'heteroestructures planars.

**Advanced Luminescent Materials and Quantum**

**Confinement** M. Cahay, 1999 *Ultrafast Physical Processes in Semiconductors*, 2000-10-06 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

*Infrared Ellipsometry on Semiconductor Layer Structures* Mathias Schubert, 2004-11-26 The study of semiconductor layer structures using infrared ellipsometry is a rapidly growing field within optical spectroscopy This book offers basic insights into the concepts of phonons plasmons and polaritons and the infrared dielectric function of semiconductors in layered structures It describes how strain composition and the state of the atomic order within complex layer structures of multinary alloys can be determined from an infrared ellipsometry examination Special emphasis is given to free charge carrier properties and magneto optical effects A broad range of experimental examples are described including multinary alloys of zincblende and wurtzite structure semiconductor materials and future applications such as organic layer structures and highly correlated electron systems are proposed

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 June 1 ,2022-01-19 No detailed description available for June 1

*Physics Of Semiconductors, The - Proceedings Of The 22nd International Conference (In 3 Volumes)* David J Lockwood,1995-01-20 These proceedings review the progress in most aspects of semiconductor physics including those related to materials processing and devices The conference continues the tradition of the ICPS series and these volumes include state of the art lectures The plenary and invited papers address areas of major interest These volumes will serve as excellent material for researchers in semiconductor physics and related fields **Scientific and Technical Aerospace Reports** ,1995

*Surface Waves* Farzad Ebrahimi,2018-05-02 Surface waves have drawn a significant attention and interest in the recent years in a broad range of commercial applications while their commercial developments have been supported by fundamental and applied research studies This book is a result of contributions of experts from international scientific community working in different aspects of surface waves and reports on the state of the art research and development findings on this topic through original and innovative research studies It contains up to date publications of leading experts and the edition is intended to furnish valuable recent information to the professionals involved in surface wave analysis and applications The text is addressed not only to researchers but also to professional engineers students and other experts in various disciplines both academic and industrial seeking to gain a better understanding of what has been done in the field recently and what kind of open problems are in this area **Electronic States and Optical Transitions in Semiconductor Heterostructures** Fedor T. Vasko,Alex V. Kuznetsov,2012-12-06

The study of semiconductor heterostructures started more than forty years ago In the 1980s this area of research moved to the forefront of semiconductor physics largely due to progress in growth technologies which are now capable of producing ultrathin layers up to a few monolayers of different semiconductor materials The availability of structures with nearly ideal well controlled properties has made semiconductor heterostructures a test ing ground for solid state physics These structures have had a profound impact on basic research in semiconductor physics by opening new possibilities for studying low dimensional electrons as well as the atomic and electronic properties of interfaces Semiconductor heterostructures have also a variety of important practical

applications they provide a material basis for a number of novel devices and also open the way for improving the operating characteristics of traditional micro and optoelectronic components. As a result of the growing importance of heterostructure physics more and more people are entering this dynamic field either from graduate school or from other areas of research. For the new entrants the task of familiarizing themselves with the vast body of existing knowledge about heterostructures has become quite a challenge due to the rapid development of the field and its increasing subdivision into distinct subfields. Even for those who already work in one area of heterostructure physics keeping up with the developments in neighboring areas is not an easy task. The purpose of this book is to make heterostructure physics more accessible.

**Semiconductor Research** Amalia Patane, Naci Balkan, 2012-04-12 The book describes the fundamentals, latest developments and use of key experimental techniques for semiconductor research. It explains the application potential of various analytical methods and discusses the opportunities to apply particular analytical techniques to study novel semiconductor compounds such as dilute nitride alloys. The emphasis is on the technique rather than on the particular system studied.

**Advanced Semiconductor Heterostructures** Mitra Dutta, Michael A. Stroscio, 2003 Novel heterostructure devices: Electron-phonon interactions in intersubband laser heterostructures; M. V. Kisin, M. Dutta and M. A. Stroscio: Quantum dot infrared detectors and sources; P. Bhattacharya et al.: Generation of terahertz emission based on intersubband transitions; Q. Hu: Mid-infrared GaSb-based lasers with Type I heterointerfaces; D. V. Donetsky, R. U. Martinelli and G. L. Belenky: Advances in quantum dot research and technology: the path to applications in biology; M. A. Stroscio and M. Dutta: Potential device applications and basic properties; High-field electron transport controlled by optical phonon emission in nitrides; S. M. Komirenko et al.: Cooling by inverse Nottingham effect with resonant tunneling; Y. Yu, R. F. Greene and R. Tsu: The physics of single electron transistors; M. A. Kastner: Carrier capture and transport within tunnel injection lasers; a quantum transport analysis; L. F. Register et al.: The influence of environmental effects on the acoustic phonon spectra in quantum dot heterostructures; S. Rufo, M. Dutta and M. A. Stroscio: Quantum devices with multipole electrode heterojunctions; hybrid structures; R. Tsu.

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-dimensional and zero-dimensional 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

### **Quantum Heterostructures** Vladimir Vasil'evich

Mitin, Viacheslav Kochelap, Michael A. Stroscio, 1999-07-13 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 Semiconductors Peter YU, Manuel Cardona, 2010-04-07

Excellent bridge between general solid state physics textbook and research articles packed with providing detailed explanations of the electronic vibrational transport and optical properties of semiconductors The most striking feature of the book is its modern outlook provides a wonderful foundation The most wonderful feature is its efficient style of exposition an excellent book Physics Today Presents the theoretical derivations carefully and in detail and gives thorough discussions of the experimental results it presents This makes it an excellent textbook both for learners and for more experienced researchers wishing to check facts I have enjoyed reading it and strongly recommend it as a text for anyone working with semiconductors I know of no better text I am sure most semiconductor physicists will find this book useful and I recommend it to them Contemporary Physics Offers much new material an extensive appendix about the important and by now well established deep center known as the DX center additional problems and the solutions to over fifty of the problems at the end of the various chapters

*Modern Plasmonics* Alexei A. Maradudin, J. Roy Sambles, William L. Barnes, 2014-09-10 Plasmonics is entering the curriculum of many universities either as a stand alone subject or as part of some course or courses Nanotechnology institutes have been and are being established in universities in which plasmonics is a significant topic of research Modern Plasmonics offers a comprehensive presentation of the properties of surface plasmon polaritons in systems of different structures and various natures e g active nonlinear graded theoretical computational and experimental techniques for studying them and their use in a variety of applications Contains material not found in existing books on plasmonics including

basic properties of these surface waves theoretical computational and experimental approaches and new applications of them Each chapter is written by an expert in the subject to which it is devoted Emphasis on applications of plasmonics that have been realized not just predicted or proposed Handbook of Nitride Semiconductors and Devices, Electronic and Optical Processes in Nitrides 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 2 addresses the electrical and optical properties of nitride materials It includes semiconductor metal contacts impurity and carrier concentrations and carrier transport in semiconductors Fundamentals of Semiconductor Peter YU,Manuel Cardona,2013-11-11 Fundamentals of Semiconductors attempts to fill the gap between a general solid state physics textbook and research articles by providing detailed explanations of the electronic vibrational transport and optical properties of semiconductors The approach is physical and intuitive rather than formal and pedantic Theories are presented to explain experimental results This textbook has been written with both students and researchers in mind Its emphasis is on understanding the physical properties of Si and similar tetrahedrally coordinated semiconductors The explanations are based on physical insights Each chapter is enriched by an extensive collection of tables of material parameters figures and problems Many of these problems lead the student by the hand to arrive at the results



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