



Properties of Impurity States in Superlattice Semiconductors

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NATO ASI Series

Series B: Physics VOL. 183

Properties Of Impurity States In Superlattice Semiconductors

J.P. Nougier



Properties Of Impurity States In Superlattice Semiconductors:

Properties of Impurity States in Superlattice Semiconductors C.Y. Fong, Inder P. Batra, S. Ciraci, 2012-12-06 A NATO workshop on The Properties of Impurity States in Semiconductor Superlattices was held at the University of Essex Colchester United Kingdom from September 7 to 11 1987 Doped semiconductor superlattices not only provide a unique opportunity for studying low dimensional electronic behavior they can also be custom designed to exhibit many other fascinating electronic properties The possibility of using these materials for new and novel devices has further induced many astonishing advances especially in recent years The purpose of this workshop was to review both advances in the state of the art and recent results in various areas of semiconductor superlattice research including i growth and characterization techniques ii deep and shallow impurity states iii quantum well states and iv two dimensional conduction and other novel electronic properties This volume consists of all the papers presented at the workshop Chapters 1-6 are concerned with growth and characterization techniques for superlattice semiconductors The question of a layer is also discussed in this section Chapters 7-15 contain a discussion of various aspects of the impurity states Chapters 16-22 are devoted to quantum well states Finally two dimensional conduction and other electronic properties are described in chapters 23-26

Light Scattering in Semiconductor Structures and Superlattices D.J. Lockwood, Jeff F. Young, 2013-12-20 Just over 25 years ago the first laser excited Raman spectrum of any crystal was obtained In November 1964 Hobden and Russell reported the Raman spectrum of GaP and later in June 1965 Russell published the Si spectrum Then in July 1965 the forerunner of a series of meetings on light scattering in solids was held in Paris Laser Raman spectroscopy of semiconductors was at the forefront in new developments at this meeting Similar meetings were held in 1968 New York 1971 Paris and 1975 Campinas Since then and apart from the multidisciplinary biennial International Conference on Raman Spectroscopy there has been no special forum for experts in light scattering spectroscopy of semiconductors to meet and discuss latest developments Meanwhile technological advances in semiconductor growth have given rise to a veritable renaissance in the field of semiconductor physics Light scattering spectroscopy has played a crucial role in the advancement of this field providing valuable information about the electronic vibrational and structural properties both of the host materials and of heterogeneous composite structures On entering a new decade one in which technological advances in lithography promise to open even broader horizons for semiconductor physics it seemed to us to be an ideal time to reflect on the achievements of the past decade to be brought up to date on the current state of the art and to catch some glimpses of where the field might be headed in the 1990s

The Physics of Semiconductors Marius Grundmann, 2021-03-06 The 4th edition of this highly successful textbook features copious material for a complete upper level undergraduate or graduate course guiding readers to the point where they can choose a specialized topic and begin supervised research The textbook provides an integrated approach beginning from the essential principles of solid state and semiconductor physics to their use in various classic and

modern semiconductor devices for applications in electronics and photonics The text highlights many practical aspects of semiconductors alloys strain heterostructures nanostructures amorphous semiconductors and noise which are essential aspects of modern semiconductor research but often omitted in other textbooks This textbook also covers advanced topics such as Bragg mirrors resonators polarized and magnetic semiconductors nanowires quantum dots multi junction solar cells thin film transistors and transparent conductive oxides The 4th edition includes many updates and chapters on 2D materials and aspects of topology The text derives explicit formulas for many results to facilitate a better understanding of the topics Having evolved from a highly regarded two semester course on the topic The Physics of Semiconductors requires little or no prior knowledge of solid state physics More than 2100 references guide the reader to historic and current literature including original papers review articles and topical books providing a go to point of reference for experienced researchers as well

Point and Extended Defects in Semiconductors Giorgio Benedek, 2013-06-29 The systematic study of defects in semiconductors began in the early fifties From that time on many questions about the defect structure and properties have been answered but many others are still a matter of investigation and discussion Moreover during these years new problems arose in connection with the identification and characterization of defects their role in determining transport and optical properties of semiconductor materials and devices as well as from the technology of the ever increasing scale of integration This book presents to the reader a view into both basic concepts of defect physics and recent developments of high resolution experimental techniques The book does not aim at an exhaustive presentation of modern defect physics rather it gathers a number of topics which represent the present time research in this field The volume collects the contributions to the Advanced Research Workshop Point Extended and Surface Defects in Semiconductors held at the Ettore Majorana Centre at Erice Italy from 2 to 7 November 1988 in the framework of the International School of Materials Science and Technology The workshop has brought together scientists from thirteen countries Most participants are currently working on defect problems in either silicon submicron technology or in quantum wells and superlattices where point defects dislocations interfaces and surfaces are closely packed together

Spectroscopy of Semiconductor Microstructures Gerhard Fasol, Annalisa Fasolino, Paolo Lugli, 2013-06-29 Proceedings of a NATO ARW held in Venice Italy May 9-13 1989

Semiconductor Optics Claus F. Klingshirn, 1997-02-03 Semiconductor Optics provides an introduction to and an overview of semiconductor optics from the IR through the visible to the UV including linear and nonlinear optical properties dynamics magneto and electrooptics high excitation effects some applications experimental techniques and group theory Mathematics is kept as elementary as possible enough for an intuitive understanding of the experimental results and techniques treated The subjects covered extend from physics to materials science and optoelectronics

Quantum Semiconductor Structures Claude Weisbuch, Borge Vinter, 1991-05-12 A review of the fundamentals of quantified semiconductor structures first seen as an introductory chapter in Volume 24 of Semiconductors and Semimetals which

covers the basics of electronic states optical interactions and quantum transport in two dimensional quantified systems

III-V Microelectronics J.P. Nougier, 2014-05-27 As is well known Silicon widely dominates the market of semiconductor devices and circuits and in particular is well suited for Ultra Large Scale Integration processes However a number of III V compound semiconductor devices and circuits have recently been built and the contributions in this volume are devoted to those types of materials which offer a number of interesting properties Taking into account the great variety of problems encountered and of their mutual correlations when fabricating a circuit or even a device most of the aspects of III V microelectronics from fundamental physics to modelling and technology from materials to devices and circuits are reviewed Containing contributions from European researchers of international repute this volume is the definitive reference source for anyone interested in the latest advances and results of current experimental research in III V microelectronics

Comprehensive Semiconductor Science and Technology , 2024-11-28 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 Second Edition Three Volume Set captures the breadth of this important field and presents it in a single source to the large audience who study make and use semiconductor devices Written and edited by a truly international team of experts and newly updated to capture key advancements in the field this work delivers an objective yet cohesive review of the semiconductor world The work is divided into three sections fully updated and expanded from the first edition 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 especially quantum phenomena 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 high purity or doped bulk and epitaxial materials with low defect density and well controlled electrical and optical properties The third section is devoted to design fabrication and assessment of discrete and integrated semiconductor devices It will cover the entire spectrum of devices we see all around us for telecommunications computing automation displays illumination and consumer electronics Provides a comprehensive global picture of the semiconductor world Written and Edited by an international team of experts Compiles the most important semiconductor knowledge into one comprehensive resource Moves from fundamentals and theory to more advanced knowledge such as applications allowing readers to gain a deeper understanding of the field

Negative Differential Resistance and Instabilities in 2-D Semiconductors N. Balkan, B.K. Ridley, A.J. Vickers, 2012-12-06 Instabilities associated with hot electrons in semiconductors have been investigated from the beginning of transistor physics in the 1940s The study of NDR and impact ionization in bulk material led to devices like the Gunn diode and the avalanche photo diode In layered semiconductors domain formation in HEMTs can lead to excess gate

leakage and to excess noise The studies of hot electron transport parallel to the layers in heterostructures single and multiple have shown abundant evidence of electrical instability and there has been no shortage of suggestions concerning novel NDR mechanisms such as real space transfer scattering induced NDR inter sub band transfer percolation effects etc Real space transfer has been exploited in negative resistance PETs NERFETs and in the charge injection transistor CHINT and in light emitting logic devices but far too little is known and understood about other NDR mechanisms with which quantum well material appears to be particularly well endowed for these to be similarly exploited The aim of this book is therefore to collate what is known and what is not known about NDR instabilities and to identify promising approaches and techniques which will increase our understanding of the origin of these instabilities which have been observed during the last decade of investigations into high field longitudinal transport in layered semiconductors The book covers the fundamental properties of hot carrier transport and the associated instabilities and light emission in 2 dimensional semiconductors dealing with both theory and experiment

Quantum Theory of Real Materials James R. Chelikowsky, Steven G. Louie, 1996-02-29 A

Festschrift in honor of Professor Marvin L Cohen This volume is a Festschrift in honor of Professor Marvin L Cohen The articles contributed by leading researchers in condensed matter physics high light recent advances in the use of quantum theory to explain and predict properties of real materials The invention of quantum mechanics in the 1920 s provided detailed descriptions of the electronic structure of atoms However a similar understanding of solids has been achieved only in the past 30 years owing to the complex electron ion and electron electron interactions in these systems Professor Cohen is a central figure in this achievement His development of the pseudopotential and total energy methods provided an alternate route using computers for the exploration of solids and new materials even when they have not yet been synthesized Professor Cohen s contributions to materials theory have been both fundamental and encompassing The corpus of his work consists of over 500 papers and a textbook His band structures for semiconductors are used worldwide by researchers in solid state physics and chemistry and by device engineers Professor Cohen s own use of his theories has resulted in the determination of the electronic structure optical properties structural and vibrational properties and superconducting properties of numerous condensed matter systems including semiconductors metals surfaces interfaces defects in solids clusters and novel materials such as the fullerenes and nanotubes

Modern Semiconductor Quantum Physics Ming-Fu Li, 1995-02-01

Modern Semiconductor Quantum Physics has the following constituents 1 energy band theory pseudopotential method empirical and ab initio density functional theory quasi particles LCAO method k p method spin orbit splitting effect mass and Luttinger parameters strain effects and deformation potentials temperature effects 2 Optical properties absorption and exciton effect modulation spectroscopy photo luminescence and photo luminescence excitation Raman scattering and polaritons photoionization 3 Defects and Impurities effective mass theory and shallow impurity states deep state cluster method super cell method Green s function method carrier recombination kinetics trapping transient measurements electron

spin resonance electron lattice interaction and lattice relaxation effects multi phonon nonradiative recombination negative U center DX center and EL2 Defects 4 Semiconductor surfaces two dimensional periodicity and surface reconstruction surface electronic states photo electron spectroscopy LEED STM and other experimental methods 5 Low dimensional structures Heterojunctions quantum wells superlattices quantum confined Stark effect and Wannier Stark ladder effects resonant tunneling quantum Hall effect quantum wires and quantum dots This book can be used as an advanced textbook on semiconductor physics for graduate students in physics and electrical engineering departments It is also useful as a research reference for solid state scientists and semiconductor device engineers **Metallization and Metal-Semiconductor**

Interfaces Inder P. Batra, 2012-12-06 This book represents the work presented at a NATO Advanced Research Workshop on Metallization and Metal Semiconductor Interfaces held at the Technical University of Munich Garching W Germany from 22 26 August 1988 The major focus of the workshop was to evaluate critically the progress made in the area of metal semiconductor interfaces The underlying theme was the mechanism of Schottky barrier formation and a serious assessment of the various models A significant fraction of the workshop time was also spent in discussing the interaction of alkali metals with semiconductors Alkali metals on semiconductors form ordered overlayers and the resulting system often exhibits one dimensional metallic properties The nature of their interaction has introduced new and exciting complexities and this was pursued at length during the lively discussions at the workshop A half a day was devoted to Scanning Tunneling Microscopy the emphasis being on its utility in providing structural and electronic character of low coverage regime The book should provide readers with the most current status of the research activity in the general area of metal semiconductor interfaces at an international level It should also serve as an excellent introduction to the field since sufficient review type of material has also been included The workshop organizers Dr I P Batra Director mM Almaden Research Center San Jose Prof S Ciraci Bilkent University Ankara Prof C Y Pong University of California Davis Prof Dr F Koch Local Chairman Technical University Munich Garching Dr H **Heterojunctions and Semiconductor Superlattices** Guy Allan, Gerald Bastard, Nino

Boccara, Michel Lannoo, Michel Voos, 2012-12-06 The Winter School held in Les Houches on March 12 21 1985 was devoted to Semiconductor Heterojunctions and Superlattices a topic which is recognized as being now one of the most interesting and active fields in semiconductor physics In fact following the pioneering work of Esaki and Tsu in 1970 the study of these two dimensional semiconductor heterostructures has developed rapidly both from the point of view of basic physics and of applications For instance modulation doped heterojunctions are nowadays currently used to investigate the quantum Hall effect and to make very fast transistors This book contains the lectures presented at this Winter School showing in particular that many aspects of semiconductor heterojunctions and superlattices were treated extending from the fabrication of these two dimensional systems to their basic properties and applications in micro and optoelectronics Among the subjects which were covered one can quote as examples molecular beam epitaxy and metallorganic chemical vapor deposition of semi

conductor compounds band structure of superlattices properties of electrons in heterojunctions including the fractional quantum Hall effect optical properties of two dimensional heterostructures quantum well lasers and two dimensional electron gas field effect transistors It is clear that two dimensional semiconductor systems are raising a great deal of interest in many industrial and university laboratories From the number of applications which were received and from the reactions of the participants it can certainly be asserted that this School corresponded to a need and came at the right time

Evaluation of Advanced Semiconductor Materials by Electron Microscopy David Cherns, 2012-12-06 The last few years have seen rapid improvements in semiconductor growth techniques which have produced an expanding range of high quality heterostructures for new semiconductor devices As the dimensions of such structures approach the nanometer level it becomes increasingly important to characterise materials properties such as composition uniformity strain interface sharpness and roughness and the nature of defects as well as their influence on electrical and optical properties Much of this information is being obtained by electron microscopy and this is also an area of rapid progress There have been advances for thin film studies across a wide range of techniques including for example convergent beam electron diffraction X ray and electron energy loss microanalysis and high spatial resolution cathodoluminescence as well as by conventional and high resolution methods Important developments have also occurred in the study of surfaces and film growth phenomena by both microscopy and diffraction techniques With these developments in mind an application was made to the NATO Science Committee in late summer 1987 to fund an Advanced Research Workshop to review the electron microscopy of advanced semiconductors This was subsequently accepted for the 1988 programme and became the NATO Advanced Research Workshop on the Evaluation of Advanced Semiconductor Materials by Electron Microscopy The Workshop took place in the pleasant and intimate surroundings of Wills Hall Bristol UK during the week 11-17 September 1988 and was attended by fifty five participants from fourteen countries

Science and Engineering of One- and Zero-Dimensional Semiconductors Steven P. Beaumont, Clivia M. Sotomayor Torres, 2012-12-06 This volume comprises the proceedings of the NATO Advanced Research Workshop on the Science and Engineering of 1 and 0 dimensional semiconductors held at the University of Cadiz from 29th March to 1st April 1989 under the auspices of the NATO International Scientific Exchange Program There is a wealth of scientific activity on the properties of two dimensional semiconductors arising largely from the ease with which such structures can now be grown by precision epitaxy techniques or created by inversion at the silicon/silicon dioxide interface Only recently however has there burgeoned an interest in the properties of structures in which carriers are further confined with only one or in the extreme zero degrees of freedom This workshop was one of the first meetings to concentrate almost exclusively on this subject that the attendance of some forty researchers only represented the community of researchers in the field testifies to its rapid expansion which has arisen from the increasing availability of technologies for fabricating structures with small enough sub μm dimensions Part I of this volume is a short section on important topics in

nanofabrication It should not be assumed from the brevity of this section that there is little new to be said on this issue rather that to have done justice to it would have diverted attention from the main purpose of the meeting which was to highlight experimental and theoretical research on the structures themselves

Resonant Tunneling in Semiconductors L.L.

Chang,E.E. Mendez,C. Tejedor,2012-12-06 This book contains the proceedings of the NATO Advanced Research Workshop on Resonant Tunneling in Semiconductors Physics and Applications held at Escorial Spain on May 14 18 1990 The tremendous growth in the past two decades in the field of resonant tunneling in semiconductor heterostructures has followed if not outpaced the expansion witnessed in quantum structures in general Resonant tunneling shares also the multi disciplinary nature of that broad area with an emphasis on the underlying physics but with a coverage of material systems on the one end and device applications on the other Indeed that resonant tunneling provides great flexibility in terms of materials and configurations and that it is inherently a fast process with obvious device implications by the presence of a negative differential resistance have contributed to the unrelenting interest in this field These proceedings consist of 49 refereed articles they correspond to both invited and contributed talks at the workshop Because of the intertwining nature of the subject matter it has been difficult to subdivide them in well defined sections Instead they are arranged in several broad categories meant to serve only as guidelines of emphasis on different topics and aspects The book starts with an introduction to resonant tunneling by providing a perspective of the field in the first article This is followed by discussions of different material systems with various band structure effects

Mechanisms of Reactions of Organometallic Compounds with Surfaces D.J. Cole-Hamilton,J.O. Williams,2013-11-11 A NATO Advanced Research Workshop on the Mechanisms of Reactions of Organometallic Compounds with Surfaces was held in St Andrews Scotland in June 1988 Many of the leading international researchers in this area were present at the workshop and all made oral presentations of their results In addition significant amounts of time were set aside for Round Table discussions in which smaller groups considered the current status of mechanistic knowledge identified areas of dispute or disagreement and proposed experiments that need to be carried out to resolve such disputes so as to advance our understanding of this important research area All the papers presented at the workshop are collected in this volume together with summaries of the conclusions reached at the Round Table discussions The workshop could not have taken place without financial support from NATO and donations were also received from Associated Octel Ltd STC Ltd and Epichem Ltd for which the organisers are very grateful The organisation of the meeting was greatly assisted by Mrs G MacArthur and Mr L R Dunley of the Chemistry Department St Andrews University

Molecular Beam Epitaxy Mohamed Henini,2012-12-31 This multi contributor handbook discusses Molecular Beam Epitaxy MBE an epitaxial deposition technique which involves laying down layers of materials with atomic thicknesses on to substrates It summarizes MBE research and application in epitaxial growth with close discussion and a how to on processing molecular or atomic beams that occur on a surface of a heated crystalline substrate in a vacuum MBE has expanded in

importance over the past thirty years in terms of unique authors papers and conferences from a pure research domain into commercial applications prototype device structures and more at the advanced research stage MBE is important because it enables new device phenomena and facilitates the production of multiple layered structures with extremely fine dimensional and compositional control The techniques can be deployed wherever precise thin film devices with enhanced and unique properties for computing optics or photonics are required This book covers the advances made by MBE both in research and mass production of electronic and optoelectronic devices It includes new semiconductor materials new device structures which are commercially available and many more which are at the advanced research stage Condenses fundamental science of MBE into a modern reference speeding up literature review Discusses new materials novel applications and new device structures grounding current commercial applications with modern understanding in industry and research Coverage of MBE as mass production epitaxial technology enhances processing efficiency and throughput for semiconductor industry and nanostructured semiconductor materials research community

High Magnetic Fields in Semiconductor Physics II

Gottfried Landwehr, 2012-12-06 This volume contains contributions presented at the International Conference The Application of High Magnetic Fields in Semiconductor Physics which was held at the University of Würzburg from August 22 to 26 1988 In the tradition of previous Würzburg meetings on the subject the first conference was held in 1972 only invited papers were presented orally All 42 lecturers were asked to review their subject to some extent so that this book gives a good overview of the present state of the respective topic A look at the contents shows that the subjects which have been treated at previous conferences have not lost their relevance On the contrary the application of high magnetic fields to semiconductors has grown substantially during the recent past For the elucidation of the electronic band structure of semiconductors high magnetic fields are still an indispensable tool The investigation of two dimensional electronic systems especially is frequently connected with the use of high magnetic fields The reason for this is that a high B field adds angular momentum quantization to the boundary quantization present in heterostructures and superlattices A glance at the contributions shows that the majority deal with 2D properties Special emphasis was on the integral and fractional quantum Hall effect Very recent results related to the observation of a fraction with an even denominator were presented It became obvious that the polarization of the different fractional Landau levels is more complicated than originally anticipated

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Table of Contents Properties Of Impurity States In Superlattice Semiconductors

1. Understanding the eBook Properties Of Impurity States In Superlattice Semiconductors
 - The Rise of Digital Reading Properties Of Impurity States In Superlattice Semiconductors
 - Advantages of eBooks Over Traditional Books
2. Identifying Properties Of Impurity States In Superlattice Semiconductors
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Properties Of Impurity States In Superlattice Semiconductors
 - User-Friendly Interface
4. Exploring eBook Recommendations from Properties Of Impurity States In Superlattice Semiconductors
 - Personalized Recommendations
 - Properties Of Impurity States In Superlattice Semiconductors User Reviews and Ratings
 - Properties Of Impurity States In Superlattice Semiconductors and Bestseller Lists

5. Accessing Properties Of Impurity States In Superlattice Semiconductors Free and Paid eBooks
 - Properties Of Impurity States In Superlattice Semiconductors Public Domain eBooks
 - Properties Of Impurity States In Superlattice Semiconductors eBook Subscription Services
 - Properties Of Impurity States In Superlattice Semiconductors Budget-Friendly Options
6. Navigating Properties Of Impurity States In Superlattice Semiconductors eBook Formats
 - ePub, PDF, MOBI, and More
 - Properties Of Impurity States In Superlattice Semiconductors Compatibility with Devices
 - Properties Of Impurity States In Superlattice Semiconductors Enhanced eBook Features
7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Properties Of Impurity States In Superlattice Semiconductors
 - Highlighting and Note-Taking Properties Of Impurity States In Superlattice Semiconductors
 - Interactive Elements Properties Of Impurity States In Superlattice Semiconductors
8. Staying Engaged with Properties Of Impurity States In Superlattice Semiconductors
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Properties Of Impurity States In Superlattice Semiconductors
9. Balancing eBooks and Physical Books Properties Of Impurity States In Superlattice Semiconductors
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Properties Of Impurity States In Superlattice Semiconductors
10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
11. Cultivating a Reading Routine Properties Of Impurity States In Superlattice Semiconductors
 - Setting Reading Goals Properties Of Impurity States In Superlattice Semiconductors
 - Carving Out Dedicated Reading Time
12. Sourcing Reliable Information of Properties Of Impurity States In Superlattice Semiconductors
 - Fact-Checking eBook Content of Properties Of Impurity States In Superlattice Semiconductors
 - Distinguishing Credible Sources
13. Promoting Lifelong Learning

- Utilizing eBooks for Skill Development
- Exploring Educational eBooks

14. Embracing eBook Trends

- Integration of Multimedia Elements
- Interactive and Gamified eBooks

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