

# Resonant Tunneling in Semiconductors Physics and Applications

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E. E. Mendez and

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**NATO ASI Series** 

# Resonant Tunneling In Semiconductors Physics And Applications

**G Psacharopoulos** 

# **Resonant Tunneling In Semiconductors Physics And Applications:**

**Resonant Tunneling in Semiconductors** Leroy L. Chang, E. E. Mendez, C. Tejedor, 1991 Forty nine contributions from the May 1990 meeting begin with an introduction followed by discussions of different material systems with various band structure effects Properties associated with dynamic processes are then described including electron scattering and charge The Physics and Applications of Resonant Tunnelling Diodes Hiroshi Mizuta, Tomonori storage Specific situati Tanoue,1995-09-14 A comprehensive description of the physics and applications of resonant tunnelling diodes Resonant **Tunneling in Semiconductors** L. L. Chang, E. E. Mendez, C. Tejedor, 1992-02-01 Physics of Semiconductor Devices Simon M. Sze, Yiming Li, Kwok K. Ng, 2021-03-24 The new edition of the most detailed and comprehensive single volume reference on major semiconductor devices The Fourth Edition of Physics of Semiconductor Devices remains the standard reference work on the fundamental physics and operational characteristics of all major bipolar unipolar special microwave and optoelectronic devices This fully updated and expanded edition includes approximately 1 000 references to original research papers and review articles more than 650 high quality technical illustrations and over two dozen tables of material parameters Divided into five parts the text first provides a summary of semiconductor properties covering energy band carrier concentration and transport properties. The second part surveys the basic building blocks of semiconductor devices including p n junctions metal semiconductor contacts and metal insulator semiconductor MIS capacitors Part III examines bipolar transistors MOSFETs MOS field effect transistors and other field effect transistors such as JFETs junction field effect transistors and MESFETs metal semiconductor field effect transistors Part IV focuses on negative resistance and power devices The book concludes with coverage of photonic devices and sensors including light emitting diodes LEDs solar cells and various photodetectors and semiconductor sensors This classic volume the standard textbook and reference in the field of semiconductor devices Provides the practical foundation necessary for understanding the devices currently in use and evaluating the performance and limitations of future devices Offers completely updated and revised information that reflects advances in device concepts performance and application Features discussions of topics of contemporary interest such as applications of photonic devices that convert optical energy to electric energy Includes numerous problem sets real world examples tables figures and illustrations several useful appendices and a detailed solutions manual Explores new work on leading edge technologies such as MODFETs resonant tunneling diodes quantum cascade lasers single electron transistors real space transfer devices and MOS controlled thyristors Physics of Semiconductor Devices Fourth Edition is an indispensable resource for design engineers research scientists industrial and electronics engineering managers and graduate students in the field Resonant Tunneling Diode Photonics Charlie Ironside, Bruno Romeira, José Figueiredo, 2019-11-11 This book brings together two broad themes that have generated a great deal of interest and excitement in the scientific and technical community in the last 100 years or so quantum tunnelling and nonlinear dynamical

systems It applies these themes to nanostructured solid state heterostructures operating at room temperature to gain insight into novel photonic devices systems and applications Vacuum Nanoelectronic Devices Anatoliy Evtukh, Hans Hartnagel, Oktay Yilmazoglu, Hidenori Mimura, Dimitris Pavlidis, 2016-03-16 Introducing up to date coverage of research in electron field emission from nanostructures Vacuum Nanoelectronic Devices outlines the physics of quantum nanostructures basic principles of electron field emission and vacuum nanoelectronic devices operation and offers as insight state of the art and future researches and developments This book also evaluates the results of research and development of novel quantum electron sources that will determine the future development of vacuum nanoelectronics Further to this the influence of quantum mechanical effects on high frequency vacuum nanoelectronic devices is also assessed Key features In depth description and analysis of the fundamentals of Quantum Electron effects in novel electron sources Comprehensive and up to date summary of the physics and technologies for THz sources for students of physical and engineering specialties and electronics engineers Unique coverage of quantum physical results for electron field emission and novel electron sources with quantum effects relevant for many applications such as electron microscopy electron lithography imaging and communication systems and signal processing New approaches for realization of electron sources with required and optimal parameters in electronic devices such as vacuum micro and nanoelectronics. This is an essential reference for researchers working in terahertz technology wanting to expand their knowledge of electron beam generation in vacuum and electron source quantum concepts It is also valuable to advanced students in electronics engineering and physics who want to deepen their understanding of this topic Ultimately the progress of the quantum nanostructure theory and technology will promote the progress and development of electron sources as main part of vacuum macro micro and nanoelectronics Arsenide and Related Compounds 1993, Proceedings of the 20th INT Symposium, 29 August - 2 September 1993, Freiburg im Braunschweig, Germany Günter Weimann, Hans S. Rupprecht, G. Weimann, 1994-01-01 Gallium Arsenide and Related Compounds 1993 covers III V compounds from crystal growth of materials to their device applications Focusing on the fields of optical communications and satellite broadcasting the book describes the practical applications for GaAs and III V compounds in devices and circuits both conventional and those based on quantum effects It also discusses ultrafast GaAs transistors and integrated circuits novel laser diodes and tunneling devices and considers the direction for future technologies In addition this volume addresses the increasing demands of ultra high speed systems that require careful selection of III V materials to optimize the performance of electronic and optoelectronic components It is ideal reading for physicists materials scientists electrical and electronics engineers investigating III V compound materials properties and devices 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 **Electronic Properties of Multilayers and Low-Dimensional Semiconductor Structures** J.M. Chamberlain, L. Eaves, J.C. Portal, 2012-12-06 This Advanced Study Institute on the Electronic Properties of Multilayers and Low Dimensional Semiconductor Structures focussed on several of the most active areas in modern semiconductor physics These included resonant tunnelling and superlattice phenomena and the topics of ballistic transport quantised conductance and anomalous magnetoresistance effects in laterally gated two dimensional electron systems Although the main emphasis was on fundamental physics a series of supporting lectures described the underlying technology Molecular Beam Epitaxy Metallo Organic Chemical Vapour Deposition Electron Beam Lithography and other advanced processing technologies Actual and potential applications of low dimensional structures in optoelectronic and high frequency devices were also discussed The ASI took the form of a series of lectures of about fifty minutes duration which were given by senior researchers from a wide range of countries Most of the lectures are recorded in these Proceedings The younger members of the Institute made the predominant contribution to the discussion sessions following each lecture and in addition provided most of the fifty five papers that were presented in two lively poster sessions The ASI emphasised the impressive way in which this research field has developed through the fruitful interaction of theory experiment and semiconductor device technology Many of the talks demonstrated both the effectiveness and limitations of semiclassical concepts in describing the quantum phenomena exhibited by electrons in low dimensional structures **Resonant Tunneling Diode Photonics** Devices and Applications (Second Edition) Charlie Ironside, Bruno Romeira, Jose Figueiredo, 2023-12 The book uses a

combination of quantum theory semiconductor physics and nonlinear dynamics to explain how resonant tunneling diode based photonic devices can contribute to the development of photonic and neuromorphic systems and implement hardware specifically designed for neural networks which are at the heart of artificial intelligence **Electronic Transport in Mesoscopic Systems** Supriyo Datta,1997-05-15 Advances in semiconductor technology have made possible the fabrication of structures whose dimensions are much smaller than the mean free path of an electron This book gives a thorough account of the theory of electronic transport in such mesoscopic systems After an initial chapter covering fundamental concepts the transmission function formalism is presented and used to describe three key topics in mesoscopic physics the quantum Hall effect localisation and double barrier tunnelling Other sections include a discussion of optical analogies to mesoscopic phenomena and the book concludes with a description of the non equilibrium Green's function formalism and its relation to the transmission formalism Complete with problems and solutions the book will be of great interest to graduate students of mesoscopic physics and nanoelectronic device engineering as well as to established researchers in these fields **Speed Heterostructure Devices**, 1994-07-06 Volume 41 includes an in depth review of the most important high speed switches made with heterojunction technology This volume is aimed at the graduate student or working researcher who needs a broad overview and an introduction to current literature The first complete review of InP based HFETs and complementary HFETs which promise very low power and high speed Offers a complete three chapter review of resonant tunneling Provides an emphasis on circuits as well as devices **Interfaces, Quantum Wells, and Superlattices** C. Richard Leavens, Roger Taylor, 2013-04-17 The NATO Advanced Study Institute on Interfaces Quantum Wells and Superlattices was held from August 16th to 29th 1987 in Banff Alberta Canada This volume contains most of the lectures that were given at the Institute A few of the lectures had already been presented at an earlier meeting and appear instead in the proceedings of the NATO Advanced Study Institute on Physics and Applications of Quantum Wells and Super lattices held in Erice from April 21st to May 1st earlier in the year and published by Plenum Press The study of semiconductor interfaces quantum wells and super lattices has come to represent a substantial proportion of all work in condensed matter physics In a sense the growth of interest in this area which began to accelerate about 10 years ago and seems to be continuing has been driven by technological developments While the older generation of semiconductor devices was based on adjacent semiconductors with different properties e g different doping levels separated by interfaces modern semiconductor devices tend to be based more and more on properties of the interfaces themselves This has led as an example to the field of band structure engineering Improved understanding of the fundamental physics of these systems has aided technological developments and in turn technological developments have made available systems which exhibit novel and fascinating phySical properties such as the integer and fractional quantum Hall effects **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 semiconduc tor 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 possibil ities for studying low dimensional electrons as well as the atomic and elec tronic 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 compo nents 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 familiariz ing themselves with the vast body of existing knowledge about heterostruc tures 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 **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 Nanophysics: Coherence and Transport, 2005-08-02 The developments of nanofabrication in the past years have enabled the design of electronic systems that exhibit spectacular signatures of quantum coherence Nanofabricated quantum wires and dots containing a small number of electrons are ideal experimental playgrounds for probing electron electron interactions and their interplay with disorder Going down to even smaller scales molecules such as carbon nanotubes fullerenes or hydrogen molecules can now be inserted in nanocircuits Measurements of transport through a single chain of atoms have been performed as well Much progress has also been made in the design and fabrication of superconducting and hybrid nanostructures be they normal superconductor or ferromagnetic superconductor Quantum coherence is then no longer that of individual electronic states but rather that of a superconducting wavefunction of a macroscopic number of Cooper pairs condensed in the same quantum mechanical state Beyond the study of linear response regime the physics of non equilibrium transport including non linear transport rectification of a high frequency electric field as well as shot noise has received much attention with significant experimental and theoretical insights All these quantities exhibit very specific signatures of the quantum nature of transport which cannot be obtained from basic conductance measurements Basic concepts and analytical tools needed to understand this new physics are presented in a series of theoretical fundamental courses in parallel with more phenomenological ones

where physics is discussed in a less formal way and illustrated by many experiments Electron electron interactions in one dimensional quantum transport Coulomb Blockade and Kondo physics in quantum dots Out of equilibrium noise and quantum transport Andreev reflection and subgap nonlinear transport in hybrid N S nanosructures Transport through atomic contacts Solid state Q bits Written by leading experts in the field both theorists and experimentalists **Next Generation Wireless** Terahertz Communication Networks Saim Ghafoor, Mubashir Husain Rehmani, Alan Davy, 2021-08-10 The rapid growth of the data traffic demands new ways to achieve high speed wireless links The backbone networks data centers mission critical applications as well as end users sitting in office or home all require ultra high throughput and ultra low latency wireless links Sophisticated technological advancement and huge bandwidth are required to reduce the latency Terahertz band in this regard has a huge potential to provide these high capacity links where a user can download the file in a few seconds To realize the high capacity wireless links for future applications in this book different aspects of the Terahertz band wireless communication network are presented This book highlights the Terahertz channel characteristics and modeling antenna design and beamforming device characterization applications and protocols It also provides state of the art knowledge on different communication aspects of Terahertz communication and techniques to realize the true potential of the Terahertz band for wireless communication Scientific and Technical Aerospace Reports ,1995 Two-dimensional Materials for Photodetector Pramoda Kumar Nayak, 2018-04-04 Atomic thin two dimensional 2D materials are the thinnest forms of materials to ever occur in nature and have the potential to dramatically alter and revolutionize our material world Some of the unique properties of these materials including wide photoresponse wavelength passivated surfaces strong interaction with incident light and high mobility have created tremendous interest in photodetector application This book provides a comprehensive state of the art knowledge about photodetector technology in the range visible to infrared region using various 2D materials including graphene transition metal dichalcogenides III V semiconductor and so on It consists of 10 chapters contributed by a team of experts in this exciting field We believe that this book will provide new opportunities and guidance for the development of next generation 2D photodetector Proceedings of the 4th Brazilian Technology Symposium (BTSym'18) Yuzo Iano, Rangel Arthur, Osamu Saotome, Vânia Vieira Estrela, Hermes José Loschi, 2019-05-28 This book presents the Proceedings of The 4th Brazilian Technology Symposium BTSym 18 Part I of the book discusses current technological issues on Systems Engineering Mathematics and Physical Sciences such as the Transmission Line Protein modified mortars Electromagnetic Properties Clock Domains Chebyshev Polynomials Satellite Control Systems Hough Transform Watershed Transform Blood Smear Images Toxoplasma Gondi Operation System Developments MIMO Systems Geothermal Photovoltaic Energy Systems Mineral Flotation Application CMOS Techniques Frameworks Developments Physiological Parameters Applications Brain Computer Interface Artificial Neural Networks Computational Vision Security Applications FPGA Applications IoT Residential Automation Data Acquisition Industry 4 0 Cyber Physical Systems Digital

Image Processing Patters Recognition Machine Learning Photocatalytic Process Physical chemical analysis Smoothing Filters Frequency Synthesizers Voltage Controlled Ring Oscillator Difference Amplifier Photocatalysis and Photodegradation Part II of the book discusses current technological issues on Human Smart and Sustainable Future of Cities such as the Digital Transformation Data Science Hydrothermal Dispatch Project Knowledge Transfer Immunization Programs Efficiency and Predictive Methods PMBOK Applications Logistics Process IoT Data Acquisition Industry 4 0 Cyber Physical Systems Fingerspelling Recognition Cognitive Ergonomics Ecosystem services Environmental Ecosystem services valuation Solid Waste and University Extension BTSym is the brainchild of Prof Dr Yuzo Iano who is responsible for the Laboratory of Visual Communications LCV at the Department of Communications DECOM of the Faculty of Electrical and Computing Engineering FEEC State University of Campinas UNICAMP Brazil

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