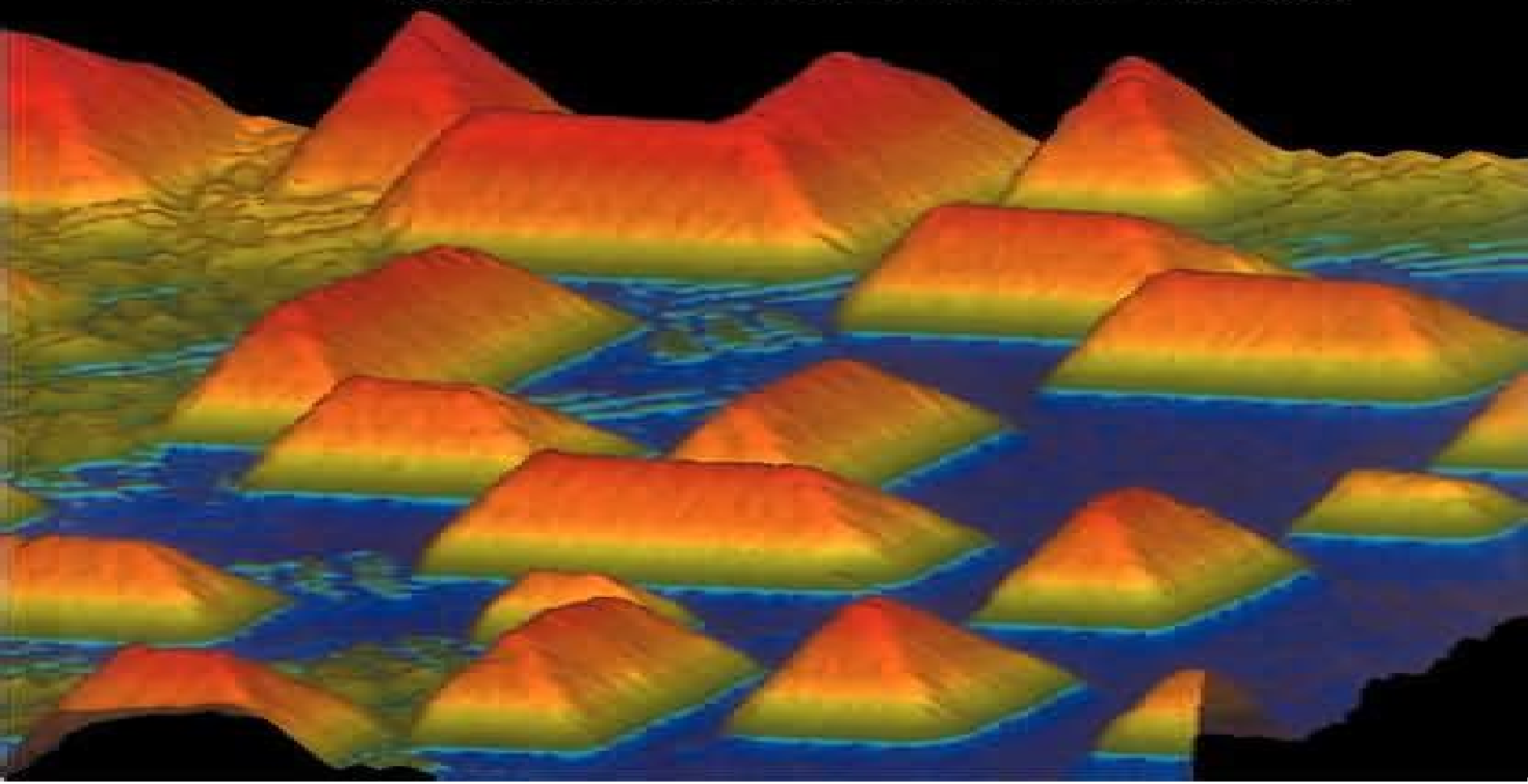


# **LOW-DIMENSIONAL** **semiconductor structures**

Fundamentals and device applications

Edited by **Keith Barnham** and **Dimitri Vvedensky**



# Low Dimensional Semiconductor Structures Fundamentals And Device Applications

**Arthur McGurn**



## **Low Dimensional Semiconductor Structures Fundamentals And Device Applications:**

Low-Dimensional Semiconductor Structures Keith Barnham, Dimitri Vvedensky, 2001-07-12 Low Dimensional Semiconductor Structures offers a seamless atoms to devices introduction to the latest quantum heterostructures It covers their fabrication electronic optical and transport properties role in exploring new physical phenomena and utilization in devices The authors describe the epitaxial growth of semiconductors and the physical behavior of electrons and phonons in low dimensional structures They then go on to discuss nonlinear optics in quantum heterostructures The final chapters deal with semiconductor lasers mesoscopic devices and high speed heterostructure devices The book contains many exercises and comprehensive references

**Devices Based on Low-Dimensional Semiconductor Structures** M. Balkanski, 2012-12-06 Low dimensional semiconductor quantum structures are a major high technological development that has a considerable industrial potential The field is developing extremely rapidly and the present book represents a timely guide to the latest developments in device technology fundamental properties and some remarkable applications The content is largely tutorial and the book could be used as a textbook The book deals with the physics fabrication characteristics and performance of devices based on low dimensional semiconductor structures It opens with fabrication procedures The fundamentals of quantum structures and electro optical devices are dealt with extensively Nonlinear optical devices are discussed from the point of view of physics and applications of exciton saturation in MQW structures Waveguide based devices are also described in terms of linear and nonlinear coupling The basics of pseudomorphic HEMT technology device physics and materials layer design are presented Each aspect is reviewed from the elementary basics up to the latest developments Audience Undergraduates in electrical engineering graduates in physics and engineering schools Useful for active scientists and engineers wishing to update their knowledge and understanding of recent developments

*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

**Device Applications of Low-dimensional Semiconductor Structures** James Michael Alexander Gilman, 1991

**Advanced Electronic Technologies and Systems Based on Low-Dimensional Quantum Devices** M. Balkanski, Nikolai Andreev, 2013-03-14 This volume on Advanced Electronic Technologies and Systems based on Low Dimensional Quantum Devices closes a three years series of NATO ASI s The first year was focused on the fundamental properties and applications The second year was devoted to Devices Based on Low Dimensional Semiconductor Structures The third year is covering Systems Based on Low Dimensional Quantum Semiconductor Devices The three volumes containing the lectures given at the three successive NATO ASI s constitute a

complete review on the latest advances in semiconductor Science and Technology from the methods of fabrication of the quantum structures through the fundamental physics and basic knowledge of properties and projection of performances to the technology of devices and systems In the first volume Fabrication Properties and Application of Low Dimensional Semiconductors are described the practical ways in which quantum structures are produced the present status of the technology difficulties encountered and advances to be expected The basic theory of Quantum Wells Double Quantum Wells and Superlattices is introduced and the fundamental aspects of their optical properties are presented The effect of reduction of dimensionality on lattice dynamics of quantum structures is also discussed In the second volume Devices Based on Low Dimensional Structures the fundamentals of quantum structures and devices in the two major fields Electro Optical Devices and Pseudomorphic High Electron Mobility Transistors are extensively discussed

**Semiconductor Quantum Optics** Mackillo Kira, Stephan W. Koch, 2011-11-17 The emerging field of semiconductor quantum optics combines semiconductor physics and quantum optics with the aim of developing quantum devices with unprecedented performance In this book researchers and graduate students alike will reach a new level of understanding to begin conducting state of the art investigations The book combines theoretical methods from quantum optics and solid state physics to give a consistent microscopic description of light matter and many body interaction effects in low dimensional semiconductor nanostructures It develops the systematic theory needed to treat semiconductor quantum optical effects such as strong light matter coupling light matter entanglement squeezing as well as quantum optical semiconductor spectroscopy Detailed derivations of key equations help readers learn the techniques and nearly 300 exercises help test their understanding of the materials covered The book is accompanied by a website hosted by the authors containing further discussions on topical issues latest trends and publications on the field The link can be found at [www.cambridge.org/9780521875097](http://www.cambridge.org/9780521875097)

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

**Oxford Handbook of Nanoscience and Technology** A. V. Narlikar, Y. Y. Fu, 2010-02-11 This is an agenda setting and high profile book that presents an authoritative and cutting edge analysis of nanoscience and technology The Oxford Handbook of Nanoscience and Technology provides a comprehensive and accessible overview of the major achievements in different aspects of this field The Handbook comprises 3 volumes structured thematically with 25 chapters each Volume I presents fundamental issues of basic physics chemistry biochemistry tribology etc of nanomaterials Volume II focuses on the progress made with host of nanomaterials including DNA and protein based nanostructures Volume III highlights engineering and related developments with a focus on frontal application areas All chapters are written by noted international experts in the field The book should be useful for final year undergraduates specializing in the field It should prove indispensable to graduate students and

serious researchers from academic and industrial sectors working in the field of Nanoscience and Technology from different disciplines including Physics Chemistry Biochemistry Biotechnology Medicine Materials Science Metallurgy Ceramics Information Technology as well as Electrical Electronic and Computational Engineering

An Introduction to Condensed Matter Physics for the Nanosciences Arthur McGurn, 2023-04-13 The book provides an accessible introduction to the principles of condensed matter physics with a focus on the nanosciences and device technologies The basics of electronic phononic photonic superconducting optics quantum optics and magnetic properties are explored and nanoscience and device materials are incorporated throughout the chapters Many examples of the fundamental principles of condensed matter physics are taken directly from nanoscience and device applications This book requires a background in electrodynamics quantum mechanics and statistical mechanics at the undergraduate level It will be a valuable reference for advanced undergraduates and graduate students of physics engineering and applied mathematics Features Contains discussions of the basic principles of quantum optics and its importance to lasers quantum information and quantum computation Provides references and a further reading list to additional scientific literature so that readers can use the book as a starting point to then follow up with a more advanced treatment of the topics covered Requires only a basic background in undergraduate electrodynamics quantum mechanics and statistical mechanics

The Electrical Engineering Handbook - Six Volume Set Richard C. Dorf, 2018-12-14 In two editions spanning more than a decade The Electrical Engineering Handbook stands as the definitive reference to the multidisciplinary field of electrical engineering Our knowledge continues to grow and so does the Handbook For the third edition it has grown into a set of six books carefully focused on specialized areas or fields of study Each one represents a concise yet definitive collection of key concepts models and equations in its respective domain thoughtfully gathered for convenient access Combined they constitute the most comprehensive authoritative resource available Circuits Signals and Speech and Image Processing presents all of the basic information related to electric circuits and components analysis of circuits the use of the Laplace transform as well as signal speech and image processing using filters and algorithms It also examines emerging areas such as text to speech synthesis real time processing and embedded signal processing Electronics Power Electronics Optoelectronics Microwaves Electromagnetics and Radar delves into the fields of electronics integrated circuits power electronics optoelectronics electromagnetics light waves and radar supplying all of the basic information required for a deep understanding of each area It also devotes a section to electrical effects and devices and explores the emerging fields of microlithography and power electronics Sensors Nanoscience Biomedical Engineering and Instruments provides thorough coverage of sensors materials and nanoscience instruments and measurements and biomedical systems and devices including all of the basic information required to thoroughly understand each area It explores the emerging fields of sensors nanotechnologies and biological effects Broadcasting and Optical Communication Technology explores communications information theory and devices covering all of the basic information

needed for a thorough understanding of these areas It also examines the emerging areas of adaptive estimation and optical communication Computers Software Engineering and Digital Devices examines digital and logical devices displays testing software and computers presenting the fundamental concepts needed to ensure a thorough understanding of each field It treats the emerging fields of programmable logic hardware description languages and parallel computing in detail Systems Controls Embedded Systems Energy and Machines explores in detail the fields of energy devices machines and systems as well as control systems It provides all of the fundamental concepts needed for thorough in depth understanding of each area and devotes special attention to the emerging area of embedded systems Encompassing the work of the world s foremost experts in their respective specialties The Electrical Engineering Handbook Third Edition remains the most convenient reliable source of information available This edition features the latest developments the broadest scope of coverage and new material on nanotechnologies fuel cells embedded systems and biometrics The engineering community has relied on the Handbook for more than twelve years and it will continue to be a platform to launch the next wave of advancements The Handbook s latest incarnation features a protective slipcase which helps you stay organized without overwhelming your bookshelf It is an attractive addition to any collection and will help keep each volume of the Handbook as fresh as your latest research

**Low Dimensional Semiconductor Structures** Hilmi Ünlü, Norman J. M. Horing, 2012-09-14 Starting with the first transistor in 1949 the world has experienced a technological revolution which has permeated most aspects of modern life particularly over the last generation Yet another such revolution looms up before us with the newly developed capability to control matter on the nanometer scale A truly extraordinary research effort by scientists engineers technologists of all disciplines in nations large and small throughout the world is directed and vigorously pressed to develop a full understanding of the properties of matter at the nanoscale and its possible applications to bring to fruition the promise of nanostructures to introduce a new generation of electronic and optical devices The physics of low dimensional semiconductor structures including heterostructures superlattices quantum wells wires and dots is reviewed and their modeling is discussed in detail The truly exceptional material Graphene is reviewed its functionalization and Van der Waals interactions are included here Recent research on optical studies of quantum dots and on the physical properties of one dimensional quantum wires is also reported Chapters on fabrication of nanowire based nanogap devices by the dielectrophoretic assembly approach The broad spectrum of research reported here incorporates chapters on nanoengineering and nanophysics In its presentation of tutorial chapters as well as advanced research on nanostructures this book is ideally suited to meet the needs of newcomers to the field as well as experienced researchers interested in viewing colleagues recent advances

**Advanced Electronic Technologies and Systems Based on Low-Dimensional Quantum Devices** M. Balkanski, Nikolai Andreev, 2010-12-15 This volume on Advanced Electronic Technologies and Systems based on Low Dimensional Quantum Devices closes a three years series of NATO AS s The first year was focused on the fundamental properties and applications The second year was

devoted to Devices Based on Low Dimensional Semiconductor Structures The third year is covering Systems Based on Low Dimensional Quantum Semiconductor Devices The three volumes containing the lectures given at the three successive NATO ASI s constitute a complete review on the latest advances in semiconductor Science and Technology from the methods of fabrication of the quantum structures through the fundamental physics am basic knowledge of properties and projection of performances to the technology of devices and systems In the first volume Fabrication Properties and Application of Low Dimensional Semiconductors are described the practical ways in which quantum structures are produced the present status of the technology difficulties encountered and advances to be expected The basic theory of Quantum Wells Double Quantum Wells and Superlattices is introduced and the fundamental aspects of their optical properties are presented The effect of reduction of dimensionality on lattice dynamics of quantum structures is also discussed In the second volume Devices Based on Low Dimensional Structures the fundamentals of quantum structures and devices in the two major fields Electro Optical Devices and Pseudomorphic High Electron Mobility Transistors are extensively discussed

*Introduction to Isotopic Materials Science* Vladimir G. Plekhanov, 2018-12-05 This book describes new trends in the nanoscience of isotopic materials science Assuming a background in graduate condensed matter physics and covering the fundamental aspects of isotopic materials science from the very beginning it equips readers to engage in high level professional research in this area The book s main objective is to provide insight into the question of why solids are the way they are either because of how their atoms are bonded with one another because of defects in their structure or because of how they are produced or processed Accordingly it explores the science of how atoms interact connects the results to real materials properties and demonstrates the engineering concepts that can be used to produce or improve semiconductors by design In addition it shows how the concepts discussed are applied in the laboratory The book addresses the needs of researchers graduate students and senior undergraduate students alike Although primarily written for materials science audience it will be equally useful to those teaching in electrical engineering materials science or even chemical engineering or physics curricula In order to maintain the focus on materials concepts however the book does not burden the reader with details of many of the derivations and equations nor does it delve into the details of electrical engineering topics

*Sensors, Nanoscience, Biomedical Engineering, and Instruments* Richard C. Dorf, 2018-10-03 In two editions spanning more than a decade The Electrical Engineering Handbook stands as the definitive reference to the multidisciplinary field of electrical engineering Our knowledge continues to grow and so does the Handbook For the third edition it has expanded into a set of six books carefully focused on a specialized area or field of study Each book represents a concise yet definitive collection of key concepts models and equations in its respective domain thoughtfully gathered for convenient access Sensors Nanoscience Biomedical Engineering and Instruments provides thorough coverage of sensors materials and nanoscience instruments and measurements and biomedical systems and devices including all of the basic information required to thoroughly understand

each area It explores the emerging fields of sensors nanotechnologies and biological effects Each article includes defining terms references and sources of further information Encompassing the work of the world s foremost experts in their respective specialties Sensors Nanoscience Biomedical Engineering and Instruments features the latest developments the broadest scope of coverage and new material on multisensor data fusion and MEMS and NEMS

**Theory of Electron Transport in Semiconductors** Carlo Jacoboni,2010-09-05 This book originated out of a desire to provide students with an instrument which might lead them from knowledge of elementary classical and quantum physics to modern theoretical techniques for the analysis of electron transport in semiconductors The book is basically a textbook for students of physics material science and electronics Rather than a monograph on detailed advanced research in a specific area it intends to introduce the reader to the fascinating field of electron dynamics in semiconductors a field that through its applications to electronics greatly contributed to the transformation of all our lives in the second half of the twentieth century and continues to provide surprises and new challenges The field is so extensive that it has been necessary to leave aside many subjects while others could be dealt with only in terms of their basic principles The book is divided into five major parts Part I moves from a survey of the fundamentals of classical and quantum physics to a brief review of basic semiconductor physics Its purpose is to establish a common platform of language and symbols and to make the entire treatment as far as possible self contained Parts II and III respectively develop transport theory in bulk semiconductors in semiclassical and quantum frames Part IV is devoted to semiconductor structures including devices and mesoscopic coherent systems Finally Part V develops the basic theoretical tools of transport theory within the modern nonequilibrium Green function formulation starting from an introduction to second quantization formalism

**Effect of Static Electric Fields on The Electronic And Optical Properties of Layered Semiconductor Nanostructures** Volodya A. Harutyunyan,2015-11-04 This volume investigates the theory of the effect of static electric fields on one electron states in nanocylindrical and nanospherical heterolayers and quantized semiconductor films Homogeneous external electrostatic field for all these structures has been considered as a universal modulating factor For structures with radial symmetry a study on the influence of radial static field and the electric field of a charged ring on one electron states is presented Chapters focusing on homogeneous field effect on low dimensional excitonic states in the quantized films and quantum wires in both wide bandgap and narrowband semiconductors are also included Other contents include calculations weak moderate and strong electric fields quantum mechanical approximation and perturbation theory the quasi classical approximation WKB method Readers will benefit from the varied methodological to the subject which gives them a concrete analytical framework to solve problems related to nanoscale semiconductor design The reference should prove to be useful to academics and professionals working in semiconductor nanoelectronics research and development

**Micro and Nano Machined Electrometers** Yong Zhu,2020-02-13 This book reviews advances in cutting edge micro nano electrometers and discusses the technological challenges involved in their practical

implementation The detection of electrostatic charge has a wide range of applications in ionization chambers bio analyte and aerosol particle instruments mass spectrometers scanning tunneling microscopes and even quantum computers Designing micro nano electrometers also known as charge sensors for electrometry is considered vital because of the charge sensitivity and resolution issues at micro nano scales The remarkably dynamic microelectromechanical systems MEMSs nanoelectromechanical systems NEMSs and advances in solid state electronics hold considerable potential for the design and fabrication of extremely sensitive charge sensors **Advances in Solar Energy: Volume 17** D. Yogi Goswami, 2015-12-08 Essential for any serious technical library PROFESSOR MARTIN GREEN UNIVERSITY OF NEW SOUTHWALES AUSTRALIA Valuable detailed information that helps me plan for the future DON OSBORN FORMERLY OF SACRAMENTO MUNICIPAL UTILITY DISTRICT The Advances in Solar Energy series offers state of the art information on all primary renewable energy technologies including solar wind and biomass bringing together invited contributions from the foremost international experts in renewable energy Spanning a broad range of technical subjects this volume and series is a must have reference on global developments in the field of renewable energy Volume 17 focuses primarily on solar energy with respect to heating hot water drying and detoxification Specific chapter subjects include Alternative World Energy Outlook 2006 A Possible Path towards a Sustainable Future Quantum Well Solar Cells Recent Progress of Organic Photovoltaics Thermal and Material Characterization of Immersed Heat Exchangers for Solar Domestic Hot Water Photocatalytic Detoxification of Water with Solar Energy Solar Hydrogen A Solid State Chemistry Perspective Solar Heat for Industrial Processes Solar Energy Technology in the Middle East and North Africa MENA for Sustainable Energy Water and Environment

*Nanotechnology-Enabled Sensors* Kourosh Kalantar-zadeh, Benjamin Fry, 2007-09-19 Nanotechnology provides tools for creating functional materials devices and systems by controlling materials at the atomic and molecular scales and making use of novel properties and phenomena Nanotechnology enabled sensors find applications in several fields such as health and safety medicine process control and diagnostics This book provides the reader with information on how nanotechnology enabled sensors are currently being used and how they will be used in the future in such diverse fields as communications building and facilities medicine safety and security including both homeland defense and military operations

**Fabrication, Properties and Applications of Low-Dimensional Semiconductors** M. Balkanski, Ivan Yanchev, 2012-12-06 A recent major development in high technology and one which bears considerable industrial potential is the advent of low dimensional semiconductor quantum structures The research and development activity in this field is moving fast and it is thus important to afford scientists and engineers the opportunity to get updated by the best experts in the field The present book draws together the latest developments in the fabrication technology of quantum structures as well as a competent and extensive review of their fundamental properties and some remarkable applications The book is based on a set of lectures that introduce different aspects of the basic knowledge available it has a tutorial content and could

be used as a textbook Each aspect is reviewed from elementary concepts up to the latest developments Audience Undergraduates and graduates in electrical engineering and physics schools Also for active scientists and engineers updating their knowledge and understanding of the frontiers of the technology

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In some sort of defined by information and interconnectivity, the enchanting power of words has acquired unparalleled significance. Their capability to kindle emotions, provoke contemplation, and ignite transformative change is really awe-inspiring. Enter the realm of "**Low Dimensional Semiconductor Structures Fundamentals And Device Applications**," a mesmerizing literary masterpiece penned with a distinguished author, guiding readers on a profound journey to unravel the secrets and potential hidden within every word. In this critique, we shall delve to the book is central themes, examine its distinctive writing style, and assess its profound impact on the souls of its readers.

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