

NANOSCIENCE  
AND TECHNOLOGY

M. Grundmann  
(Ed.)

# Nano- Optoelectronics

Concepts, Physics  
and Devices



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# Nanophotonics Concepts Physics And Devices

**Marius Grundmann**



## **Nanooptoelectronics Concepts Physics And Devices:**

**Nano-Optoelectronics** Marius Grundmann, 2002-07-03 Traces the quest to use nanostructured media for novel and improved optoelectronic devices Leading experts among them Nobel laureate Zhores Alferov write here about the fundamental concepts behind nano optoelectronics the material basis physical phenomena device physics and systems

**Nano-Optoelectronics** Marius Grundmann, 2012-12-06 Traces the quest to use nanostructured media for novel and improved optoelectronic devices Leading experts among them Nobel laureate Zhores Alferov write here about the fundamental concepts behind nano optoelectronics the material basis physical phenomena device physics and systems

Nanoelectrodynamics Hitoshi Nejo, 2013-03-14 Many books on mesoscopic systems have been published as progress has continued in the fields of nanoscience and nanotechnology The focus in these books is mainly on quantum mechanical behavior in artificial electronic systems fabricated by nanometer scale structuring Such quantum mechanical behavior is projected to macroscopic observers and the quantum nature can be utilized in practical devices Quantum computers another hot topic nowa days are characterized by excitation coherence properties among nanostructures and the ability to maintain excitations is very important when using the characteristics as information In that sense the device is described as a microscopic system and some processes occur before being projected to macroscopic observers In this book the authors try to describe not only the techniques for fabricating nanostructures but also new directions as regards exciting systems and understanding how energy is dissipated through observation The idea of nano electrodynamics underlying the book is an analogy with the well established classical electrodynamics In contrast to the latter nano electrodynamics is still in its infancy and far from well established When a structure is miniaturized as a device it is essential to have control over energy excitation and dissipation Otherwise when a device is squeezed down beyond a certain size and the energy dissipation becomes overwhelmed the device will eventually collapse It is our aim in this book to provide some thoughts on the task of making devices out of small structures

**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

**Advanced Nano Deposition Methods** Yuan Lin,2016-12-12 This concise reference summarizes the latest results in nano structured thin films the first to discuss both deposition methods and electronic applications in detail Following an introduction to this rapidly developing field the authors present a variety of organic and inorganic materials along with new deposition techniques and conclude with an overview of applications and considerations for their technology deployment

Nanotechnology Ben Rogers,Jesse Adams,Sumita Pennathur,2013-03-20 Winner of an Outstanding Academic Title Award from CHOICE Magazine Transistors using one electron at a time Seemingly transparent sunscreens made with titanium dioxide particles that block harmful UV rays Nanometer sized specks of gold that change color to red and melt at 750 C instead of 1 064 C Nanotechnology finds the unique properties of thin

**Self-Assembled Quantum Dots** Zhiming M Wang,2007-11-29 This multidisciplinary book provides up to date coverage of carrier and spin dynamics and energy transfer and structural interaction among nanostructures Coverage also includes current device applications such as quantum dot lasers and detectors as well as future applications to quantum information processing The book will serve as a reference for anyone working with or planning to work with quantum dots

**Semiconductor Nanostructures for Optoelectronic Applications** Todd D. Steiner,2004 Annotation Tiny structures measurable on the nanometer scale one billionth of a meter are known as nanostructures and nanotechnology is the emerging application of these nanostructures into useful nanoscale devices As we enter the 21st century more and more professional are using nanotechnology to create semiconductors for a variety of applications including communications information technology medical and transportation devices Written by today s best researchers of semiconductor nanostructures this cutting edge resource provides a snapshot of this exciting and fast changing field The book covers the latest advances in nanotechnology and discusses the applications of nanostructures to optoelectronics photonics and electronics

**Nanophysics, Nanoclusters and Nanodevices** Kimberly S. Gehar,2006 Nanotechnology is a catch all description of activities at the level of atoms and molecules that have applications in the real world A nanometre is a billionth of a metre about 1 80 000 of the diameter of a human hair or 10 times the diameter of a hydrogen atom Nanotechnology is now used in precision engineering new materials development as well as in electronics electromechanical systems as well as mainstream biomedical applications in areas such as gene therapy drug delivery and novel drug discovery techniques This book presents the latest research in this frontier field

**Handbook of Self Assembled Semiconductor Nanostructures for Novel Devices in Photonics and Electronics** Mohamed Henini,2011-07-28 The self assembled nanostructured materials described in this book offer a number of advantages over conventional material technologies in a wide range of sectors World leaders in the

field of self organisation of nanostructures review the current status of research and development in the field and give an account of the formation properties and self organisation of semiconductor nanostructures Chapters on structural electronic and optical properties and devices based on self organised nanostructures are also included Future research work on self assembled nanostructures will connect diverse areas of material science physics chemistry electronics and optoelectronics This book will provide an excellent starting point for workers entering the field and a useful reference to the nanostructured materials research community It will be useful to any scientist who is involved in nanotechnology and those wishing to gain a view of what is possible with modern fabrication technology Mohamed Henini is a Professor of Applied Physics at the University of Nottingham He has authored and co authored over 750 papers in international journals and conference proceedings and is the founder of two international conferences He is the Editor in Chief of Microelectronics Journal and has edited three previous Elsevier books Contributors are world leaders in the field Brings together all the factors which are essential in self organisation of quantum nanostructures Reviews the current status of research and development in self organised nanostructured materials Provides a ready source of information on a wide range of topics Useful to any scientist who is involved in nanotechnology Excellent starting point for workers entering the field Serves as an excellent reference manual

**Compound Semiconductors** Ferdinand Scholz, 2017-10-06 This book provides an overview of compound semiconductor materials and their technology After presenting a theoretical background it describes the relevant material preparation technologies for bulk and thin layer epitaxial growth It then briefly discusses the electrical optical and structural properties of semiconductors complemented by a description of the most popular characterization tools before more complex hetero and low dimensional structures are discussed A special chapter is devoted to GaN and related materials owing to their huge importance in modern optoelectronic and electronic devices on the one hand and their particular properties compared to other compound semiconductors on the other In the last part of the book the physics and functionality of optoelectronic and electronic device structures LEDs laser diodes solar cells field effect and heterojunction bipolar transistors are discussed on the basis of the specific properties of compound semiconductors presented in the preceding chapters of the book Compound semiconductors form the back bone of all opto electronic and electronic devices besides the classical Si electronics Currently the most important field is solid state lighting with highly efficient LEDs emitting visible light Also laser diodes of all wavelength ranges between mid infrared and near ultraviolet have been the enabler for a huge number of unprecedented applications like CDs and DVDs for entertainment and data storage not to speak about the internet which would be impossible without optical data communications with infrared laser diodes as key elements This book provides a concise overview over this class of materials including the most important technological aspects for their fabrication and characterisation also covering the most relevant devices based on compound semiconductors It presents therefore an excellent introduction into this subject not only for students but also for engineers and scientist who intend to put their focus

on this field of science      Sensors, Nanoscience, Biomedical Engineering and Instruments Mr. Rohit Manglik, 2024-01-14

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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

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**Semiconductor Quantum Dots** Y. Masumoto, T. Takagahara, 2013-04-17 Semiconductor quantum dots represent one of the fields of solid state physics that have experienced the greatest progress in the last decade Recent years have witnessed the discovery of many striking new aspects of the optical response and electronic transport phenomena This book surveys this progress in the physics optical spectroscopy and application oriented research of semiconductor quantum dots It focuses especially on excitons multi excitons their dynamical relaxation behaviour and their interactions with the surroundings of a semiconductor quantum dot Recent developments in fabrication techniques are reviewed and potential applications discussed This book will serve not only as an introductory textbook for graduate students but also as a concise guide for active researchers

**Non-Equilibrium Dynamics of Semiconductors and Nanostructures** Kong-Thon Tsen, 2018-10-03 The advent of the femto second laser has enabled us to observe phenomena at the atomic timescale One area to reap enormous benefits from this ability is ultrafast dynamics Collecting the works of leading experts from around the globe Non Equilibrium Dynamics of Semiconductors and Nanostructures surveys recent developments in a variety of areas in ultrafast dynamics In eight authoritative chapters illustrated by more than 150 figures this book spans a broad range of new techniques and advances It begins with a review of spin dynamics in a high mobility two dimensional electron gas followed by the generation propagation and nonlinear properties of high amplitude ultrashort strain solitons in solids The discussion then turns to nonlinear optical properties of nanoscale artificial dielectrics optical properties of GaN self assembled quantum dots and optical studies of carrier dynamics and non equilibrium optical phonons

in nitride based semiconductors Rounding out the presentation the book examines ultrafast non equilibrium electron dynamics in metal nanoparticles monochromatic acoustic phonons in GaAs and electromagnetically induced transparency in semiconductor quantum wells With its pedagogical approach and practical up to date coverage *Non Equilibrium Dynamics of Semiconductors and Nanostructures* allows you to easily put the material into practice whether you are a seasoned researcher or new to the field

**Semiconductor Physics** Karlheinz Seeger, 2013-03-09 This book now in its ninth edition still has the character of a textbook with the emphasis on Physics The volume has increased somewhat because several improvements have been made and some new items have been included In Sect 13 2 the new Quantum Cascade Laser which covers the far in frared spectral range has been added In Sect 14 4 the theory of the quantum Hall effect is now based on ballistic transport which in a more general respect without referring to the then still unknown quantum Hall effect was consid ered already by Rudolf Peierls In the same chapter the recent discovery of a low temperature resistance oscillation in a very pure semiconductor under the influence of combined dc and ac electric fields in addition to a magnetic field is presented Furthermore quantum Hall effect observations with an unpre dented high precision are remarkable and may give a new impetus to theory A new Sect 15 5 presents information about coaxial carbon tubes of nanometer size diameter and how they are integrated as the current transporting element in a field effect transistor In another new addition Sect 15 6 with the title Molecular Electronics the current voltage rectifying characteristics of an or ganic Langmuir Blodgett film of nanometer thickness is shown These efforts serve to demonstrate where the ever decreasing size of electronic circuits may come to its natural limits The system of units preferred here is the SI system

*Introduction to Simulations of Semiconductor Lasers* Marek Wartak, 2024-03-21 Simulations play an increasingly important role not only in scientific research but also in engineering developments *Introduction to Simulations of Semiconductor Lasers* introduces senior undergraduates to the design of semiconductor lasers and their simulations The book begins with explaining the physics and fundamental characteristics behind semiconductor lasers and their applications It presumes little prior knowledge such that only a familiarity with the basics of electromagnetism and quantum mechanics is required The book transitions from textbook explanations equations and formulas to ready to run numeric codes that enable the visualization of concepts and simulation studies Multiple chapters are supported by MATLAB code which can be accessed by the students These are ready to run but they can be modified to simulate other structures if desired Providing a unified treatment of the fundamental principles and physics of semiconductors and semiconductor lasers *Introduction to Simulations of Semiconductor Lasers* is an accessible practical guide for advanced undergraduate students of Physics particularly for courses in laser physics

**Key Features** A unified treatment of fundamental principles Explanations of the fundamental physics of semiconductor Explanations of the operation of semiconductor lasers An historical overview of the subject

[Nanocomposite Materials for Biomedical and Energy Storage Applications](#) Ashutosh Sharma, 2022-11-02 *Nanocomposite Materials for Biomedical and Energy Storage*



Applications presents an overview of various types of advanced nanostructured and nanocomposite materials. It discusses current research trends, problems, and applications of these nanomaterials in various biomedical, energy conversion, and storage applications. The book also gives a brief overview of advances in conducting polymers and their applications in electronic devices. Chapters address such topics as nanocomposite materials and their fabrication, nanocomposite materials for energy conversion and energy storage devices, advanced nanocomposite materials in biomedicine and health care, nanocomposites in organic light emitting diodes and display devices, and much more. *Progress in Compound Semiconductor Materials ...--electronic and Optoelectronic Applications*, 2005

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