



Semiconductor Optics

Heinz Kalt, Claus F. Klingshirn



Semiconductor Optics:

Semiconductor Optics Claus F. Klingshirn, 2012-07-06 The updated and enlarged new edition of this book provides an introduction to and an overview of semiconductor optics from the IR through the visible to the UV It includes coverage of linear and nonlinear optical properties dynamics magneto and electrooptics high excitation effects some applications experimental techniques and group theory The mathematics is kept as elementary as possible The subjects covered extend from physics to materials science and optoelectronics New or updated chapters add coverage of current topics while the chapters on bulk materials have been revised and updated

Semiconductor Optics Claus F. Klingshirn, 1995-07-21 *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

Semiconductor Optics 1 Heinz Kalt, Claus F. Klingshirn, 2019-09-20 This revised and updated edition of the well received book by C Klingshirn provides an introduction to and an overview of all aspects of semiconductor optics from IR to visible and UV It has been split into two volumes and rearranged to offer a clearer structure of the course content Inserts on important experimental techniques as well as sections on topical research have been added to support research oriented teaching and learning Volume 1 provides an introduction to the linear optical properties of semiconductors The mathematical treatment has been kept as elementary as possible to allow an intuitive approach to the understanding of results of semiconductor spectroscopy Building on the phenomenological model of the Lorentz oscillator the book describes the interaction of light with fundamental optical excitations in semiconductors phonons free carriers excitons It also offers a broad review of seminal research results augmented by concise descriptions of the relevant experimental techniques e g Fourier transform IR spectroscopy ellipsometry modulation spectroscopy and spatially resolved methods to name a few Further it picks up on hot topics in current research like quantum structures mono layer semiconductors or Perovskites The experimental aspects of semiconductor optics are complemented by an in depth discussion of group theory in solid state optics Covering subjects ranging from physics to materials science and optoelectronics this book provides a lively and comprehensive introduction to semiconductor optics With over 120 problems more than 480 figures abstracts to each chapter as well as boxed inserts and a detailed index it is intended for use in graduate courses in physics and neighboring sciences like material science and electrical engineering It is also a valuable reference resource for doctoral and advanced researchers

Semiconductor Optics and Transport Phenomena Wilfried Schäfer, Martin Wegener, 2013-06-29 Whenever a physicist visits the physics faculty in Dortmund he she is bound to hear the success story of the so called integrated course a four semester introduction to physics These lectures are given by two professors simultaneously one experimentalist and one

theorist After having asked the common question How many professors have killed each other the visitor usually realizes that this is an excellent way of presenting a coherent introduction to both experimental and theoretical physics We decided to try this concept in an advanced course on semiconductor physics At that point the typical student has already had an introductory course in solid state physics and solid state theory The aim of the lectures was to repeat some of the most important well known classics of semiconductor optics and transport and eventually guide the students to topics of current interest in research When preparing the lectures we did not find a textbook addressing all these aspects experiment and theory in semiconductor optics and transport which made us write this book This book presents the phenomenology and a simple intuitive understanding of many effects and in addition attempts to explain the underlying physics on a consistent theoretical footing Calculations are presented such that a student should be able to follow them with a pencil and a piece of paper

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

Optics of Semiconductors and Their Nanostructures Heinz Kalt, Michael Hetterich, 2013-04-09 In recent years the field of semiconductor optics has been pushed to several extremes The size of semiconductor structures has shrunk to dimensions of a few nanometers the semiconductor light interaction is studied on timescales as fast as a few femtoseconds and transport properties on a length scale far below the wavelength of light have been revealed These advances were driven by rapid improvements in both semiconductor and optical technologies and were further facilitated by progress in the theoretical description of optical excitations in semiconductors This book written by leading experts in the field provides an up to date introduction to the optics of semiconductors and their nanostructures so as to help the reader understand these exciting new developments It also discusses recently established applications such as blue light emitters as well as the quest for future applications in areas such as spintronics quantum information processing and third generation solar cells

Coherent Semiconductor Optics Torsten Meier, Peter Thomas, Stephan W. Koch, 2007-02-13 This book could not have been written without the extensive work of many diploma and Ph D students in our Theoretical Semiconductor Physics Group at the Philipps University in Marburg They have contributed to the fundamental understanding and to many applications in the area of coherent semiconductor optics The one dimensional tight binding model which is exclusively treated in the present book has been the basis of many of their diploma and Ph D theses The reader will find references to their results and also their names as authors of the publications listed in the sections Suggested Reading In particular the authors wish to thank Irina Kuznetsova who prepared a large number of the figures and recalculated the underlying data on the basis of the equations

presented in this book in cases where parameters or presentation had to be changed and or optimized Some of the problems in particular those connected to the more introductory chapters were solved by Swantje Horst and Joachim Kalden They made valuable suggestions for improved formulation of the problems and pointed out a number of hints we should give our readers in order to help them with the solutions Furthermore we wish to thank all our numerous collaborators together with whom we have performed research in the area of coherent semiconductor optics in the past and present for many valuable discussions In particular without the close cooperation between experiment and theory this research would not have advanced to the present level

Semiconductor Optics 2 Heinz Kalt, Claus F. Klingshirn, 2024-03-16 This book provides an introduction to and an overview of the multifaceted area of dynamics and nonlinearities related to optical excitations in semiconductors It is a revised and significantly extended edition of the well established book by C Klingshirn split into two volumes and restructured to make it more concise Inserts on important experimental techniques reference to topical research and novel materials as well as consideration of photonic applications support research oriented teaching and learning This book reviews nonlinear optical properties and many body phenomena evoked by high densities of quasi particles in semiconductors Coherent dynamics and relaxation of optical excitations carriers excitons electron hole plasmas etc as well as condensation phenomena are elucidated in these materials A broad overview is provided of seminal research results augmented by detailed descriptions of the relevant experimental techniques e g ultrafast spectroscopy four wave mixing and the Hanbury Brown and Twiss experiment Offering a comprehensive introduction to hot topics in current research polariton condensates valley coherence and single photons to name a few it also discusses applications of the described physical concepts in topical areas such as quantum information photonics spintronics and optoelectronics Covering subjects ranging from physics to materials science and optoelectronics the book provides a lively and comprehensive introduction to semiconductor optics beyond the linear regime With many problems chapter introductions schematic depictions of physical phenomena as well as boxed inserts and a detailed index it is suitable for use in graduate courses in physics and neighboring sciences like material science and optical communication It is also a valuable reference resource for doctoral and advanced researchers

Fundamentals of Photonics Bahaa E. A. Saleh, Malvin Carl Teich, 2020-03-04 Fundamentals of Photonics A complete thoroughly updated full color third edition Fundamentals of Photonics Third Edition is a self contained and up to date introductory level textbook that thoroughly surveys this rapidly expanding area of engineering and applied physics Featuring a blend of theory and applications coverage includes detailed accounts of the primary theories of light including ray optics wave optics electromagnetic optics and photon optics as well as the interaction of light and matter Presented at increasing levels of complexity preliminary sections build toward more advanced topics such as Fourier optics and holography photonic crystal optics guided wave and fiber optics LEDs and lasers acousto optic and electro optic devices nonlinear optical devices ultrafast optics optical interconnects and switches and optical fiber communications The

third edition features an entirely new chapter on the optics of metals and plasmonic devices Each chapter contains highlighted equations exercises problems summaries and selected reading lists Examples of real systems are included to emphasize the concepts governing applications of current interest Each of the twenty four chapters of the second edition has been thoroughly updated **Optical Properties and Applications of Semiconductors** Inamuddin,Mohd Imran

Ahamed,Rajender Boddula,Tariq Altalhi,2022-07-18 Semiconductors with optical characteristics have found widespread use in evolving semiconductor photovoltaics where optical features are important The industrialization of semiconductors and their allied applications have paved the way for optical measurement techniques to be used in new ways Due to their unique properties semiconductors are key components in the daily employed technologies in healthcare computing communications green energy and a range of other uses This book examines the fundamental optical properties and applications of semiconductors It summarizes the information as well as the optical characteristics and applicability of semiconductors through an in depth review of the literature Accomplished experts in the field share their knowledge and examine new developments **FEATURES** Comprehensive coverage of all types of optical applications using semiconductors Explores relevant composite materials and devices for each application Addresses the optical properties of crystalline and amorphous semiconductors Describes new developments in the field and future potential applications **Optical Properties and Applications of Semiconductors** is a comprehensive reference and an invaluable resource for engineers scientists academics and industry R D teams working in applied physics **Introduction To Semiconductor Physics** Holger T

Grahn,1999-04-19 This book covers the physics of semiconductors on an introductory level assuming that the reader already has some knowledge of condensed matter physics Crystal structure band structure carrier transport phonons scattering processes and optical properties are presented for typical semiconductors such as silicon but III V and II VI compounds are also included In view of the increasing importance of wide gap semiconductors the electronic and optical properties of these materials are dealt with too **Fundamentals of Semiconductors** Peter YU,Manuel Cardona,2010-04-07 Excellent bridge

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

Handbook of Carbon Nano Materials Francis D'Souza, Karl M. Kadish, 2011

- 1 Functionalization of graphene Nikolaos Karousis, Solon Economopoulos and Nikos Tagmatarchis
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- 3 Carbon nanomaterial based molecular architectures for light energy conversion Taku Hasobe
- 4 Electrochemistry of carbon nanostructures from pristine materials to functional devices Matteo Iurlo und weitere
- 5 Fullerene based self assembled morphological materials Yanfei Shen, Junko Aimi and Takashi Nakanishi
- 6 Hybrids involving fullerenes and carbon nanotubes Maria Vizuite und weitere
- 7 Semiconductor carbon nanotube optics Lisa J. Nogaj, Libai Huang and Todd D. Krauss
- 8 Near field optics of SWNTs and FRET in their nanoscale complexes Tetyana Ignatova, Andrei M. Nemilentsau and Slava V. Rotkin
- 9 Understanding the role of the metal catalyst in carbon nanotube growth towards chiral selective growth of single walled carbon nanotubes Wei Hung Chiang and R. Mohan Sankaran
- 10 Stability computations for fullerenes and metallofullerenes Zdenek Slanina und weitere

Medicinal and Bio-Related Applications Francis D'Souza, Karl M. Kadish, 2012

A hands on reference guide for scientists working in the area of medicine, biology, chemistry, physics, materials science, sensor and biosensor devices and nanotechnology. The first volume compiles topics from leading authors on medicinal and bio related applications while the second volume covers topics ranging from materials and fundamental applications. In depth and comprehensive coverage of topics combined with the perspectives for future research by the contributing authors. An invaluable reference source essential for both beginning and advanced researchers in the field.

Handbook Of Carbon Nano Materials (In 2 Volumes) - Volume 3: Medicinal And Bio-related Applications; Volume 4: Materials And Fundamental Applications Karl M. Kadish, Francis D'souza, 2012-05-15

A hands on reference guide for scientists working in the area of medicine, biology, chemistry, physics, materials science, sensor and biosensor devices and nanotechnology. The first volume compiles topics from leading authors on medicinal and bio related applications while the second volume covers topics ranging from materials and fundamental applications. In depth and comprehensive coverage of topics combined with the perspectives for future research by the contributing authors. An invaluable reference source essential for both beginning and advanced researchers in the field.

Quantum Coherence Correlation and Decoherence in Semiconductor Nanostructures Toshihide Takagahara, 2003-02-10

Semiconductor nanostructures are attracting a great deal of interest as the most promising device with which to implement quantum information processing and quantum computing. This book surveys the present status of nanofabrication techniques, near field spectroscopy and microscopy to assist the fabrication of nanostructures. It will be essential reading for academic and industrial researchers in pure and applied physics, optics, semiconductors and microelectronics. The first up to date review articles on various aspects on quantum coherence correlation and decoherence in semiconductor nanostructures.

II-VI Semiconductor Materials and their Applications Maria C. Tamargo, 2018-05-04

II-VI Semiconductor Materials and Their Applications deals with II-VI compound semiconductors and the status of the two areas of current optoelectronics applications: blue green emitters and IR

detectors Specifically the growth characterization materials and device issues for these two applications are described Emphasis is placed on the wide bandgap emitters where much progress has occurred recently The book also presents new directions that have potential future applications in optoelectronics for II VI materials In particular it discusses the status of dilute magnetic semiconductors for magnetic optical and electromagnetic devices nonlinear optical properties photorefractive effects and new materials and physics phenomena such as self organized low dimensional structures II_VI Semiconductor Materials and Their Applications is a valuable reference book for researchers in the field as well as a textbook for materials science and applied physics courses

Quantum Theory of the Optical and Electronic Properties of Semiconductors
Hartmut Haug, Stephan W. Koch, 2004 This invaluable textbook presents the basic elements needed to understand and research into semiconductor physics It deals with elementary excitations in bulk and low dimensional semiconductors including quantum wells quantum wires and quantum dots The basic principles underlying optical nonlinearities are developed including excitonic and many body plasma effects Fundamentals of optical bistability semiconductor lasers femtosecond excitation the optical Stark effect the semiconductor photon echo magneto optic effects as well as bulk and quantum confined Franz Keldysh effects are covered The material is presented in sufficient detail for graduate students and researchers with a general background in quantum mechanics

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
Spectroscopy of Semiconductors and Semiconductor Nanostructures Jagdeep Shah, 2013-11-11

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Semiconductor Optics Introduction

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