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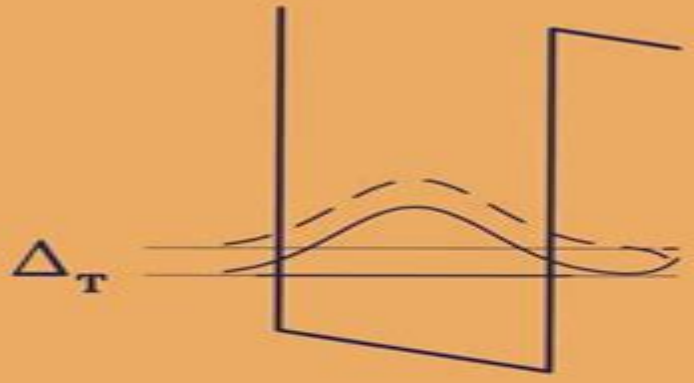
Alex V. Kuznetsov

Electronic States and Optical Transitions in Semiconductor Heterostructures



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Electronic States And Optical Transitions In Semiconductor Heterostructures

David Gershoni

Electronic States And Optical Transitions In Semiconductor Heterostructures:

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 *Fundamentals of Solid State Engineering* Manijeh Razeghi,2006-06-12 Fundamentals of Solid State Engineering 2nd Edition provides a multi disciplinary introduction to Solid State Engineering combining concepts from physics chemistry electrical engineering materials science and mechanical engineering Basic physics concepts are introduced followed by a thorough treatment of the technology for solid state engineering Topics include compound semiconductor bulk and epitaxial thin films growth techniques current semiconductor device processing and nano fabrication technologies Examples of semiconductor devices and a description of their theory of operation are then discussed including transistors semiconductor lasers and photodetectors Revised throughout this second edition includes new chapters on the reciprocal lattice optical properties of semiconductors semiconductor heterostructures semiconductor characterization techniques and an introduction to lasers Additions and improvements have been made to the material on photodetectors and quantum mechanics as well as to the problem sections *Electronic States and Optical Transitions in Bulk and Quantum Well Structures of III-V Compound Semiconductors* Yong Hee Cho,2015 In this work we apply the methods of band structure calculation combined with self consistent treatment of the light matter interaction to a variety of problems in bulk semiconductors and semiconductor heterostructures as well as in new optoelectronic devices In particular we utilize the 30 and 8 band k p band structure calculation methods to study the electronic magnetic and optical properties of the diluted magnetic semiconductor GaMnAs in the mean field Zener model We calculate the anisotropic

dielectric response of GaMnAs in the metallic regime and show that our model produces a good agreement with the experimental results of magneto optical Kerr spectroscopy in the interband transition region We also discuss the advantages of the 30 band k p model for spin polarized ferromagnetic GaMnAs We present new methods for calculating electronic states in low dimensional semiconductor heterostructures based on the real space Hamiltonian The formalism provides extreme simplicity of the numerical implementation and superior accuracy of the results They are applicable to a general n band k p model and specifically tested in the 6 and 8 band k p models and a simple parabolic one band model The transparency of the new method allows us to investigate the origin and elimination of spurious solutions in the unified manner Spurious solutions have long been a major issue in low dimensional band structure calculations As an application of nonlinear optical interactions in two dimensional semiconductor heterostructures we calculate the upper limits on the efficiency of the passive terahertz difference frequency generation based on the intersubband resonant nonlinearity Our approach incorporates electronic states together with propagating coupled fields through the self consistent calculation of the Poisson equation density matrix equations and coupled wave equations We develop optimal device geometries and systematically study the device performance as a function of various parameters The results are compared with a simplified analytic solution The electronic version of this dissertation is accessible from http hdl handle net 1969 1 152436 **Handbook of II-VI Semiconductor-Based Sensors and Radiation Detectors** Ghenadii Korotcenkov,2023-04-20 Three volumes book Handbook of II VI Semiconductor Based Sensors and Radiation Detectors is the first to cover both chemical sensors and biosensors and all types of photodetectors and radiation detectors based on II VI semiconductors It contains a comprehensive and detailed analysis of all aspects of the application of II VI semiconductors in these devices The first volume Materials and Technologies of a three volume set describes the physical chemical and electronic properties of II VI compounds which give rise to an increased interest in these semiconductors Technologies that are used in the development of various devices based on II VI connections such as material synthesis deposition characterization processing and device fabrication are also discussed in detail in this volume It covers also topics related to synthesis and application of II VI based nanoparticles and quantum dots as well their toxicity biocompatibility and biofunctionalization **Characterization of Semiconductor Heterostructures and Nanostructures** S. Sanguinetti,M. Guzzi,E. Gatti,M. Gurioli,2013-04-11 *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 *Optics of Excitons in Confined Systems, Proceedings of the INT Meeting, Italy, 24-27 September 1991* Andrea D'Andrea,1992-03-26 Optics of Excitons in Confined Systems provides an overview of research in semiconductors that exhibit resonance enhanced optical nonlinearities in the frequency range close to the valence conduction band gap The book is divided into the following sections quantum wells wires and dots superlattices nonlinear optical properties of confined systems and effects of external fields on confined systems Topics range from fundamental theory to more applied aspects of excitons in confined sytems **Introduction to Superstrings and M-Theory** Michio Kaku,2012-12-06 Superstrings provocative controversial possibly untestable but unarguably one of the most interesting and active areas of research in current physics Called by some the theory of everything superstrings may solve a problem which has eluded physicists for the past 50 years the final unification of the two great theories of the twentieth century general relativity and quantum field theory Now here is a course tested comprehensive introductory graduate text on superstrings which stresses the most current areas of interest not covered in other presentation including string field theory multi loops Teichmueller spaces conformal field theory four dimensional strings The book begins with a simple discussion of point particle theory and uses the Feynman path integral technique to unify the presentation of superstrings Prerequisites are an aquaintance with quantum mechanics and relativity This second edition has been revised and updated throughout **Gallium-Nitride (GaN) II** ,1998-10-22 Since its inception in 1966 the series of numbered volumes known as Semiconductors and Semimetals has distinguished itself through the careful selection of well known authors editors and contributors The Willardson and Beer Series as it is widely known has succeeded in publishing numerous landmark volumes and chapters Not only did many of these volumes make an impact at the time of their publication but they continue to be well cited years after their original release Recently Professor Eicke R Weber of the University of California at Berkeley joined as a co editor of the series Professor Weber a well known expert in the field of semiconductor materials will further contribute to continuing the series tradition of publishing timely highly relevant and long impacting volumes Some of the recent volumes such as Hydrogen in Semiconductors Imperfections in III V Materials Epitaxial Microstructures High Speed Heterostructure Devices Oxygen in Silicon and others promise indeed that this tradition will be maintained and even expanded Reflecting the truly interdisciplinary nature of the field that the series covers the volumes in Semiconductors and Semimetals have been and will continue to be of great interest to physicists chemists materials scientists and device

engineers in modern industry **Quantum Optics of Confined Systems** M. Ducloy,Daniel Bloch,2012-12-06 In the last few years it was seen the emergence of various new quantum phenomena specifically related with electronic or optical confinement on a sub wavelength size Fast developments simultaneously occurred in the field of Atomic Physics notably through various regimes of Cavity Quantum Electrodynamics and in Solid State Physics with advances in Quantum Well technology and Nanooptoelectronics Simultaneously breakthroughs in Near Field Optics provided new tools which should be widely applicable to these domains However the key concepts used to describe these new and partly related effects are often very different and specific of the Community involved in a given development It has been the ambition of the Meeting held at Centre de Physique des Houches to give an opportunity to specialists of different Communities to deepen their understanding of advances more or less intimately related to their own field while presenting the basic concepts of these different fields through pedagogical Introductions The audience comprised advanced students postdocs and senior scientists with a balanced participation of Atomic Physicists and Solid State Physicists and had a truly international character The considerable efforts of the lecturers in order to present exciting new results in a language accessible to the whole audience were the essential ingredients to achieve successfully what was the main goal of this School **Physics of Photonic Devices** Shun Lien Chuang,2012-11-07 The most up to date book available on the physics of photonic devices This new edition of Physics of Photonic Devices incorporates significant advancements in the field of photonics that have occurred since publication of the first edition Physics of Optoelectronic Devices New topics covered include a brief history of the invention of semiconductor lasers the Lorentz dipole method and metal plasmas matrix optics surface plasma waveguides optical ring resonators integrated electroabsorption modulator lasers and solar cells It also introduces exciting new fields of research such as surface plasmonics and micro ring resonators the theory of optical gain and absorption in quantum dots and quantum wires and their applications in semiconductor lasers and novel microcavity and photonic crystal lasers quantum cascade lasers and GaN blue green lasers within the context of advanced semiconductor lasers Physics of Photonic Devices Second Edition presents novel information that is not yet available in book form elsewhere Many problem sets have been updated the answers to which are available in an all new Solutions Manual for instructors Comprehensive timely and practical Physics of Photonic Devices is an invaluable textbook for advanced undergraduate and graduate courses in photonics and an indispensable tool for researchers working in this rapidly growing field *Physics Of Semiconductors, The - Proceedings Of The 24th International Conference (With Cd-rom)* David Gershoni,1999-03-12 The proceedings of this important conference consist of plenary and invited papers published in hard copy and CD ROM versions The contributed oral and poster presentations are included in the CD ROM version only *Optical Properties of Semiconductors* G. Martinez,2013-06-29 It is widely recognized that an understanding of the optical pro perties of matter will give a great deal of important information re levant to the fundamental physical properties This is especially true in semiconductor physics for which due to the

intrinsic low screening of these materials the optical response is quite rich Their spectra reflect indeed as well electronic as spin or phonon transitions This is also in the semiconductor field that artificial structures have been recently developed showing for the first time specific physical properties related to the low dimentionality of the electronic and vi bronic properties with this respect the quantum and fractional quan tum Hall effects are among the most well known aspects The associated reduced screening is also a clear manifestation of these aspects and as such favors new optical properties or at least significantly enhan ces some of them For all these reasons it appeared necessary to try to review in a global way what the optical investigation has brought today about the understanding of the physics of semiconductors This volume collects the papers presented at the NATO Advanced study Inst i tut e on Optical Properties of Semiconductors held at the Ettore Majorana Centre Erice Sicily on March 9th to 20th 1992 This school brought together 70 scientists active in research related to optical properties of semiconductors There were 12 lecturers who pro vided the main contributions Chemical Abstracts ,2002 **Fundamentals of Semiconductor** Peter YU,Manuel Cardona,2013-11-11 Fundamentals of Semiconductors attempts to fill the gap between a general solid state physics textbook and research articles by providing detailed explanations of the electronic vibrational transport and optical properties of semiconductors The approach is physical and intuitive rather than formal and pedantic Theories are presented to explain experimental results This textbook has been written with both students and researchers in mind Its emphasis is on understanding the physical properties of Si and similar tetrahedrally coordinated semiconductors The explanations are based on physical insights Each chapter is enriched by an extensive collection of tables of material parameters figures and problems Many of these problems lead the student by the hand to arrive at the results *Nonlinear Optics in Semiconductors I* ,1998-10-22 Since its inception in 1966 the series of numbered volumes known as Semiconductors and Semimetals has distinguished itself through the careful selection of well known authors editors and contributors The Willardson and Beer Series as it is widely known has succeeded in publishing numerous landmark volumes and chapters Not only did many of these volumes make an impact at the time of their publication but they continue to be well cited years after their original release Recently Professor Eicke R Weber of the University of California at Berkeley joined as a co editor of the series Professor Weber a well known expert in the field of semiconductor materials will further contribute to continuing the series tradition of publishing timely highly relevant and long impacting volumes Some of the recent volumes such as Hydrogen in Semiconductors Imperfections in III V Materials Epitaxial Microstructures High Speed Heterostructure Devices Oxygen in Silicon and others promise that this tradition will be maintained and even expanded Reflecting the truly interdisciplinary nature of the field that the series covers the volumes in Semiconductors and Semimetals have been and will continue to be of great interest to physicists chemists materials scientists and device engineers in modern industry *Fundamentals of Semiconductors* Peter YU,Manuel Cardona,2013-03-09 We have so far received many comments and feedback on our book from all quarters including students

instructors and of course many friends We are most grateful to them not only for their compliments but also for their valu able criticism We also received many requests for an instructor manual and solutions to the problems at the end of each chapter We realize that semicon ductor physics has continued to evolve since the publication of this book and there is a need to continue to update its content To keep our readers informed of the latest developments we have created a Web Page for this book Its ad dress as of the writing of this preface is http pauline berkeley edultextbook At this point this Web Page displays the following information 1 Content outline and an excerpt of the book 2 Reviews of the book in various magazines and journals 3 Errata to both first and second printing most have been corrected in the second edition as of this date 4 Solutions to selected problems 5 Additional supplementary problems **Highlights Of Light Spectroscopy On Semiconductors Holsos 95 - Proceedings Of The Workshop** A D'andrea,L G Quagliano,S Selci,1996-08-30 The aim of this volume is to provide an overview on the state of art in optical spectroscopy covering the focal theoretical and experimental aspects of the last research developments on semiconductor field Some key topics in semiconductor science namely optical spectroscopy as a tool for in situ epitaxial growth monitoring and non destructive surface and interface characterizations in mesocopic superstructures are addressed in the book A non exhaustive list of arguments is surface and interface characterization chemical reactions in semiconductor surfaces heterostructures quantum wells and superlattices nanostructures and microlasers **Coherent States, Wavelets and Their Generalizations** Syed T. Ali,J-P Antoine,Jean-Perre Gazeau,2012-12-06 Nitya kaaler utshab taba Bishyer i dipaalika Aami shudhu tar i mateer pradeep Jaalao tahaar shikhaa 1 Tagore Should authors feel compelled to justify the writing of yet another book In an overpopulated world should parents feel compelled to justify bringing forth yet another child Perhaps not But an act of creation is also an act of love and a love story can always be happily shared In writing this book it has been our feeling that in all of the wealth of material on coherent states and wavelets there exists a lack of a discern able unifying mathematical perspective The use of wavelets in research and technology has witnessed explosive growth in recent years while the use of coherent states in numerous areas of theoretical and experimental physics has been an established trend for decades Yet it is not at all un common to find practitioners in either one of the two disciplines who are hardly aware of one discipline s links to the other Currently many books are on the market that treat the subject of wavelets from a wide range of perspectives and with windows on one or several areas of a large spectrum IThine is an eternal celebration A cosmic Festival of Lights Therein I am a mere flicker of a wicker lamp 0 kindle its flame my Master vi Preface of possible applications **Organic Electronic Materials** R. Farchioni,G. Grosso,2013-11-21 Studies on the electronic properties of conjugated polymers and low molecular weight organic solids have been of increasing interest in recent years This book is organized into two parts dedicated to these two classes of materials For each part a general introductory review provides background knowledge of the language and of the main points required for understanding the book s contents The reviews that follow provide a more complete

understanding of the underlying physics of the materials through discussion of the interconnected topics Theoretical concepts models and methods are overviewed this is used to support the explanation of the physical and chemical properties of these materials The presentation of selected aspects of experimental research greatly contributes to the basic understanding of organic electronic materials

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