Introduction To Solid State Theory Springer Series In Solid State Sciences Pdf Pdf

Introduction To Solid State Theory Springer Series In Solid State Sciences Pdf Pdf - **introduction to solid state theory springer series in solid state sciences pdf pdf** Book Review: Unveiling the Power of Words

In a world driven by information and connectivity, the ability of words has be more evident than ever. They have the capacity to inspire, provoke, and ignite change. Such could be the essence of the book **introduction to solid state theory springer series in solid state sciences pdf pdf**, a literary masterpiece that delves deep to the significance of words and their effect on our lives. Published by a renowned author, this captivating work takes readers on a transformative journey, unraveling the secrets and potential behind every word. In this review, we shall explore the book is key themes, examine its writing style, and analyze its overall effect on readers.

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Diffusion in Solids Helmut Mehrer 2007-07-24 This book describes the central aspects of diffusion in solids, and goes on to provide easy access to important information about diffusion in metals, alloys, semiconductors, ion-conducting materials, glasses and nanomaterials. Coverage includes diffusion-controlled phenomena including ionic conduction, grain-boundary and dislocation pipe diffusion. This book will benefit graduate students in such disciplines as solid-state physics, physical metallurgy, materials science, and geophysics, as well as scientists in academic and industrial research laboratories.

Quantum Theory of the Solid State Lev Kantorovich 2004-05-31 "Quantum Physics of the Solid State: an Introduction" Draft foreword: 26/09/03 If only this book had been available when I was starting out in science! It would have saved me countless hours of struggle in trying to apply the general ideas of the standard solid-state text-books to solve real problems. The fact is that most of the texts stop at the point where the real difficulties begin. The great merit of this book is that it describes in an honest and detailed way what one really has to do in order to understand the multifarious properties of solids in terms of the fundamental physical theory of quantum mechanics. University students of the physical sciences are taught about the fundamental the ories, and know that quantum mechanics, together with relativity, is our basis for understanding the physical world. But the practical difficulties of using quantum mechanics to do anything useful are usually not very well explained. The truth is that the application of quantum theory to achieve our present detailed understand ing of solids has required the development of a large array of mathematical tech niques. This is closely analogous to the challenge faced long ago by theoretical astronomers in trying to apply Newton's equations of motion to the heavens -they too had to develop a battery of theoretical and computational techniques to do cal culations that could be compared with observation.

Topological Insulators Shun-Qing Shen 2013-01-11 Topological insulators are insulating in the bulk, but process metallic states present around its boundary owing to the topological origin of the band structure. The metallic edge or surface states are immune to weak disorder or impurities, and robust against the deformation of the system geometry. This book, the first of its kind on topological insulators, presents a unified description of topological insulators from one to three dimensions based on the modified Dirac equation. A series of solutions of the bound states near the boundary are derived, and the existing conditions of these solutions are described. Topological invariants and their applications to a variety of systems from one-dimensional polyacetalene, to two-dimensional quantum spin Hall effect and p-wave superconductors, and three-dimensional topological insulators and superconductors or superfluids are introduced, helping readers to better understand this fascinating new field. This book is intended for researchers and graduate students working in the field of topological insulators and related areas. Shun-Qing Shen is a Professor at the Department of Physics, the University of Hong Kong, China.

Theory of Quantum Transport at Nanoscale Dmitry Ryndyk 2015-12-08 This book is an introduction to a rapidly developing field of modern theoretical physics – the theory of quantum transport at nanoscale. The

theoretical methods considered in the book are in the basis of our understanding of charge, spin and heat transport in nanostructures and nanostructured materials and are widely used in nanoelectronics, molecular electronics, spin-dependent electronics (spintronics) and bio-electronics. The book is based on lectures for graduate and post-graduate students at the University of Regensburg and the Technische Universität Dresden (TU Dresden). The first part is devoted to the basic concepts of quantum transport: Landauer-Büttiker method and matrix Green function formalism for coherent transport, Tunneling (Transfer) Hamiltonian and master equation methods for tunneling, Coulomb blockade, vibrons and polarons. The results in this part are obtained as possible without sophisticated techniques, such as nonequilibrium Green functions, which are considered in detail in the second part. A general introduction into the nonequilibrium Green function theory is given. The approach based on the equation-of-motion technique, as well as more sophisticated one based on the Dyson-Keldysh diagrammatic technique are presented. The main attention is paid to the theoretical methods able to describe the nonequilibrium (at finite voltage) electron transport through interacting nanosystems, specifically the correlation effects due to electron-electron and electron-vibron interactions.

The Quantum Hall Effect Daijiro Yoshioka 2013-03-09 The fractional quantum Hall effect has opened up a new paradigm in the study of strongly correlated electrons and it has been shown that new concepts, such as fractional statistics, anyon, chiral Luttinger liquid and composite particles, are realized in two-dimensional electron systems. This book explains the quantum Hall effects together with these new concepts starting from elementary quantum mechanics.

Electron Correlations in Molecules and Solids Peter Fulde 2012-12-06 Dieser Titel verbindet die Festkörpertheorie mit der Quantenchemie. Neue Konzepte der Vielteilchen-Verarbeitung und Korrelations-Effekte, normale quantenchemische Verfahren mit Projektionstechniken, Greensche Funktionen und Monte-Carlo-Methoden werden erarbeitet. Anwendungsbereiche der Molekültheorie, von Halbleitern, supraleitender high-Tc-Materialien, etc., werden vorgestellt.

Group Theory Mildred S. Dresselhaus 2007-12-18 This concise, class-tested book was refined over the authors' 30 years as instructors at MIT and the University Federal of Minas Gerais (UFMG) in Brazil. The approach centers on the conviction that teaching group theory along with applications helps students to learn, understand and use it for their own needs. Thus, the theoretical background is confined to introductory chapters. Subsequent chapters develop new theory alongside applications so that students can retain new concepts, build on concepts already learned, and see interrelations between topics. Essential problem sets between chapters aid retention of new material and consolidate material learned in previous chapters.

Quantum Kinetics in Transport and Optics of Semiconductors Hartmut Haug 2007-12-10 The state-of-the-art of quantum transport and quantum kinetics in semiconductors, plus the latest applications, are covered in this monograph. Since the publishing of the first edition in 1996, the nonequilibrium Green function technique has been applied to a large number of new research topics, and the revised edition introduces the reader to many of these areas. This book is both a reference work for researchers and a self-tutorial for

graduate students.

Green’s Functions in Quantum Physics Eleftherios N. Economou 2013-03-14 In this edition the second and main part of the book has been considerably expanded as to cover important applications of the formalism. In Chap.5 a section was added outlining the extensive role of the tight binding (or equivalently the linear combination of atomic-like orbitals) approach to many branches of solid-state physics. Some additional informa tion (including a table of numerical values) regarding square and cubic lattice Green's functions were incorporated. In Chap.6 the difficult subjects of superconductivity and the Kondo effect are examined by employing an appealingly simple connection to the question of the existence of a bound state in a very shallow potential well. The existence of such a bound state depends entirely on the form of the un perturbed density of states near the end of the spectrum: if the density of states blows up there is always at least one bound state. If the density of states approaches zero continuously, a critical depth (and/or width) of the well must be reached in order to have a bound state. The borderline case of a finite discontinuity (which is very important to superconductivity and the Kondo effect) always produces a bound state with an exponentially small binding energy.

Solid State Theory Ulrich Rössler 2013-06-29 "Solid-State Theory - An Introduction" is a textbook for graduate students of physics and material sciences. Whilst covering the traditional topics of older textbooks, it also takes up new developments in theoretical concepts and materials that are connected with such breakthroughs as the quantum-Hall effects, the high-Tc superconductors, and the low-dimensional systems realized in solids. Thus besides providing the fundamental concepts to describe the physics of the electrons and ions comprising the solid, including their interactions, the book casts a bridge to the experimental facts and gives the reader an excellent insight into current research fields. A compilation of problems makes the book especially valuable to both students and teachers.

Solid State Theory, Volume 1 Gerd Czycholl 2023-01-04 The textbooks “Solid State Theory" give an introduction to the methods, contents and results of modern solid state physics in two volumes. This first volume has the basic courses in theoretical physics as prerequisites, i.e. knowledge of classical mechanics, electrodynamics and, in particular, quantum mechanics and statistical physics is assumed. The formalism of second quantization (occupation number representation), which is needed for the treatment of many-body effects, is introduced and used in the book. The content of the first volume deals with the classical areas of solid state physics (phonons and electrons in the periodic potential, Bloch theorem, Hartree-Fock approximation, density functional theory, electron-phonon interaction). The first volume is already suitable for Bachelor students who want to go beyond the basic courses in theoretical physics and get already familiar with an application area of theoretical physics, e.g. for an elective subject "Theoretical (Solid State) Physics" or as a basis for a Bachelor thesis. Every solid-state physicist working experimentally should also be familiar with the theoretical methods covered in the first volume. The content of the first volume can therefore also be the basis for a module "Solid State Physics" in the Master program in Physics or, together with the content of the

2nd volume, for a module "Theoretical Solid State Physics" or "Advanced Theoretical Physics". The following second volume covers application areas such as superconductivity and magnetism to areas that are current research topics (e.g. quantum Hall effect, high-temperature superconductivity, low-dimensional structures).

Computational Materials Science Kaoru Ohno 2018-04-14 This textbook introduces modern techniques based on computer simulation to study materials science. It starts from first principles calculations enabling to calculate the physical and chemical properties by solving a many-body Schroedinger equation with Coulomb forces. For the exchange-correlation term, the local density approximation is usually applied. After the introduction of the first principles treatment, tight-binding and classical potential methods are briefly introduced to indicate how one can increase the number of atoms in the system. In the second half of the book, Monte Carlo simulation is discussed in detail. Problems and solutions are provided to facilitate understanding. Readers will gain sufficient knowledge to begin theoretical studies in modern materials research. This second edition includes a lot of recent theoretical techniques in materials research. With the computers power now available, it is possible to use these numerical techniques to study various physical and chemical properties of complex materials from first principles. The new edition also covers empirical methods, such as tight-binding and molecular dynamics.

Foundations of Nanomechanics Andrew N. Cleland 2013-03-09 This text provides an introduction, at the level of an advanced student in engineering or physics, to the field of nanomechanics and nanomechanical devices. It provides a unified discussion of solid mechanics, transducer applications, and sources of noise and nonlinearity in such devices. Demonstrated applications of these devices, as well as an introduction to fabrication techniques, are also discussed. The text concludes with an overview of future technologies, including the potential use of carbon nanotubes and other molecular assemblies.

Physical Acoustics in the Solid State Bruno Lüthi 2006-01-15 Physical Acoustics in the Solid State reviews the modern aspects in the field, including many experimental results, especially those involving ultrasonics. It covers practically all fields of solid-state physics. After a review of the relevant experimental techniques and an introduction to the theory of elasticity, the book details applications in the various fields of condensed matter physics.

Fundamentals of Solid State Engineering Manijeh Razeghi 2006-06-12 Provides a multidisciplinary introduction to quantum mechanics, solid state physics, advanced devices, and fabrication Covers wide range of topics in the same style and in the same notation Most up to date developments in semiconductor physics and nano-engineering Mathematical derivations are carried through in detail with emphasis on clarity Timely application areas such as biophotonics , bioelectronics

Contact, Adhesion and Rupture of Elastic Solids D. Maugis 2013-03-14 This book, based on the analogy between contact mechanics and fracture mechanics proposed by the author twenty years ago, starts with a treatment of the surface energy and tension of solids and surface thermodynamics. The essential concepts of fracture mechanics are presented with emphasis on the thermodynamic aspects. Readers will find complete

analytical results and detailed calculations for cracks submitted to pressure distributions and the Dugdale model. Contact mechanics and the contact and adherence of rough solids are also covered.

Solid State Physics John J. Quinn 2009-09-18 Intended for a two semester advanced undergraduate or graduate course in Solid State Physics, this treatment offers modern coverage of the theory and related experiments, including the group theoretical approach to band structures, Moessbauer recoil free fraction, semi-classical electron theory, magnetoconductivity, electron self-energy and Landau theory of Fermi liquid, and both quantum and fractional quantum Hall effects. Integrated throughout are developments from the newest semiconductor devices, e.g. space charge layers, quantum wells and superlattices. The first half includes all material usually covered in the introductory course, but in greater depth than most introductory textbooks. The second half includes most of the important developments in solid-state researches of the past half century, addressing e.g. optical and electronic properties such as collective bulk and surface modes and spectral function of a quasiparticle, which is a basic concept for understanding LEED intensities, X ray fine structure spectroscopy and photoemission. So both the fundamental principles and most recent advances in solid state physics are explained in a class-tested tutorial style, with end-of-chapter exercises for review and reinforcement of key concepts and calculations.

Introduction to Frustrated Magnetism Claudine Lacroix 2011-01-12 The field of highly frustrated magnetism has developed considerably and expanded over the last 15 years. Issuing from canonical geometric frustration of interactions, it now extends over other aspects with many degrees of freedom such as magneto-elastic couplings, orbital degrees of freedom, dilution effects, and electron doping. Its is thus shown here that the concept of frustration impacts on many other fields in physics than magnetism. This book represents a state-of-the-art review aimed at a broad audience with tutorial chapters and more topical ones, encompassing solid-state chemistry, experimental and theoretical physics.

Group Theory and Its Applications in Physics Teturo Inui 2012-12-06 This book has been written to introduce readers to group theory and its ap plications in atomic physics, molecular physics, and solid-state physics. The first Japanese edition was published in 1976. The present English edi tion has been translated by the authors from the revised and enlarged edition of 1980. In translation, slight modifications have been made in. Chaps. 8 and 14 to update and condense the contents, together with some minor additions and improvements throughout the volume. The authors cordially thank Professor J. L. Birman and Professor M. Car dona, who encouraged them to prepare the English translation. Tokyo, January 1990 T. Inui . Y. Tanabe Y. Onodera Preface to the Japanese Edition As the title shows, this book has been prepared as a textbook to introduce readers to the applications of group theory in several fields of physics. Group theory is, in a nutshell, the mathematics of symmetry. It has three main areas of application in modern physics. The first originates from early studies of crystal morphology and constitutes a framework for classical crystal physics. The analysis of the symmetry of tensors representing macroscopic physical properties (such as elastic constants) belongs to this category. The sec ond area was enunciated by E. Wigner (1926) as a powerful means of handling quantum-

mechanical problems and was first applied in this sense to the analysis of atomic spectra. Soon, H.

Conductors, Semiconductors, Superconductors Rudolf P. Huebener 2015-11-05 This undergraduate textbook provides an introduction to the fundamentals of solid state physics, including a description of the key people in the field and the historic context. The book concentrates on the electric and magnetic properties of materials. It is written for students up to the bachelor level in the fields of physics, materials science, and electric engineering. Because of its vivid explanations and its didactic approach, it can also serve as a motivating pre-stage and supporting companion in the study of the established and more detailed textbooks of solid state physics. The textbook is suitable for a quick repetition prior to examinations. This second edition is extended considerably by detailed mathematical treatments in many chapters, as well as extensive coverage of magnetic impurities.

Introduction to Solid-State Theory Otfried Madelung 2012-12-06 Introduction to Solid-State Theory is a textbook for graduate students of physics and materials science. It also provides the theoretical background needed by physicists doing research in pure solid-state physics and its applications to electrical engineering. The fundamentals of solid-state theory are based on a description by delocalized and localized states and - within the concept of delocalized states - by elementary excitations. The development of solid-state theory within the last ten years has shown that by a systematic introduction of these concepts, large parts of the theory can be described in a unified way. This form of description gives a "pictorial" formulation of many elementary processes in solids, which facilitates their understanding.

Introduction To Solid - State Theory Madelung 2004-01-01

Advances in Polaron Physics Alexandre S. Alexandrov 2009-10-03 This book reviews recent developments in the field of polarons, starting with the basics and covering a number of active directions of research. It integrates theory and experimental results.

Superconductivity and Electromagnetism Teruo Matsushita 2021-03-27 This book introduces readers to the characteristic features of electromagnetic phenomena in superconductivity. It first demonstrates not only that the diamagnetism in the superconductivity complies with Maxwell’s theory, which was formulated before the discovery of superconductivity, but also that the dominant E-B analogy in the electromagnetism loses perfection without the superconductivity. The book then explores flux pinning, which is responsible for the non-dissipative current in DC, leading to irreversibility in AC. Drawing on Maxwell’s work, it also proves theoretically that if there is no energy dissipation in the superconductivity caused by the break in time reversal symmetry, it contradicts the thermodynamic principle of energy conservation – something that had previously only been proved experimentally. Lastly, the book addresses the longitudinal magnetic field effect, and explains how this phenomenon leads to a new development of Maxwell’s theory. Featuring numerous appendices to help readers understand the methods of derivation of equations, this book offers students and young scientists an introduction to applied superconductivity, especially in the context of power applications. Presenting the characteristic features of electromagnetic phenomena in superconductivity from basic to advanced topics for applications, the book

offers a valuable resource for graduate students and researchers studying superconductivity as well as engineers working in electric utility industry.
Magnetism in the Solid State Peter Mohn 2006-06-09 This book presents a phenomenological approach to the field of solid state magnetism. It surveys the various theories and discusses their applicability in different types of materials. The text will be valuable as a text for graduate courses in magnetism and magnetic materials.
Introduction to Solid State Physics and Crystalline Nanostructures Giuseppe Iadonisi 2014-06-13 This textbook provides conceptual, procedural, and factual knowledge on solid state and nanostructure physics. It is designed to acquaint readers with key concepts and their connections, to stimulate intuition and curiosity, and to enable the acquisition of competences in general strategies and specific procedures for problem solving and their use in specific applications. To these ends, a multidisciplinary approach is adopted, integrating physics, chemistry, and engineering and reflecting how these disciplines are converging towards common tools and languages in the field. Each chapter discusses essential ideas before the introduction of formalisms and the stepwise addition of complications. Questions on everyday manifestations of the concepts are included, with reasoned linking of ideas from different chapters and sections and further detail in the appendices. The final section of each chapter describes experimental methods and strategies that can be used to probe the phenomena under discussion. Solid state and nanostructure physics is constantly growing as a field of study where the fascinating quantum world emerges and otherwise imaginary things can become real, engineered with increasing creativity and control: from tinier and faster technologies realizing quantum information concepts, to understanding of the fundamental laws of Physics. Elements of Solid State Physics and of Crystalline Nanostructures will offer the reader an enjoyable insight into the complex concepts of solid state physics.
Topology in Condensed Matter Michael I. Monastyrsky 2006-02-04 This book reports new results in condensed matter physics for which topological methods and ideas are important. It considers, on the one hand, recently discovered systems such as carbon nanocrystals and, on the other hand, new topological methods used to describe more traditional systems such as the Fermi surfaces of normal metals, liquid crystals and quasicrystals. The authors of the book are renowned specialists in their fields and present the results of ongoing research, some of it obtained only very recently and not yet published in monograph form.
Quantum Chemistry of Solids Robert A. Evarestov 2007-08-16 This book delivers a comprehensive account of the main features and possibilities of LCAO methods for the first principles calculations of electronic structure of periodic systems. The first part describes the basic theory underlying the LCAO methods applied to periodic systems and the use of wave-function-based, density-based (DFT) and hybrid hamiltonians. The second part deals with the applications of LCAO methods for calculations of bulk crystal properties.
Introduction to Solid-State Theory Otfried Madelung 1997-05-01 Introduction to Solid-State Theory is a textbook for graduate students of physics and materials science. It also provides the theoretical background needed by physicists doing research in pure solid-state

physics and its applications to electrical engineering. The fundamentals of solid-state theory are based on a description by delocalized and localized states and - within the concept of delocalized states - by elementary excitations. The development of solid-state theory within the last ten years has shown that by a systematic introduction of these concepts, large parts of the theory can be described in a unified way. This form of description gives a "pictorial" formulation of many elementary processes in solids, which facilitates their understanding.

Introduction to the Physics of Matter Nicola Manini 2020-10-20 This is the second edition of a well-received book. It provides an up-to-date, concise review of essential topics in the physics of matter, from atoms and molecules to solids, including elements of statistical mechanics. It features over 160 completely revised and enhanced figures illustrating the main physical concepts and the fundamental experimental facts, and discusses selected experiments, mainly in spectroscopy and thermodynamics, within the general framework of the adiabatic separation of the motions of electrons and nuclei. The book focuses on what can be described in terms of independent-particle models, providing the mathematical derivations in sufficient detail for readers to grasp the relevant physics involved. The final section offers a glimpse of more advanced topics, including magnetism and superconductivity, sparking readers’ curiosity to further explore the latest developments in the physics of matter.

Modern Theory of Magnetism in Metals and Alloys Yoshiro Kakehashi 2013-01-11 This book describes theoretical aspects of the metallic magnetism from metals to disordered alloys to amorphous alloys both at the ground state and at finite temperatures. The book gives an introduction to the metallic magnetism, and treats effects of electron correlations on magnetism, spin fluctuations in metallic magnetism, formation of complex magnetic structures, a variety of magnetism due to configurational disorder in alloys as well as a new magnetism caused by the structural disorder in amorphous alloys, especially the itinerant-electron spin glasses. The readers will find that all these topics can be understood systematically by means of the spin-fluctuation theories based on the functional integral method.

Solid-State Physics James D. Patterson 2019-03-24 While the standard solid state topics are covered, the basic ones often have more detailed derivations than is customary (with an empasis on crystalline solids). Several recent topics are introduced, as are some subjects normally included only in condensed matter physics. Lattice vibrations, electrons, interactions, and spin effects (mostly in magnetism) are discussed the most comprehensively. Many problems are included whose level is from "fill in the steps" to long and challenging, and the text is equipped with references and several comments about experiments with figures and tables.

Quantum Solid-State Physics Serghey V. Vonsovsky 2012-05-05 This book treats the major problems of the quantum physics of solids, ranging from fundamental concepts to topical issues. Rather than use a deductive method of exposition, the authors consider and analyze simple empirically established properties of solids and employ more complicated models only as the need arises. Detailed treatment is given of classical problems such

as chemical bonding in crystals, the one-dimensional Schrödinger equation with a periodic potential, the metal-insulator criterion, and the quantum theory of band electron motion in external fields. Consideration is also given to topical problems such as neutron scattering by the crystal lattice, plasma and Fermi liquid effects, the theory of disordered systems, and the polaron. The reader is expected to know only the fundamentals of quantum mechanics and statistical physics. Compared with the Russian edition (Nauka, Moscow 1983), the book has been substantially revised and enlarged, new sections have been written and recent results have been incorporated.

Electron Correlations in Molecules and Solids Peter Fulde 2012-12-06 This volume bridges the gap between quantum chemistry and solid-state theory. The text develops new concepts for treating many-body and correlation effects, and deals with applications of the theory to molecules, semiconductors, transition metals, heavy-fermion systems, and the new high-Tc superconducting materials.

Site Symmetry in Crystals Robert A. Evarestov 2012-12-06 Site Symmetry in Crystals is the first comprehensive account of the group-theoretical aspects of the site (local) symmetry approach to the study of crystalline solids. The efficiency of this approach, which is based on the concepts of simple induced and band representations of space groups, is demonstrated by considering newly developed applications to electron surface states, point defects, symmetry analysis in lattice dynamics, the theory of second-order phase transitions, and magnetically ordered and non-rigid crystals. Tables of simple induced respresentations are given for the 24 most common space groups, allowing the rapid analysis of electron and phonon states in complex crystals with many atoms in the unit cell.

Theory of Nonlinear Lattices Morikazu Toda 2012-12-06 Soliton theory, the theory of nonlinear waves in lattices composed of particles interacting by nonlinear forces, is treated rigorously in this book. The presentation is coherent and self-contained, starting with pioneering work and extending to the most recent advances in the field. Special attention is focused on exact methods of solution of nonlinear problems and on the exact mathematical treatment of nonlinear lattice vibrations. This new edition updates the material to take account of important new advances.

Electronic Structure of Strongly Correlated Materials Vladimir Anisimov 2010-07-23 Electronic structure and physical properties of strongly correlated materials containing elements with partially filled 3d, 4d, 4f and 5f electronic shells is analyzed by Dynamical Mean-Field Theory (DMFT). DMFT is the most universal and effective tool used for the theoretical investigation of electronic states with strong correlation effects. In the present book the basics of the method are given and its application to various material classes is shown. The book is aimed at a broad readership: theoretical physicists and experimentalists studying strongly correlated systems. It also serves as a handbook for students and all those who want to be acquainted with fast developing filed of condensed matter physics.

Quantum Theory of the Solid State Lev Kantorovich 2004-05-31 "Quantum Physics of the Solid State: an Introduction" Draft foreword: 26/09/03 If only this book had been available when I was starting out in science! It would have saved me countless hours of struggle in trying to apply the general ideas of the standard solid-

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Excitons in Low-Dimensional Semiconductors Stephan Glutsch 2013-04-17 The author develops the effective-mass theory of excitons in low-dimensional semiconductors and describes numerical methods for calculating the optical absorption including Coulomb interaction, geometry, and external fields. The theory is applied to Fano resonances in low-dimensional semiconductors and the Zener breakdown in superlattices. Comparing theoretical results with experiments, the book is essentially self-contained; it is a hands-on approach with detailed derivations, worked examples, illustrative figures, and computer programs. The book is clearly structured and will be valuable as an advanced-level self-study or course book for graduate students, lecturers, and researchers.