Theory Of Optical Processes In Semiconductors Paperback

Handbook of Nitride Semiconductors and Devices, Electronic and Optical Processes in Nitrides
Porous Semiconductors
Quantum Aspects of Light Propagation
Theory of Crystal Space Groups and Lattice Dynamics; Infra-Red and Raman Optical Processes of Insulating Crystals
Quantum Statistics of Linear and Nonlinear Optical Phenomena
Optical Processes in Semiconductors
A Microscopic Quantum Electrodynamical Theory of Novel Nonlinear Optical Processes
Optical Processes in Microcavities
Theory of Crystal Space Groups and Lattice Dynamics
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Optical Systems and Processes
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Dispersion, Complex Analysis and Optical Spectroscopy
R-Matrix Theory of Atomic Collisions
Systems Theory and the Analysis of Photo-optical Processes
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Photons and Molecules
Theory of Crystal Space Groups and Lattice Dynamics
Cooperative Effects in Optics, Superradiance and Phase Transitions
R-Matrix Theory of Atomic Collisions
Quantum Optical Processes
R-Matrix Theory of Atomic Molecular and Optical Processes
Pose-varied Multi-axis Optical Finishing Systems
Theory of Optical Processes in Semiconductors
Theory of Optical Processes in Semiconductors
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Optical Processes in Microcavities
Electrodynamics of Metamaterials

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Handbook of Nitride Semiconductors and Devices, Electronic and Optical Processes in Nitrides Courier Corporation
Reissue of Encyclopedia of Physics/Handbuch der Physik, Vol. XXV/2b I am very pleased that my book is now to be reprinted and rebound in a new format which should make it accessible at a modest price to students and active researchers in condensed matter physics. In writing this book I had in mind an audience of physicists and chemists with no previous deep exposure to symmetry analysis of crystalline matter, non to the use of symmetry in simplifying and refining predictions of the results of optical experiments. Hence the book was written to explain and illustrate in all necessary detail how to: 1) describe the space group symmetry in terms of space group symmetry operations; 2) obtain irreducible representations and selection rules for optical infra-red and Raman and other transition processes. On the physical side I redeveloped the traditional theory of classical and quantum lattice dynamics, illustrating how space-time symmetry designations in the equations of motion can: 1) simplify and rationalize calculations of the classical eigenvectors of the dynamical equation; 2) permit classification of the eigenstates of the quantum lattice-dynamic pro blem; 3) give specific selection rules for optical infra-red and Raman lattice processes, and thus make "go, no-go" predictions including polarization of absorbed or scattered radiation; and 4) simplify the modern many-body theories of optical processes.
Porous Semiconductors Springer Science & Business Media
Primary goal of this book is to provide a cohesive description of the vast field of semiconductor quantum devices, with special emphasis on basic quantum-mechanical phenomena governing the electro-optical response of new-generation nanomaterials. The book will cover within a common language different types of optoelectronic nanodevices, including quantum-cascade laser sources and detectors, few-electron/exciton quantum devices, and semiconductor-based quantum logic gates. The

distinguishing feature of the present volume is a unified microscopic treatment of quantum-transport and coherent-optics phenomena on ultrasmall space- and time-scales, as well as of their semiclassical counterparts.

Quantum Aspects of Light Propagation Springer Science & Business Media

Based on a series of lectures at Berkeley, 1968–1969, this is the first book to deal comprehensively with all of the phenomena involving light in semiconductors. The author has combined, for the graduate student and researcher, a great variety of source material, journal research, and many years of experimental research, adding new insights published for the first time in this book. Coverage includes energy states in semiconductors and their perturbation by external parameters, absorption, relationships between optical constants, spectroscopy, radiative transitions, nonradiative recombination, processes in pn junctions, semiconductor lasers, interactions involving coherent radiation, photoelectric emission, photovoltaic effects, polarization effects, photochemical effects, effect of traps on luminescence, and reflective modulation. The author has presented the subject in a manner which couples readily to physical intuition. He introduces new techniques and concepts, including nonradiative recombination, effects of doping on optical properties, Franz-Keldysh effect in absorption and emission, reflectance modulation, and many others. Dr. Pankove emphasizes the underlying principle that can be applied to the analysis and design of a wide variety of functional devices and systems. Many valuable references, illustrative problems, and tables are also provided here.

Theory of Crystal Space Groups and Lattice Dynamics; Infra-Red and Raman Optical Processes of Insulating Crystals Cambridge University Press

In last years increasing attention has been again devoted to interpretations of quantum theory. In the same time interesting quantum optical experiments have been performed using nonlinear optical processes, in particular frequency down conversion, which provided new information about nature of a photon on the basis of interference and correlation (coincidence) phenomena. Such single-photon and twin-photon effects of quantum optics provide new point of view of interpretations of quantum theory and new tests of its principles. The purpose of this book is to discuss these questions. To follow this goal we give brief reviews of principles of quantum theory and of quantum theory of measurement. As a fundamental theoretical tool the coherent state technique is adopted based on a general algebraic treatment, including the de scription of interaction of radiation and matter. Typical quantum behaviour of physical systems is exhibited by nonclassical optical phenomena, which can be examined using photon interferences and correlations. These phenomena are closely related to violation of various classical inequalities and Bell's in equalities. The most important part of this book discusses quantum optical experiments supporting quantum theory. This book may be considered as a continuation of previous monographs by one of the authors on Coherence of Light (Van Nostrand Reinhold, London 1972, second edition D. Reidel, Dordrecht 1985) and on Quantum Statistics of Linear and Nonlinear Optical Phenomena (D. Reidel, Dordrecht 1984, second edition Kluwer, Dordrecht 1991), which may serve as a preparation for reading this book.

Quantum Statistics of Linear and Nonlinear Optical Phenomena World Scientific

This book focuses on advanced optical finishing techniques and design for high-performance manufacturing systems. It provides numerous detailed examples of how advanced automation techniques have been applied to optical fabrication processes. The simulations, removal rate and accurate experimental results offer useful resources for engineering practice. Researchers, engineers and graduate students working in optical engineering and precision manufacture engineering will benefit from this book.

Optical Processes in Semiconductors Springer Science & Business Media

Local electromagnetic field fluctuations and related enhancement of nonlinear phenomena in metal-dielectric composites near the percolation threshold (percolation composites) have recently become an area of active study, because of the many fundamental problems involved and the high potential for various applications. It has been recognized recently that local field fluctuations can be especially large in the optical and infrared spectral ranges due to the surface plasmon resonance in metallic granules and their clusters. The strong fluctuations of the local electric and magnetic fields result in the enhancement of various optical effects: anomalous absorption, Rayleigh and Raman scattering, generation of the higher harmonic, Kerr nonlinearity, etc. Nonlinear percolation composites are potentially of great practical importance as media with intensity-dependent dielectric functions and, in particular, as nonlinear filters and optical bistable elements. The optical response of nonlinear composites can be tuned, for example, by controlling the volume fraction and morphology of constituents. This book presents a new theory of electromagnetic field distribution and nonlinear optical processes in metal-dielectric composites. The new approach is based on a percolation theory and the fact that the problem of optical excitations in percolation composites mathematically maps the Anderson transition problem in quantum mechanics. The theory predicts localization of the excitations (surface plasmons) in percolation composites and describes in detail the localization pattern that allows one to obtain relatively simple expressions for the enhancement of linear and nonlinear optical responses. Thistheory is supported by recent near-field experiments where the surface plasmon localization has been directly observed in the percolating composites in optical and microwave bands.

CRC Press

Semiconductor optoelectronic devices are at the heart of all information generation and processing systems and are likely to be essential components of future optical computers. With more emphasis on optoelectronics and photonics in graduate programmes in physics and engineering, there is aneed for a text providing a basic understanding of the important physical phenomena involved. Such a training is necessary for the design, optimization, and search for new materials, devices, and application areas. This book provides a simple quantum mechanical theory of important optical processes,i.e. band-to-band, intersubband, and excitonic absorption and recombination in bulk, quantum wells, wires, dots, superlattices, and strained layers including electro-optic effects. The classical theory of absorption, quantization of radiation, and band picture based on k.p perturbation has beenincluded to provide the necessary background. Prerequisites for the book are a knowledge of quantum mechanics and solid state theory. Problems have been set at the end of each chapter, some of which may guide the reader to study processes not covered in the book. The application areas of thephenomena are also indicated.

A Microscopic Quantum Electrodynamical Theory of Novel Nonlinear Optical Processes Springer

The dielectric microstructures act as ultrahigh Q factors optical cavities, which modify the spontaneous emission rates and alter the spatial distributions of the input and output radiation. The editors have selected leading scientists who have made seminal contributions in different aspects of optical processes in

microcavities. Every attempt has been made to unify the underlying physics pertaining to microcavities of various shapes. This book begins with a chapter on the role of microcavity modes with additional chapters on how these microcavity modes affect the spontaneous and stimulated emission rates, enhance nonlinear optical processes, used in cavity-QED and chemical physics experiments, aid in single-molecule detection, influence the design of microdisk semiconductor lasers, and how deformed cavities can be treated with classical chaos theory. Contents:The Role of Quasinormal Modes (E S-C Ching et al.)Optical Mode Density and Spontaneous Emission in Microcavities (S D Brorson & P M W Skovgaard)Very High Q Whispering-Gallery Modes in Silica Microspheres for Cavity-QED Experiments (V Lefèvre-Seguin et al.)Molecular Fluorescence in a Microcavity: Solvation Dynamics and Single Molecule Detection (M D Barnes et al.)Cavity QED Modified Stimulated and Spontaneous Processes in Microdroplets (A J Campillo et al.)Perturbation Effects on the Resonances of a Spherical Dielectric Microcavity (M M Mazumder et al.)Nonlinear Optical Effects in Microcylinders and Microdroplets (R L Armstrong)The Role of MDRs in Chemical Physics: Intermolecular Energy Transfer in Microdroplets (S Arnold et al.)Dynamic Optical Processes in Microdisk Lasers (R E Slusher & U Mohideen)Dielectric Photonic Wells and Wires and Spontaneous Emission Coupling Efficiency of Microdisk and Photonic-Wire Semiconductor Lasers (S-T Ho et al.)Chaotic Light: A Theory of Asymmetric Resonant Cavities (J U Nöckel & A D Stone) Readership: Scientists interested in the optics of microcavities, droplets, cavity quantum electrodynamics, nonlinear optics, laser diagnostics, advanced undergraduates and graduates. keywords:Microcavity;Lasing;Whispering Gallery Mode (WGM);Morphology Dependent Resonances (MDR);Cavity Quantum Electrodynamics (CQED);Q-Factor;Microdroplets;Micro Cyclinders;Micro-Disks;Modified Emission

Optical Processes in Microcavities CRC Press

R-Matrix Theory of Atomic, Molecular and Optical Processes describes a generalized R-matrix theory approach to the study of atomic, molecular, and optical processes. Essentially an introduction to the concepts and notation required, Part I provides a brief review of scattering theory, resonances, threshold behavior, scattering amplitude, and cross section. Part II contains a detailed discussion of R-matrix theory and its applications, including electron scattering by atoms and their ions, atomic photoionization, atomic multiphoton processes, electron scattering by molecules, molecular multiphoton processes, positron scattering, and surface interactions.

Theory of Crystal Space Groups and Lattice Dynamics Springer Science & Business Media

The dielectric microstructures act as ultrahigh Q factors optical cavities, which modify the spontaneous emission rates and alter the spatial distributions of the input and output radiation. The editors have selected leading scientists who have made seminal contributions in different aspects of optical processes in microcavities. Every attempt has been made to unify the underlying physics pertaining to microcavities of various shapes. This book begins with a chapter on the role of microcavity modes with additional chapters on how these microcavity modes affect the spontaneous and stimulated emission rates, enhance nonlinear optical processes, used in cavity-QED and chemical physics experiments, aid in single-molecule detection, influence the design of microdisk semiconductor lasers, and how deformed cavities can be treated with classical chaos theory.

Optical Characterization of Solids World Scientific

A unifying element that links the apparently diverse phenomena observed in optical processes is the dielectric dispersion of matter. It describes the response of matter to incoming electromagnetic waves and charged particles, and thus predicts their behavior in the self-induced field of matter, known as polariton and polaron effects. The energies of phonon, exciton and plasmon, quanta of collective motions of charged particles constituting the matter, are also governed by dielectric dispersion. Since the latter is a functional of the former, one can derive useful relations for their self-consistency. Nonlinear response to laser light inclusive of multiphoton processes, and excitation of atomic inner shells by synchrotron radiation, are also described. Within the configuration coordinate model, photo-induced lattice relaxation and chemical reaction are described equally to both ground and relaxed excited states, to provide a novel and global perspective on structural phase transitions and the nature of interatomic bonds. This book was first published in 2003.

Optical Processes in Microparticles and Nanostructures John Wiley & Sons

The quantum statistical properties of radiation represent an important branch of modern physics with rapidly increasing applications in spectroscopy, quantum generators of radiation, optical communication, etc. They have also an increasing role in fields other than pure physics, such as biophysics, psychophysics, biology, etc. Interesting applications have been developed in high energy elementary particle collisions. The present monograph represents an extension and continuation of the previous monograph by this author entitled Coherence of Light (Van Nostrand Reinhold Company, London 1972, translated into Russian in the Publishing House Mir, Moscow 1974, second edition published by D. Reidel, Dordrecht-Boston 1985) and ofa review chapter in Progress in Optics, Vol. 18 (edited by E. Wolf, North-Holland Publishing Company, Amsterdam 1980) as well. It applies the fundamental tools of the coherent-state technique, as described in Coherence of Light, to particular studies of the quantum statistical properties of radiation interacting with matter. In particular. nonlinear optical processes are considered, and purely quantum phenom ena such as antibunching of photons, their sub-Poisson behaviour and squeezing of vacuum fluctuations are discussed. Compared to the first edition of this book, pub lished in 1984, we have added much more information about squeezing of vacuum fluctuations in nonlinear optical process in this second edition; further we have included the description of experiments and their results performed from that time. Also a new brief chapter on nonlinear dynamics and chaos in quantum statistical optics has been included.

Theory of Optical and Dissipative Processes in Quantum Dots World Scientific

This study looks at the basic principles of optical parametric processes and recent results on the rapidly developing optical parametric device technology. The theoretical basis of stimulated and spontaneous optical parametric processes and detailed design considerations of optical parametric oscillators and amplifiers are discussed, followed by a review of the materials properties of the most important nonlinear optical crystals for such applications. It concludes with a review of the recent developments on practical low-repetition rate nanosecond optical parametric oscillators and broadly tunable high-repetition rate continuous-pulse-train femtosecond optical parametric oscillations from the uv to the mid ir.

The Quantum Theory of Light Elsevier

The advent of the laser has brought about a revolution in the kinds of experimental phenomena that can be investigated. In particular, ultra-high power monochromatic, collimated sources have intensities of sufficient magnitude to enable studies to be carried out in the regime where 'non-linear' effects are important, even dominant. Important among these are processes which are

characterised by the simultaneous absorption of two or more optical photons. While multiple photon processes are not completely new, those in the optical part of the spectrum, like Raman scattering, have, until the advent of the laser, been thought of as linear in the incident intensity, or, like the two-quantum decay of the metastable 2s states of hydrogen-like atoms and ions, been confined to theory. Of the multiple photon, non-linear optical processes, multiquantum ionization is one of the more fruitful for detailed, quantitative measurements, and for comparison with theory, since (1) one does not require precise coincidence between the laser light and an absorption line (2) the ionizations can be detected unambiguously with 100% efficiency (3) atomic wave functions are simple, and sufficiently accurate to enable one to make reasonable precise calculations.

Semiconductor Laser Theory Oxford University Press

This book is devoted to dispersion theory in linear and nonlinear optics. Dispersion relations and methods of analysis in optical spectroscopy are derived with the aid of complex analysis. The book introduces the mathematical basis and derivations of various dispersion relations that are used in optical spectroscopy. In addition, it presents the dispersion theory of the nonlinear optical processes which are essential in modern optical spectroscopy. The book includes new methods such as the maximum entropy model for wavelength-dependent spectra analysis.

Second Order Non-linear Optics of Silicon and Silicon Nanostructures CRC Press

The theory and practice of the non-linear optics of silicon are inextricably linked with a variety of areas of solid state physics, particularly semiconductor physics. However, the current literature linking these fields is scattered across various sources and is lacking in depth. Second Order Non-linear Optics of Silicon and Silicon Nanostructures describes the physical properties of silicon as they apply to non-linear optics while also covering details of the physics of semiconductors. The book contains six chapters that focus on: The physical properties and linear optics of silicon Basic theoretical concepts of reflected second harmonics (RSH) The authors' theory of the generation of RSH at the non-linear medium–linear medium interface An analytical review of work on the non-linear optics of silicon The results of non-linear optical studies of silicon nanostructures A theory of photoinduced electronic processes in semiconductors and their influence on RSH generation The book also includes methodological problems and a significant amount of reference data. It not only reflects the current state of research but also provides a single, thorough source of introductory information for those who are becoming familiar with non-linear optics. Second Order Non-linear Optics of Silicon and Silicon Nanostructures is a valuable contribution to the fields of non-linear optics, semiconductor physics, and microelectronics, as well as a useful resource for a wide range of readers, from undergraduates to researchers.

Fundamentals of Optical Parametric Processes and Oscillations Springer Science & Business Media

Quantum Aspects of Light Propagation provides an overview of spatio-temporal descriptions of the electromagnetic field in linear and nonlinear dielectric media, appropriate to macroscopic and microscopic theories. Readers will find an introduction to canonical quantum descriptions of light propagation in a nonlinear dispersionless dielectric medium, and an approach to linear and nonlinear dispersive dielectric media. Illustrated by optical processes, these descriptions are simplified by a transition to one-dimensional propagation. Quantum theories of light propagation in optical media are generalized from dielectric media to magnetodielectrics, in addition to a presentation of classical and nonclassical properties of radiation propagating through negative-index media. Valuable analyses of quantization in waveguides, photonic crystals, and propagation in strongly scattering media are also included, along with various optical resonator properties. The theories are utilized for the quantum electrodynamical effects to be determined in periodic dielectric structures which are known to be a basis of new schemes for lasing and a control of light field state. Quantum Aspects of Light Propagation is a valuable reference for researchers and engineers involved with general optics, quantum optics and electronics, nonlinear optics, and photonics.

Multiple Photon Ionization Processes in Atoms Oxford University Press, USA

Nonlinear Optical Parametric Processes in Liquids and Gases focuses on the parametric processes that occur in liquids and gases. This book examines the mathematical results that are intended mainly for their usefulness in quantifying the physical interpretations of the various concepts to actual systems. Comprised of six chapters, this text starts with a discussion on the nonlinear optical processes, and then explores the basis for nonlinear optical interactions. This book describes the various third-order frequency mixing processes and the basic properties of nonlinear interactions, including phase matching and resonant enhancement. Other chapters consider the processes of frequency mixing and harmonic generation that are used as illustrations of the basic principles. The final chapter explores the applications of several nonlinear optical interactions, with a focus on the use of nonlinear optical processes to control the propagation of optical waves or to obtain information about a material system. This book is intended for researchers and readers engaged in the study of university-level mathematics, electromagnetic theory, and atomic physics.

Nonlinear Optical Processes in Two-Dimensional Semiconductor Structures Elsevier

Gives a comprehensive and coherent account of the basic methods to characterize a solid through its interaction with an electromagnetic field.

Optical Systems and Processes World Scientific

This third edition, like its two predecessors, provides a detailed account of the basic theory needed to understand the properties of light and its interactions with atoms, in particular the many nonclassical effects that have now been observed in quantum-optical experiments. The earlier chapters describe the quantum mechanics of various optical processes, leading from the classical representation of the electromagnetic field to the quantum theory of light. The later chapters develop the theoretical descriptions of some of the key experiments in quantum optics. Over half of the material in this third edition is new. It includes topics that have come into prominence over the last two decades, such as the beamsplitter theory, squeezed light, two-photon interference, balanced homodyne detection, travelling-wave attenuation and amplification, quantum jumps, and the ranges of nonlinear optical processes important in the generation of nonclassical light. The book is written as a textbook, with the treatment as a whole appropriate for graduate or postgraduate students, while earlier chapters are also suitable for final-year undergraduates. Over 100 problems help to intensify the understanding of the material presented.