

Jai Singh
Richard T. Williams *Editors*

Excitonic and Photonic Processes in Materials

Excitonic And Photonic Processes In Materials Springer Series In Materials Science

Baldassare di Bartolo



Excitonic And Photonic Processes In Materials Springer Series In Materials Science:

Excitonic and Photonic Processes in Materials Jai Singh, Richard T. Williams, 2014-07-29 This book is expected to present state of the art understanding of a selection of excitonic and photonic processes in useful materials from semiconductors to insulators to metal insulator nanocomposites both inorganic and organic Among the featured applications are components of solar cells detectors light emitting devices scintillators and materials with novel optical properties Excitonic properties are particularly important in organic photovoltaics and light emitting devices as also in questions of the ultimate resolution and efficiency of new generation scintillators for medical diagnostics border security and nuclear non proliferation Novel photonic and optoelectronic applications benefit from new material combinations and structures to be discussed

Developments and Novel Approaches in Biomechanics and Metamaterials Bilen Emek Abali, Ivan Giorgio, 2020-07-06 This book presents a selection of cutting edge methods that allow readers to obtain novel models for nonlinear solid mechanics Today engineers need more accurate techniques for modeling solid body mechanics chiefly due to innovative methods like additive manufacturing for example 3D printing but also due to miniaturization This book focuses on the formulation of continuum and discrete models for complex materials and systems and especially the design of metamaterials It gathers outstanding papers from the international conference IcONSOM 2019

Springer Handbook of Electronic and Photonic Materials Safa Kasap, Peter Capper, 2007-08-01 Electronic materials is a truly interdisciplinary subject that encompasses a number of traditional disciplines such as materials science electrical engineering chemical engineering mechanical engineering physics and chemistry This unique handbook provides broad coverage of a wide range of electronic and photonic materials starting from fundamentals and building up to advanced topics and applications Its wide coverage with clear illustrations and applications and its chapter sequencing and logical flow make this a very useful and useable handbook Each chapter has been prepared either by expert researchers or instructors who have been teaching the subject at a university or in corporate laboratories Unlike other handbooks that concentrate on a narrow field and have chapters that start at an advanced level the present handbook starts at a senior undergraduate level and builds up the subject matter in easy steps and in a logical flow Wherever possible the sections are logically sequenced to allow those who need a quick overview of a particular topic immediate access to it Additional valuable features include the practical applications used as examples details on experimental techniques useful tables that summarize equations and most importantly properties of various materials Each chapter is full of clear color illustrations that convey the concepts and make the subject matter enjoyable to read and understand An extensive glossary aids readers from adjacent fields The Handbook constitutes an essential reference for today's electrical engineers materials scientists and physicists

Excitonic Processes in Solids Masayasu Ueta, Hiroshi Kanzaki, Koichi Kobayashi, Yutaka Toyozawa, Eiichi Hanamura, 2012-12-06 An exciton is an electronic excitation wave consisting of an electron hole pair which propagates in a nonmetallic solid Since the pioneering research of

Frenkel Wannier and the Pohl group in the 1930s a large number of experimental and theoretical studies have been made. Due to these investigations the exciton is now a well established concept and the electronic structure has been clarified in great detail. The next subjects for investigation are naturally dynamical processes of excitons such as excitation relaxation annihilation and molecule formation and in fact many interesting phenomena have been disclosed by recent works. These excitonic processes have been recognized to be quite important in solid state physics because they involve a number of basic interactions between excitons and other elementary excitations. It is the aim of this quasi monograph to describe these excitonic processes from both theoretical and experimental points of view. We take a few to discuss and illustrate the excitonic processes in solids important and well investigated insulating crystals as playgrounds for excitons on which they play in a manner characteristic of each material. The selection of the materials is made in such a way that they possess some unique properties of excitonic processes and are adequate to cover important interactions in which excitons are involved. In each material excitonic processes are described in detail from the experimental side in order to show the whole story of excitons in a particular material.

Slow Light Jacob B. Khurgin, Rodney S. Tucker, 2018-10-08 One of the Top Selling Physics Books according to YBP Library Services. The exotic effects of slow light have been widely observed in the laboratory. However current literature fails to explore the wider field of slow light in photonic structures and optical fibers. Reflecting recent research Slow Light Science and Applications presents a comprehensive introduction to slow light and its potential applications including storage switching DOD applications and nonlinear optics. The book covers fundamentals of slow light in various media including atomic media semiconductors fibers and photonic structures. Leading authorities in such diverse fields as atomic vapor spectroscopy fiber amplifiers and integrated optics provide an interdisciplinary perspective. They uncover potential applications in both linear and nonlinear optics. While it is impossible to account for all the captivating developments that have occurred in the last few years this book provides an exceptional survey of the current state of the slow light field.

Handbook of Advanced Electronic and Photonic Materials and Devices: Semiconductors Hari Singh Nalwa, 2001 Electronic and photonic materials discussed in this handbook are the key elements of continued scientific and technological advances in the 21st century. The electronic and photonic materials comprising this handbook include semiconductors superconductors ferroelectrics liquid crystals conducting polymers organic and superconductors conductors nonlinear optical and optoelectronic materials electrochromic materials laser materials photoconductors photovoltaic and electroluminescent materials dielectric materials nanostructured materials supramolecular and self assemblies silicon and glasses photosynthetic and respiratory proteins etc etc. Some of these materials have already been used and will be the most important components of the semiconductor and photonic industries: computers internet information processing and storage telecommunications satellite communications integrated circuits photocopiers solar cells batteries light emitting diodes liquid crystal displays magneto optic memories audio and video systems recordable compact discs video cameras X ray

technology color imaging printing flat panel displays optical waveguides cable televisions computer chips molecular sized transistors and switches as well as other emerging cutting edge technologies Electronic and photonic materials are expected to grow to a trillion dollar industry in the new millennium and will be the most dominating forces in the emerging new technologies in the fields of science and engineering This handbook is a unique source of the in depth knowledge of synthesis processing fabrication spectroscopy physical properties and applications of electronic and photonic materials covering everything for today s and developing future technologies This handbook consists of over one hundred state of the art review chapters written by more than 200 world leading experts from 25 different countries With more than 23 000 bibliographic citations and several thousands of figures tables photographs chemical structures and equations this handbook is an invaluable major reference source for scientists and students working in the field of materials science solid state physics chemistry electrical and optical engineering polymer science device engineering and computational engineering photophysics data storage and information technology and technocrats everyone who is involved in science and engineering of electronic and photonic materials Key Features This is the first handbook ever published on electronic and photonic materials 10 volumes summarize the advances in electronic and photonic materials made over past the two decades This handbook is a unique source of the in depth knowledge of synthesis processing spectroscopy physical properties and applications of electronic and photonic materials Over 100 state of the art review chapters written by more than 200 leading experts from 25 different countries About 25 000 bibliographic citations and several thousand figures tables photographs chemical structures and equations Easy access to electronic and photonic materials from a single reference Each chapter is self contained with cross references Single reference having all inorganic organic and biological materials Witten in very clear and concise fashion for easy understanding of structure property relationships in electronic and photonic materials

Summaries of Papers Presented at the Optical Fiber Communication Conference ... ,1992 Excitonic

Processes in Solids Masayasu Ueta,1986 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

On Exciton-Vibration and Exciton-Photon Interactions in Organic

Semiconductors Antonios M. Alvertis, 2021-10-25 What are the physical mechanisms that underlie the efficient generation and transfer of energy at the nanoscale Nature seems to know the answer to this question having optimised the process of photosynthesis in plants over millions of years of evolution It is conceivable that humans could mimic this process using synthetic materials and organic semiconductors have attracted a lot of attention in this respect Once an organic semiconductor absorbs light bound pairs of electrons with positively charged holes termed excitons are formed Excitons behave as fundamental energy carriers hence understanding the physics behind their efficient generation and transfer is critical to realising the potential of organic semiconductors for light harvesting and other applications such as LEDs and transistors However this problem is extremely challenging since excitons can interact very strongly with photons Moreover simultaneously with the exciton motion organic molecules can vibrate in hundreds of possible ways having a very strong effect on energy transfer The description of these complex phenomena is often beyond the reach of standard quantum mechanical methods which rely on the assumption of weak interactions between excitons photons and vibrations In this thesis Antonios Alvertis addresses this problem through the development and application of a variety of different theoretical methods to the description of these strong interactions providing pedagogical explanations of the underlying physics A comprehensive introduction to organic semiconductors is followed by a review of the background theory that is employed to approach the relevant research questions and the theoretical results are presented in close connection with experiment yielding valuable insights for experimentalists and theoreticians alike

On Exciton-Vibration and Exciton-Photon

Interactions in Organic Semiconductors Antonios M. Alvertis, 2021 What are the physical mechanisms that underlie the efficient generation and transfer of energy at the nanoscale Nature seems to know the answer to this question having optimised the process of photosynthesis in plants over millions of years of evolution It is conceivable that humans could mimic this process using synthetic materials and organic semiconductors have attracted a lot of attention in this respect Once an organic semiconductor absorbs light bound pairs of electrons with positively charged holes termed excitons are formed Excitons behave as fundamental energy carriers hence understanding the physics behind their efficient generation and transfer is critical to realising the potential of organic semiconductors for light harvesting and other applications such as

LEDs and transistors However this problem is extremely challenging since excitons can interact very strongly with photons Moreover simultaneously with the exciton motion organic molecules can vibrate in hundreds of possible ways having a very strong effect on energy transfer The description of these complex phenomena is often beyond the reach of standard quantum mechanical methods which rely on the assumption of weak interactions between excitons photons and vibrations In this thesis Antonios Alvertis addresses this problem through the development and application of a variety of different theoretical methods to the description of these strong interactions providing pedagogical explanations of the underlying physics A comprehensive introduction to organic semiconductors is followed by a review of the background theory that is employed to approach the relevant research questions and the theoretical results are presented in close connection with experiment yielding valuable insights for experimentalists and theoreticians alike

Time-Resolved Light Scattering from Excitons Heinrich Stolz, 2006-04-11 Time Resolved Light Scattering from Excitons investigates exciton states in semiconductors and their relaxation processes by time resolved light scattering The reader will gain both a clear understanding of the theoretical aspects of this method and profound knowledge of the experimental state of the art The development of quantum beat spectroscopy for excitons is also discussed

Excitonic Processes In Condensed Matter, Proceedings Of 2000 International Conference (Excon2000) Kikuo Cho, Atsuo Matsui, 2001-08-22 At Yamada Conference LIII papers on many novel materials and on novel phenomena in condensed matter physics were presented for instance the achievement of simultaneous creation of excitons and free electron hole pairs in rare gas solids and a low frequency fluctuation of the spectral shift of indirect excitons in GaAs coupled quantum wells Single molecule spectroscopy is a powerful tool for studying molecules including biological systems the study of delocalization of excitons in the photosynthetic light harvesting antenna system was also reported The proceedings thus contain many excellent papers dealing with current research topics on the excitonic processes in bulk quantum wells quantum dots and other confined systems This book will serve as an excellent source of recent references and reviews for a wide range of researchers in physics chemistry engineering and biological sciences The proceedings have been selected for coverage in Index to Scientific Technical Proceedings ISTEP CDRom version ISI Proceedings

Optical Properties of Excited States in Solids Baldassare di Bartolo, 2012-12-06 This book presents an account of the course Optical Properties of Excited States in Solids held in Erice Italy from June 16 to 30 1991 This meeting was organized by the International School of Atomic and Molecular Spectroscopy of the Ettore Majorana Centre for Scientific Culture The purpose of this course was to present physical models mathematical formalisms and experimental techniques relevant to the optical properties of excited states in solids Some active physical species such as ions or radicals could survive indefinitely if they were completely isolated in space Other active species such as excited molecular and solid state systems are inherently unstable even in isolation due to the spontaneous mechanisms that may convert their excitation energies into radiation or heat Physical parameters that may be used to characterize these excited systems are the

localization or delocalization and the coherence or incoherence of their state excitations In solids the excited states whether they are localized as for impurities in insulators or delocalized as they may occur in semiconductors are relevant in several regards Their de excitation is extremely sensitive to the nature of the excitations of the systems and a study of the de excitation processes can yield a variety of information For example the excited states may represent the initial condition of the onset of such processes as Stokes shifted emission hot luminescence symmetry dependent Jahn Teller and scattering processes tunneling processes energy transfer to like and unlike centers superradiance coherent radiation and excited state absorption

Dissipative Exciton Dynamics in Light-Harvesting Complexes Marco Schröter, 2015-03-18 Marco Schröter investigates the influence of the local environment on the exciton dynamics within molecular aggregates which build e g the light harvesting complexes of plants bacteria or algae by means of the hierarchy equations of motion HEOM method He addresses the following questions in detail How can coherent oscillations within a system of coupled molecules be interpreted What are the changes in the quantum dynamics of the system for increasing coupling strength between electronic and nuclear degrees of freedom To what extent does decoherence govern the energy transfer properties of molecular aggregates

Physics of New Materials Francisco E. Fujita, 2012-03-17 Physics of New Materials After the discoveries and applications of superconductors new ceramics amorphous and nano materials shape memory and other intelligent materials physics became more and more important comparable with chemistry in the research and development of advanced materials In this book several important fields of physics oriented new materials research and physical means of analyses are selected and their fundamental principles and methods are described in a simple and understandable way It is suitable as a textbook for university materials science courses

Advances In Multi-photon Processes And Spectroscopy, Vol 10 Kenneth P Ghiggino, Reza Islampour, Sheng-hsien Lin, Gregory D Scholes, Masahide Terazima, Albert A Villaeys, Yuichi Fujimura, 1996-06-20 In view of the rapid growth in both experimental and theoretical studies of multiphoton processes and multiphoton spectroscopy of atoms ions and molecules in chemistry physics biology materials science etc it is desirable to publish an Advanced Series that contains review papers readable not only by active researchers in these areas but also by those who are not experts in the field but who intend to enter the field The present series attempts to serve this purpose Each review article is written in a self contained manner by the experts in the area so that the readers can grasp the knowledge in the area without too much preparation It is hoped that the collection of topics in this volume will be useful not only to active researchers but also to other scientists in biology chemistry materials science and physics

Advances In Multi-photon Processes And Spectroscopy, Vol 7 R G Alden, J P Allen, Hai-lung Dai, Reza Islampour, Sheng-hsien Lin, J C Williams, Richard N Zare, 1991-07-22 In view of the rapid growth in both experimental and theoretical studies of multiphoton processes and multiphoton spectroscopy of atoms ions and molecules in chemistry physics biology materials sciences etc it is desirable to publish an Advanced Series that contains review papers readable not only by active researchers in these areas

but also by those who are not experts in the field but who intend to enter the field The present series attempts to serve this purpose Each review article is written in a self contained manner by experts in the area so that the readers can grasp the knowledge in the area without too much preparation This volume will be useful not only to active researchers but also to other scientists in the area of biology chemistry materials science and physics **Theory of Multiphoton Processes**

Farhad H. M. Faisal, 2014-09-01 **Light Scattering from Polymer Solutions and Nanoparticle Dispersions** Wolfgang Schärftl, 2007-08-13 Light scattering is a very powerful method to characterize the structure of polymers and nanoparticles in solution Recent technical developments have strongly enhanced the possible applications of this technique overcoming previous limitations like sample turbidity or insufficient experimental time scales However despite their importance these new developments have not yet been presented in a comprehensive form In addition and maybe even more important to the broad audience there lacks a simple to read textbook for students and non experts interested in the basic principles and fundamental techniques of light scattering As part of the Springer Laboratory series this book tries not only to provide such a simple to read and illustrative textbook about the seemingly very complicated topic of light scattering from polymers and nanoparticles in dilute solution but also intends to cover some of the newest technical developments in experimental light scattering

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