



Semiconductor Quantum Dots

Yasuaki Masumoto, T. Takagahara



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Semiconductor Quantum Dots Ladislaus Alexander Banyai, Stephan W Koch, 1993-05-28 *Semiconductor Quantum Dots* presents an overview of the background and recent developments in the rapidly growing field of ultrasmall semiconductor microcrystallites in which the carrier confinement is sufficiently strong to allow only quantized states of the electrons and holes. The main emphasis of this book is the theoretical analysis of the confinement induced modifications of the optical and electronic properties of quantum dots in comparison with extended materials. The book develops the theoretical background material for the analysis of carrier quantum confinement effects, introduces the different confinement regimes for relative or center of mass motion, quantization of the electron hole pairs and gives an overview of the best approximation schemes for each regime. A detailed discussion of the carrier states in quantum dots is presented and surface polarization instabilities are analyzed leading to the self trapping of carriers near the surface of the dots. The influence of spin orbit coupling on the quantum confined carrier states is discussed. The linear and nonlinear optical properties of small and large quantum dots are studied in detail and the influence of the quantum dot size distribution in many realistic samples is outlined. Phonons in quantum dots as well as the influence of external electric or magnetic fields are also discussed. Last but not least the recent developments dealing with regular systems of quantum dots are also reviewed. All things included, this is an important piece of work on semiconductor quantum dots not to be dismissed by serious researchers and physicists. **Single**

Semiconductor Quantum Dots Peter Michler, 2009-06-13 This book reviews recent advances in the field of semiconductor quantum dots via contributions from prominent researchers in the scientific community. Special focus is given to optical quantum optical and spin properties of single quantum dots. Semiconductor Quantum Dots Yasuaki Masumoto, T.

Takagahara, 2002-05-28 Growth of Self Organized Quantum Dots J S Lee Excitonic Structures and Optical Properties of Quantum Dots Toshihide Takagahara Electron Phonon Interactions in Semiconductor Quantum Dots Toshihide Takagahara Micro Imaging and Single Dot Spectroscopy of Self Assembled Quantum Dots Mitsuru Sugisaki Persistent Spectral Hole Burning in Semiconductor Quantum Dots Yasuaki Masumoto Dynamics of Carrier Relaxation in Self Assembled Quantum Dots Ivan V Ignatiev Igor E Kozin Resonant Two Photon Spectroscopy of Quantum Dots Alexander Baranov Homogeneous Width of Confined Excitons in Quantum Dots Experimental Yasuaki Masumoto Theory of Exciton Dephasing in Semiconductor Quantum Dots Toshihide Takagahara Excitonic Optical Nonlinearity and Weakly Correlated Exciton Pair States Selvakumar V Nair Toshihide Takagahara Coulomb Effects in the Optical Spectra of Highly Excited Semiconductor Quantum Dots Selvakumar V Nair Device **Quantum Dots** Alexander Tartakovskii, 2012-07-19 A comprehensive review of cutting edge

solid state research focusing on quantum dot nanostructures for graduate students and researchers. *Semiconductor Nanocrystal Quantum Dots* Andrey Rogach, 2008-09-02 When investigations on semiconductor nanocrystal quantum dots started more than a quarter of a century ago, no one ever believed that nanoparticle research would develop into one of the

major fields in modern science The basis was laid by studies of photocatalysis and artificial water splitting driven by the former oil crisis These euphorically started activities ebbed away more and more when on one side oil brimmed over again and the scientists on the other did not succeed in the concomitant formation of hydrogen and oxygen At the same time size quantisation was discovered in nanocrystals initiating a fruitful research field on scaling laws of physical and chemical properties of quantum dots Especially optical investigations of semiconductor nanocrystals led to fascinating scientific results and to applications in optoelectronics and biolabeling Advances in spectroscopic measurements were always correlated with advances in synthesis The better the size shape and surface control of the particles was developed the more detailed and precise was the spectroscopic information gained Applications of nanocrystal quantum dots often require assembly processes for the formation of polymer hybrids or thin films For this as well as for the use in biomedical applications new ligand chemistry needed to be developed during the recent past This book gives a very competent view on all these facets of nanocrystal quantum dot research Twelve chapters are written by experts in the fields in a way introducing the respective concepts and providing comprehensive overview on the current state of the art

Semiconductor Quantum Dots Yasuaki Masumoto, T. Takagahara, 2014-03-12 Semiconductor quantum dots represent one of the fields of solid state physics that have experienced the greatest progress in the last decade Recent years have witnessed the discovery of many striking new aspects of the optical response and electronic transport phenomena This book surveys this progress in the physics optical spectroscopy and application oriented research of semiconductor quantum dots It focuses especially on excitons multi excitons their dynamical relaxation behaviour and their interactions with the surroundings of a semiconductor quantum dot Recent developments in fabrication techniques are reviewed and potential applications discussed This book will serve not only as an introductory textbook for graduate students but also as a concise guide for active researchers

Capture and Relaxation in Self-Assembled Semiconductor Quantum Dots Robson Ferreira, Gerald Bastard, 2016-02-23 This is an overview of different models and mechanisms developed to describe the capture and relaxation of carriers in quantum dot systems Despite their undisputed importance the mechanisms leading to population and energy exchanges between a quantum dot and its environment are not yet fully understood The authors develop a first order approach to such effects using elementary quantum mechanics and an introduction to the physics of semiconductors The book results from a series of lectures given by the authors at the Master's level

Semiconductor Quantum Dots Mark Green, 2014-07-01 Quantum dots are nano sized particles of semiconducting material typically chalcogenides or phosphides of metals found across groups II to VI of the periodic table Their small size causes them to exhibit unique optical and electrical properties which are now finding applications in electronics optics and in the biological sciences Synthesis of these materials began in the late 1980's and this book gives a thorough background to the topic referencing these early discoveries Any rapidly expanding field will contain vast amounts of publications and this book presents a complete overview of the field bringing together the most relevant and

seminal aspects literature in an informed and succinct manner The author has been an active participant in the field since its infancy in the mid 1990 s and presents a unique handbook to the synthesis and application of this unique class of materials Drawing on both his own experience and referencing the primary literature Mark Green has prepared Postgraduates and experienced researchers will benefit from the comprehensive nature of the book as will manufacturers of quantum dots and those wishing to apply them *Theory of Semiconductor Quantum Dots*, 2009 *Electron Spin and Charge in Semiconductor Quantum Dots* Jeroen Martijn Elzerman, 2004-01-01 Introduction Few electron quantum dot circuit with integrated charge read out Excited state spectroscopy on a nearly closed quantum dot via charge detection Real time detection of single electron tunneling using a quantum point contact Single shot read out of an individual electron spin in a quantum dot Semiconductor few electron quantum dots as spin qubits the Kondo effect in the unitary limit Kondo effect in an integer spin quantum dot Electron cotunneling in a semiconductor dot Summary **Optical Properties of Semiconductor Quantum Dots** Ulrike Woggon, 2013-10-03 This book presents an overview of the current understanding of the physics of zero dimensional semiconductors It concentrates mainly on quantum dots of wide gap semiconductors but touches also on zero dimensional systems based on silicon and III V materials After providing the reader with a theoretical background the author illustrates the specific properties of three dimensionally confined semiconductors such as the size dependence of energy states optical transitions and dephasing mechanisms with the results from numerous experiments in linear and nonlinear spectroscopy Technological concepts of the growth concepts and the potential of this new class of semiconductor materials for electro optic and nonlinear optical devices are also discussed Capture and Relaxation in Self-Assembled Semiconductor Quantum Dots R Ferreira, 2015-12-18 **Selected Papers on Semiconductor Quantum Dots** Frank W. Wise, 2005 Semiconductor quantum dots also known as nanocrystals are structures with electronic and optical properties that can be engineered through the size of the structure not just the composition Quantum confinement of charge carriers leads to a wide range of intriguing physical and chemical phenomena and is a new degree of freedom in material design Semiconductor quantum dots have potential for applications ranging from optoelectronic devices to biological imaging The papers selected for this volume treat the fundamental properties of semiconductor quantum dots and form a significant part of the foundation on which the current field of nanoscience research is built Semiconductor Quantum Bits Fritz Henneberger, Oliver Benson, 2016-04-19 This book highlights state of the art qubit implementations in semiconductors and provides an extensive overview of this newly emerging field Semiconductor nanostructures have huge potential as future quantum information devices as they provide various ways of qubit implementation electron spin electronic excitation as well as a way to transfer *Quantum Optics with Semiconductor Nanostructures* Frank Jahnke, 2012-07-16 An understanding of the interaction between light and matter on a quantum level is of fundamental interest and has many applications in optical technologies The quantum nature of the interaction has recently attracted great attention for applications of semiconductor

nanostructures in quantum information processing Quantum optics with semiconductor nanostructures is a key guide to the theory experimental realisation and future potential of semiconductor nanostructures in the exploration of quantum optics Part one provides a comprehensive overview of single quantum dot systems beginning with a look at resonance fluorescence emission Quantum optics with single quantum dots in photonic crystal and micro cavities are explored in detail before part two goes on to review nanolasers with quantum dot emitters Light matter interaction in semiconductor nanostructures including photon statistics and photoluminescence is the focus of part three whilst part four explores all solid state quantum optics crystal nanobeam cavities and quantum dot microcavity systems Finally part five investigates ultrafast phenomena including femtosecond quantum optics and coherent optoelectronics with quantum dots With its distinguished editor and international team of expert contributors Quantum optics with semiconductor nanostructures is an essential guide for all those involved with the research development manufacture and use of semiconductors nanodevices lasers and optical components as well as scientists researchers and students A key guide to the theory experimental realisation and future potential of semiconductor nanostructures in the exploration of quantum optics Chapters provide a comprehensive overview of single quantum dot systems nanolasers with quantum dot emitters and light matter interaction in semiconductor nanostructures Explores all solid state quantum optics crystal nanobeam cavities and quantum dot microcavity systems and investigates ultrafast phenomena

Semiconductor Quantum Dots And Rods For In Vivo Imaging And Cancer Phototherapy Maoquan Chu,2017-06-19 Cancer is fast becoming one of the main causes of death worldwide Unfortunately many cases are diagnosed at an advanced incurable stage and these lives are usually lost Early diagnosis and treatment are very important for increasing disease curability In recent years novel techniques for cancer diagnosis and therapy have been developed and nanobiomedicine appears to show the most promising results The application of nanotechnology to biology and medicine in cancer diagnosis is termed nanobiomedicine Nanoparticles 1 100 nm in size usually have unique physical and or chemical properties and this has attracted great attention in the cancer research Preparation and biomedical applications of the nanoparticles are key components in nanobiomedicine Semiconductor nanocrystals including quantum dots QDs and quantum rods QRs have been extensively investigated for drug delivery biomedical imaging and tumor target therapy In Semiconductor Quantum Dots and Rods for In Vivo Imaging and Cancer Phototherapy the QD and QR optical properties sentinel lymph node mapping in vivo tumor target imaging self illuminating QDs for in vivo imaging in vivo cancer photothermal therapy and photodynamic therapy QD graphene nanosheet and QD magnetic hybrid nanocomposites for bioimaging and cancer therapy are discussed This book may interest under and postgraduate students in the field of bioengineering especially cancer phototherapy and medical professions alike

Fundamental Absorption of Semiconductor Quantum Dots David Hayrapetyan, Hayk A. Sarkisyan, Eduard M. Kazaryan,2018 This Spotlight describes the process of fundamental absorption in a variety of quantum dot QD geometries such as spherical cylindrical ellipsoidal lens shaped

conical and spherical layered including in the presence of external fields Other topics include the effect of exciton effects on the interband absorption coefficients and the application of QD ensembles in QD LED devices The mathematics involved is presented with as much detail as possible and readers need only be familiar with semiconductor physics and quantum mechanics

Semiconductor Quantum Dots in Glasses Li-Chi John Liu, 1993 *Single Semiconductor Quantum Dots* Peter Michler, 2009-06-18 This book reviews recent advances in the field of semiconductor quantum dots via contributions from prominent researchers in the scientific community Special focus is given to optical quantum optical and spin properties of single quantum dots

Single Quantum Dots Peter Michler, 2010-12-09 Special focus is given to the optical and electronic properties of single quantum dots due to their potential applications in devices operating with single electrons and or single photons This includes quantum dots in electric and magnetic fields cavity quantum electrodynamics nonclassical light generation and coherent optical control of excitons

Reviewing **Semiconductor Quantum Dots**: Unlocking the Spellbinding Force of Linguistics

In a fast-paced world fueled by information and interconnectivity, the spellbinding force of linguistics has acquired newfound prominence. Its capacity to evoke emotions, stimulate contemplation, and stimulate metamorphosis is actually astonishing. Within the pages of "**Semiconductor Quantum Dots**," an enthralling opus penned by a highly acclaimed wordsmith, readers embark on an immersive expedition to unravel the intricate significance of language and its indelible imprint on our lives. Throughout this assessment, we shall delve to the book is central motifs, appraise its distinctive narrative style, and gauge its overarching influence on the minds of its readers.

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