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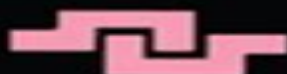
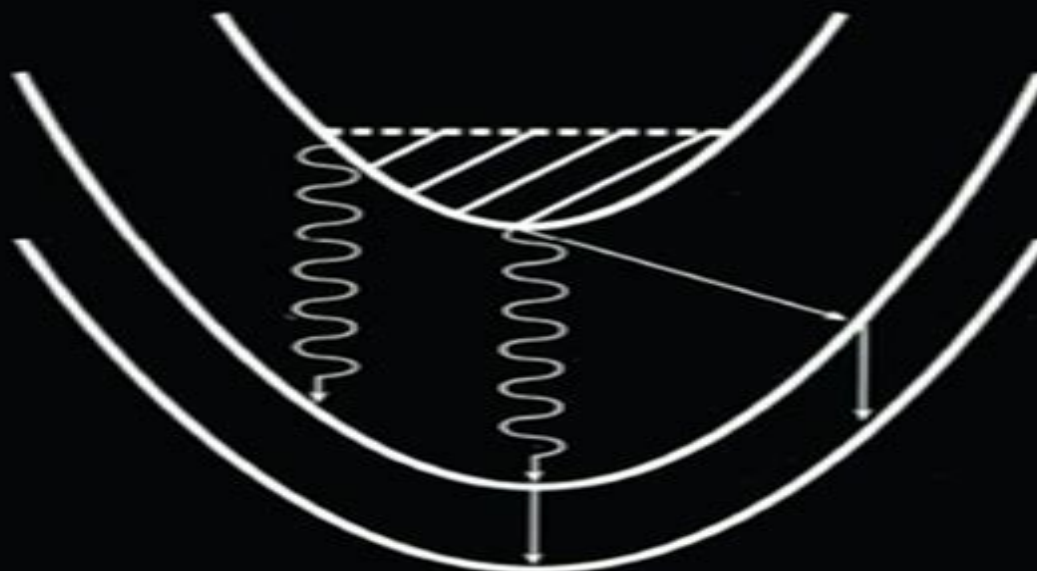
From Quantum Physics to Smart Devices

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Proceedings of the Fiftieth Scottish Universities
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Semiconductor Quantum Optoelectronics

Benjamin Lingnau



Semiconductor Quantum Optoelectronics:

Semiconductor Quantum Optoelectronics A. Miller, 2020-12-17 The development and application of low dimensional semiconductors have been rapid and spectacular during the past decade Ever improving epitaxial growth and device fabrication techniques have allowed access to some remarkable new physics in quantum confined structures while a plethora of new devices has emerged The field of optoelectronics in particular has benefited from these advances both in terms of improved performance and the invention of fundamentally new types of device at a time when the use of optics and lasers in telecommunications broadcasting the Internet signal processing and computing has been rapidly expanding An appreciation of the physics of quantum and dynamic electronic processes in confined structures is key to the understanding of many of the latest devices and their continued development Semiconductor Quantum Optoelectronics covers new physics and the latest device developments in low dimensional semiconductors It allows those who already have some familiarity with semiconductor physics and devices to broaden and expand their knowledge into new and expanding topics in low dimensional semiconductors The book provides pedagogical coverage of selected areas of new and pertinent physics of low dimensional structures and presents some optoelectronic devices presently under development Coverage includes material and band structure issues and the physics of ultrafast nonlinear coherent intersubband and intracavity phenomena The book emphasizes various devices including quantum wells visible quantum cascade and mode locked lasers microcavity LEDs and VCSELs and detectors and logic elements An underlying theme is high speed phenomena and devices for increased system bandwidths

Semiconductor Quantum Optoelectronics Alan Miller, M. Ebrahimzadeh, Majid Ebrahimzadeh, D. M. Finlayson, 1999 This book combines new physics and the latest device developments in low dimensional semiconductors The development and application of low dimensional semiconductors has been rapid and spectacular during the past decade Ever improving epitaxial growth and device fabrication techniques have allowed access to some remarkable new physics in quantum confined structures while in parallel a plethora of new devices have emerged The field of optoelectronics in particular has benefited from these advances both in terms of improved performance and the invention of fundamentally new types of device at a time when the use of optics and lasers in telecommunications broadcasting the internet signal processing and computing has been rapidly expanding An appreciation of the physics of quantum and dynamical electronic processes in confined structures is key to the understanding of many of the latest devices and involvement in their continued development This book allows those who already have some familiarity with semiconductor physics and devices to broaden and expand their knowledge into new and expanding topics in low dimensional semic

Spin-based Optoelectronics with Semiconductor Quantum Dots Pablo Aschhoff, 2012 **Semiconductor Photonics of Nanomaterials and Quantum Structures** Arash Rahimi-Iman, 2021-04-23 This book introduces the wider field of functional nanomaterials sciences with a strong emphasis on semiconductor photonics Whether you are studying photonic quantum devices or just interested in

semiconductor nanomaterials and their benefits for optoelectronic applications this book offers you a pedagogical overview of the relevant subjects along with topical reviews The book discusses different yet complementary studies in the context of ongoing international research efforts delivering examples from both fundamental and applied research to a broad readership In addition a hand full of useful optical techniques for the characterization of semiconductor quantum structures and materials are addressed Moreover nanostructuring methods for the production of low dimensional systems which exhibit advantageous properties predominantly due to quantum effects are summarized Science and engineering professionals in the interdisciplinary domains of nanotechnology photonics materials sciences and quantum physics can familiarize themselves with selected highlights with eyes towards photonic applications in the fields of two dimensional materials research light matter interactions and quantum technologies

III-Nitride Semiconductor Optoelectronics, 2017-01-05 III Nitride Semiconductor Optoelectronics covers the latest breakthrough research and exciting developments in the field of III nitride compound semiconductors It includes important topics on the fundamentals of materials growth characterization and optoelectronic device applications of III nitrides Bulk quantum well quantum dot and nanowire heterostructures are all thoroughly explored Contains the latest breakthrough research in III nitride optoelectronics Provides a comprehensive presentation that covers the fundamentals of materials growth and characterization and the design and performance characterization of state of the art optoelectronic devices Presents an in depth discussion on III nitride bulk quantum well quantum dot and nanowire technologies

Quantum Theory of the Optical and Electronic Properties of Semiconductors Hartmut Haug, Stephan W Koch, 1993-04-16 This substantially revised second edition of the Quantum Theory of the Optical and Electronic Properties of Semiconductors presents the basic elements needed to understand and engage in research in semiconductor physics In this edition misprints have been corrected and new and more detailed material has been added In order to treat the valence band structure of semiconductors an introduction to the k p theory and the related description in terms of the Luttinger Hamiltonian was included An introductory chapter on mesoscopic semiconductor structures was added which discusses the envelope function approximation and the modification caused by the spatial quantum confinement In many chapters the results are developed in parallel first for bulk material and then for quasi two dimensional quantum wells and for quasi one dimensional quantum wires Semiconductor quantum dots are treated in a separate chapter The discussion of time dependent and coherent phenomena in semiconductors has been considerably extended by including a section dealing with the theoretical description of photon echoes in semiconductors After the discussion of semiconductor laser physics optical bistability and electroabsorption in semiconductors a new chapter on magneto absorption has been added in which magneto excitons and magneto plasmas in two dimensional systems are discussed The chapter on electron kinetics due to the interaction with longitudinal optical phonons has been extended and a discussion on carrier carrier collisions has been added to the chapter dealing with the semiconductor Bloch equations The

material is presented in sufficient detail for graduate students and researchers who have a general background in quantum mechanics Request Inspection Copy Contents Oscillator Model Atom in a Classical Light Field Periodic Lattice of Atoms Free Carrier Transitions Mesoscopic Semiconductor Structures Ideal Quantum Gases Interacting Electron Gas Plasmons and Plasma Screening Retarded Green's Function for Electrons Excitons Polaritons Semiconductor Bloch Equations Optical Quasi Equilibrium Nonlinearities Optical Bistability The Semiconductor Laser Coherent Effects in Semiconductors Free Carrier Electroabsorption Exciton Electroabsorption Magneto Optics Semiconductor Quantum Dots Kinetics with Phonon Scattering Appendix A Field Quantization Appendix B Nonequilibrium Green's Functions Readership Solid state physicists engineers materials and optical scientists

Nonlinear and Nonequilibrium Dynamics of Quantum-Dot

Optoelectronic Devices Benjamin Lingnau, 2015-12-14 This thesis sheds light on the unique dynamics of optoelectronic devices based on semiconductor quantum dots The complex scattering processes involved in filling the optically active quantum dot states and the presence of charge carrier nonequilibrium conditions are identified as sources for the distinct dynamical behavior of quantum dot based devices Comprehensive theoretical models which allow for an accurate description of such devices are presented and applied to recent experimental observations The low sensitivity of quantum dot lasers to optical perturbations is directly attributed to their unique charge carrier dynamics and amplitude phase coupling which is found not to be accurately described by conventional approaches The potential of quantum dot semiconductor optical amplifiers for novel applications such as simultaneous multi state amplification ultra wide wavelength conversion and coherent pulse shaping is investigated The scattering mechanisms and the unique electronic structure of semiconductor quantum dots are found to make such devices prime candidates for the implementation of next generation optoelectronic applications which could significantly simplify optical telecommunication networks and open up novel high speed data transmission schemes

Semiconductor Quantum Well Intermixing J. T. Lie, 2000-01-18 Semiconductor Quantum Well Intermixing is an international collection of research results dealing with several aspects of the diffused quantum well DFQW ranging from Physics to materials and device applications The material covered is the basic interdiffusion mechanisms of both cation and anion groups as well as the properties of band structure

Quantum Dot Optoelectronic Devices Peng Yu, Zhiming M. Wang, 2020-04-16 This book captures cutting edge research in semiconductor quantum dot devices discussing preparation methods and properties and providing a comprehensive overview of their optoelectronic applications Quantum dots QDs with particle sizes in the nanometer range have unique electronic and optical properties They have the potential to open an avenue for next generation optoelectronic methods and devices such as lasers biomarker assays field effect transistors LEDs photodetectors and solar concentrators By bringing together leaders in the various application areas this book is both a comprehensive introduction to different kinds of QDs with unique physical properties as well as their preparation routes and a platform for knowledge sharing and dissemination of the latest advances in a novel area of

nanotechnology The Physics of Semiconductors Kevin F. Brennan, 1999-02-13 Modern fabrication techniques have made it possible to produce semiconductor devices whose dimensions are so small that quantum mechanical effects dominate their behavior This book describes the key elements of quantum mechanics statistical mechanics and solid state physics that are necessary in understanding these modern semiconductor devices The author begins with a review of elementary quantum mechanics and then describes more advanced topics such as multiple quantum wells He then discusses equilibrium and nonequilibrium statistical mechanics Following this introduction he provides a thorough treatment of solid state physics covering electron motion in periodic potentials electron phonon interaction and recombination processes The final four chapters deal exclusively with real devices such as semiconductor lasers photodiodes flat panel displays and MOSFETs The book contains many homework exercises and is suitable as a textbook for electrical engineering materials science or physics students taking courses in solid state device physics It will also be a valuable reference for practising engineers in optoelectronics and related areas

Adopting the Beat of Expression: An Psychological Symphony within **Semiconductor Quantum Optoelectronics**

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