Quantum Coherence In Solid State Systems Volume 171 International School Of Physics Enrico Fermi Proceedings Of The International School Of Physics Enrico Fermi

High-resolution NMR Techniques in Organic Chemistry24th International Conference on the Physics of SemiconductorsOptical Generation and Control of Quantum Coherence in Semiconductor NanostructuresCoherent States, Wavelets, and Their GeneralizationsManipulating Quantum Coherence in Solid State SystemsOptical Generation and Control of Quantum Coherence in Semiconductor NanostructuresSelf-Assembled Quantum DotsAdvances in Research and Applications: Semiconductor Heterostructures and NanostructuresHandbook of SpectroscopyNMR Imaging of MaterialsQuantum Information and CoherenceQuantum CoherenceSolid-State NMR in Materials ScienceQuantum Computing in Solid State SystemsSolid State NMR Studies of BiopolymersX-Ray Compton ScatteringAdvances in Solid State PhysicsQuantum Computing and Quantum Bits in Mesoscopic SystemsBinding and Scattering in Two-Dimensional SystemsSolid State PhysicsQuantum GenerationsMacroscopic Quantum Phenomena in SpintronicsAdvances in Solid State Physics 46New Techniques in Solid-State NMRUltrafast Dynamical Processes in SemiconductorsRadiation and Solid State Physics, Nuclear and High Energy Physics, Mathematical PhysicsSolid State NMRSolid State NMR SpectroscopyOptical Coherence and Quantum OpticsQuantum EngineeringFundamentals of Quantum MechanicsTowards Solid-State Quantum RepeatersDynamics at Solid State Surfaces and InterfacesFrom Atomic to MesoscaleSolid State and Quantum Theory for OptoelectronicsSolid State PhysicsMacroscopic Quantum Coherence and Quantum ComputingQuantum Coherence in Solid State SystemsSolid-State NMR IV Methods and Applications of Solid-State NMRQuantum Engineering

High-resolution NMR Techniques in Organic Chemistry

NMR imaging of materials is a field of increasing importance. Applications expand from fundamental science like the characterization of fluid transport in porous rock, catalyst pellets, and hemodialyzers into various fields of engineering for process optimization and product and quality control, for example, of polymer materials, biomaterials, elastomers, and ceramics. While the results of NMR imaging are being appreciated in a growing community, the methods of imaging are far more diverse for materials applications than for medical imaging of humans. This book provides an introduction to NMR imaging of materials covering solid-state NMR spectroscopy, imaging methods for liquid and solid samples, and unusual NMR in terms of special approaches to spatial resolution like an NMR surface scanner. Special attention is paid to the large variety of ways to generate image contrast - the most prominent feature of NMR. The text is strong on methodology, and includes today's important application areas.

24th International Conference on the Physics of Semiconductors

This book presents written versions of selected invited lectures from the spring meeting of the Arbeitskreis Festkörperphysik of the Deutsche Physikalische Gesellschaft which was held from 27 to 31 March 2006 in Dresden, Germany. Many topical talks given at the numerous symposia are included. Most of these were organized collaboratively by several of the divisions of the Arbeitskreis. The book presents, to some extent, the status of the field of solid-state physics in 2006 not only in Germany but also internationally.

Optical Generation and Control of Quantum Coherence in Semiconductor Nanostructures

With the development of potent x-ray sources, Compton scattering has become a standard tool for studying electron densities in materials. This text looks at the Compton scattering method, leading to a fundamental understanding of the electrical and magnetic properties of solid materials, both elements and compounds.

Coherent States, Wavelets, and Their Generalizations

The content of this volume has been added toeMagRes (formerly Encyclopedia of MagneticResonance) - the ahref="http://onlinelibrary.wiley.com/book/10.1002/9780470034590/homepage/rf_coils_virtual_issue.htm?cm=on-chem&cs=chem-analytic&cu=sitename-ln&cd=sitename-ln-MRIgroup-VI" target="_blank"ultimate online resource for NMR and MRI/a. The field of solid state NMR of biological samples [ssNMR] hasblossomed in the past 5-10 years, and a cohesive overview of thetechnology is needed for new practitioners in industry andacademia. This title provides an overview of Solid State NMRmethods for studying structure dynamics and ligand-binding inbiopolymers, and offers an overview of RF pulse sequences forvarious applications, including not only a systematic catalog butalso a discussion of theoretical tools for analysis of pulsesequences. Practical examples of biochemical applications areincluded, along with a detailed discussion of the many aspects ofsample preparation and handling that make spectroscopy on solidproteins successful. About EMR Handbooks / eMagResHandbooks The Encyclopedia of Magnetic Resonance (up to 2012) andeMagRes (from 2013 onward) publish a wide range of onlinearticles on all aspects of magnetic resonance in physics,chemistry, biology and medicine. The existence of this large numberof articles, written by experts in various fields, is enabling thepublication of a series of EMR Handbooks / eMagResHandbooks on specific areas of NMR and MRI. Thechapters of each of these handbooks will comprise a carefullychosen selection of articles from eMagRes. In consultationwith the eMagRes Editorial Board, the EMRHandbooks / eMagRes Handbooks are coherentlyplanned in advance by specially-selected Editors, and new articlesare written (together with updates of some already existingarticles) to give appropriate complete coverage. The handbooks areintended to be of value and interest to research students,postdoctoral fellows and other researchers learning about thescientific area in question and undertaking relevant experiments,whether in academia or industry. Have the content of this Handbook and the complete content ofeMagRes at your fingertips! Visit: ahref="http://www.wileyonlinelibrary.com/ref/eMagRes"www.wileyonlinelibrary.com/ref/eMagRes/a View other eMagRes publications ahref="h

ttp://onlinelibrary.wiley.com/book/10.1002/9780470034590/homepage/emagres_publications.htm" target="_blank"here/a

Manipulating Quantum Coherence in Solid State Systems

The fundamental concept of quantum coherence plays a central role in quantum physics, cutting across disciplines of quantum optics, atomic and condensed matter physics. Quantum coherence represents a universal property of the quantum s- tems that applies both to light and matter thereby tying together materials and p- nomena. Moreover, the optical coherence can be transferred to the medium through the light-matter interactions. Since the early days of quantum mechanics there has been a desire to control dynamics of quantum systems. The generation and c- trol of quantum coherence in matter by optical means, in particular, represents a viable way to achieve this longstanding goal and semiconductor nanostructures are the most promising candidates for controllable quantum systems. Optical generation and control of coherent light-matter states in semiconductor quantum nanostructures is precisely the scope of the present book. Recently, there has been a great deal of interest in the subject of quantum coh- ence. We are currently witnessing parallel growth of activities in different physical systems that are all built around the central concept of manipulation of quantum coherence. The burgeoning activities in solid-state systems, and semiconductors in particular, have been strongly driven by the unprecedented control of coherence that previously has been demonstrated in quantum optics of atoms and molecules, and is now taking advantage of the remarkable advances in semiconductor fabrication technologies. A recent impetus to exploit the coherent quantum phenomena comes from the emergence of the quantum information paradigm.

Optical Generation and Control of Quantum Coherence in Semiconductor Nanostructures

Quantum Computation in Solid State Systems discusses experimental implementation of quantum computing for information processing devices; in particular observations of quantum behavior in several solid state systems are presented. The complementary theoretical contributions provide models of minimizing decoherence in the different systems. Most recent theoretical and experimental results on macroscopic quantum coherence of mesoscopic systems, as well as the realization of solid-state qubits and quantum gates are discussed. Particular attention is given to coherence effects in Josephson devices. Other solid state systems---including quantum dots, optical, ion, and spin devices---are also discussed.

Self-Assembled Quantum Dots

At the end of the nineteenth century, some physicists believed that the basic principles underlying their subject were already known, and that physics in the future would only consist of filling in the details. They could hardly have been more wrong. The past century has seen the rise of quantum mechanics, relativity, cosmology, particle physics, and solid-state physics, among other fields. These subjects have fundamentally changed our understanding of space, time, and

matter. They have also transformed daily life, inspiring a technological revolution that has included the development of radio, television, lasers, nuclear power, and computers. In Quantum Generations, Helge Kragh, one of the world's leading historians of physics, presents a sweeping account of these extraordinary achievements of the past one hundred years. The first comprehensive one-volume history of twentieth-century physics, the book takes us from the discovery of X rays in the mid-1890s to superstring theory in the 1990s. Unlike most previous histories of physics, written either from a scientific perspective or from a social and institutional perspective, Quantum Generations combines both approaches. Kragh writes about pure science with the expertise of a trained physicist, while keeping the content accessible to nonspecialists and paying careful attention to practical uses of science, ranging from compact disks to bombs. As a historian, Kragh skillfully outlines the social and economic contexts that have shaped the field in the twentieth century. He writes, for example, about the impact of the two world wars, the fate of physics under Hitler, Mussolini, and Stalin, the role of military research, the emerging leadership of the United States, and the backlash against science that began in the 1960s. He also shows how the revolutionary discoveries of scientists ranging from Einstein, Planck, and Bohr to Stephen Hawking have been built on the great traditions of earlier centuries. Combining a mastery of detail with a sure sense of the broad contours of historical change, Kragh has written a fitting tribute to the scientists who have played such a decisive role in the making of the modern world.

Advances in Research and Applications: Semiconductor Heterostructures and Nanostructures

The explosion of the science of mesoscopic structures is having a great impact on physics and electrical engineering because of the possible applications of these structures in microelectronic and optoelectronic devices of the future. This volume of Solid State Physics consists of two comprehensive and authoritative articles that discuss most of the physical problems that have so far been identified as being of importance in semiconductor nanostructures. Much of the volume is tutorial in characture--while at the same time time presenting current and vital theoretical and experimental results and a copious reference list--so it will be essential reading to all those taking a part in the research and development of this emerging technology.

Handbook of Spectroscopy

Volume 43 of Advances in Solid State Physics contains the written versions of most of the plenary and invited lectures of the Spring Meeting of the Condensed Matter Physics section of the Deutsche Physikalische Gesellschaft held from March 24 to 28, 2003 in Dresden, Germany. Many of the topical talks given at the numerous and very lively symposia are also included. They covered an extremely interesting selection of timely subjects. Thus the book truly reflects the status of the field of solid state physics in 2003, and explains its attractiveness, not only in Germany but also internationally.

NMR Imaging of Materials

This volume is an outgrowth of the Second International Workshop on Macroscopic Quantum Coherence and Computing held in Napoli, Italy, in June 2000. This workshop gathered a number of experts from the major Universities and Research Institutions of several countries. The choice of the location, which recognizes the role and the traditions of Naples in this field, guaranteed the participants a stimulating atmosphere. The aim of the workshop has been to report on the recent theoretical and experimental results on the macroscopic quantum coherence of macroscopic systems. Particular attention was devoted to Josephson devices. The correlation with other atomic and molecular systems, exhibiting a macroscopic quantum behaviour, was also discussed. The seminars provided both historical overview and recent theoretical ground on the topic, as well as information on new experimental results relative to the quantum computing area. The first workshop on this topic, held in Napoli in 1998, has been ennobled by important reports on observations of Macroscopic Quantum Coherence in mesoscopic systems. The current workshop proposed, among many stimulating results, the first observations of Macroscopic Quantum Coherence between macroscopically distinct fluxoid states in rf SQUIDs, 20 years after the Leggett's proposal to experimentally test the quantum behavior of macroscopic systems. Reports on observations of quantum behaviour in molecular and magnetic systems, small Josephson devices, quantum dots have also been particularly stimulating in view of the realization of several possible q-bits.

Quantum Information and Coherence

Dedicated to the memory of Franco Bassani, the former President of the Societa Italiana di Fisica, this volume gives an overview of the manifestations of quantum coherence in different solid state systems, including semiconductor confined systems, magnetic systems, crystals and superconductors.

Quantum Coherence

This monograph is accessible to anyone with an undergraduate background in quantum mechanics, electromagnetism and some solid state physics. It describes in detail the properties of particles and fields in quasi-two-dimensional systems used to approximate realistic quantum heterostructures. Here the authors treat wires, i.e. they assume an infinite hard-wall potential for the system. They discuss bound states, the properties of transmission and reflection, conductance, etc. It is shown that the simple models developed in this book in detail are capable of understanding even complex physical phenomena. The methods are applied to optical states in photonic crystals, and similarities and differences between those and electronic states in quantum heterostructures and electromagnetic fields in waveguides are discussed.

Solid-State NMR in Materials Science

Solid-State NMR is a branch of Nuclear Magnetic Resonance which is presently experiencing a phase of strongly increasing popularity. The most striking evidence is the large number of contributions from Solid-State Resonance at NMR meetings, approaching that ofliquid state resonance. Important progress can be observed in

the areas of methodological developments and applications to organic and inorganic matter. One volume devoted to more or less one of each of these areas has been published in the preceding three issues. This volume can be considered an addendum to this series. Selected methods and applications of Solid-State NMR are featured in three chapters. The first one treats the recoupling of dipolar interactions in solids, which are averaged by fast sample rotation. Following an introduction to effective Hamiltonians and Floquet theory, different types of experiment such as rotary resonance, dipolar chemical shift correlation spectroscopy, rotational resonance and multipulse recoupling are treated in the powerful Floquet formalism. In the second chapter, the different approaches to line narrowing of quadrupolar nuclei are reviewed in a. consistent formulation of double resonance (DaR) and dynamic angle spinning (DAS). Practical aspects of probe design are considered as well as advanced 2D experiments, sensitivity enhancement techniques, and spinning sideband manipulations. The use of such techniques dramatically increases the number of nuclei which can be probed in high resolution NMR spectroscopy. The final chapter describes new experimental approaches and results of structural studies of noncrystalline solids.

Quantum Computing in Solid State Systems

This book offers an introduction to ten key topics in quantum information science and quantum coherent phenomena, aimed at graduate-student level. The chapters cover some of the most recent developments in this dynamic research field where theoretical and experimental physics, combined with computer science, provide a fascinating arena for groundbreaking new concepts in information processing. The book addresses both the theoretical and experimental aspects of the subject, and clearly demonstrates how progress in experimental techniques has stimulated a great deal of theoretical effort and vice versa. Experiments are shifting from simply preparing and measuring quantum states to controlling and manipulating them, and the book outlines how the first real applications, notably quantum key distribution for secure communication, are starting to emerge. The chapters cover quantum retrodiction, ultracold quantum gases in optical lattices, optomechanics, quantum algorithms, quantum key distribution, quantum control based on measurement, orbital angular momentum of light, entanglement theory, trapped ions and quantum metrology, and open quantum systems subject to decoherence. The contributing authors have been chosen not just on the basis of their scientific expertise, but also because of their ability to offer pedagogical and well-written contributions which will be of interest to students and established researchers.

Solid State NMR Studies of Biopolymers

With contributions by numerous experts

X-Ray Compton Scattering

This multidisciplinary book provides up-to-date coverage of carrier and spin dynamics and energy transfer and structural interaction among nanostructures. Coverage also includes current device applications such as quantum dot lasers and detectors, as well as future applications to quantum information processing. The

book will serve as a reference for anyone working with or planning to work with quantum dots.

Advances in Solid State Physics

Solid-state NMR is a powerful physical method widely applied in modern fundamental and applied science, medicine, and industry. Its role is particularly valuable in materials chemistry due to the capability of solid-state NMR to rapidly solve tasks connected with structural descriptions of complex systems on macro and/or molecular levels, and the identification of the dynamics often responsible for complex systems mechanical properties. Written for non-specialists, Solid-State NMR in Materials Science: Principles and Applications introduces the general physical principles of pulsed NMR, by including elements of the theory and practice in the registration of NMR signals, and by explaining different NMR equipment. After the preliminaries, the book covers: The theory and features of solid-state NMR and nuclear relaxation in solids, including dynamics of materials Different materials, diamagnetic and paramagnetic, from metals and metal clusters to amorphous composites The methodology of collection and interpretations of solid-state NMR data, including strategies and criteria for structural characterizations of different materials Practical examples of multinuclear NMR and relaxation experiments as well as interpretations of data obtained Numerous solid-state NMR experiments performed for various materials to evaluate their structure and dynamics Written in clear and simple language, this book includes clear illustrations, numerous examples, and detailed bibliographies. It an excellent reference not only for young and experienced researchers, but also for students interested in a future in materials science.

Quantum Computing and Quantum Bits in Mesoscopic Systems

Quantum engineering – the design and fabrication of quantum coherent structures – has emerged as a field in physics with important potential applications. This book provides a self-contained presentation of the theoretical methods and experimental results in quantum engineering. The book covers topics such as the quantum theory of electric circuits, theoretical methods of quantum optics in application to solid state circuits, the quantum theory of noise, decoherence and measurements, Landauer formalism for quantum transport, the physics of weak superconductivity and the physics of two-dimensional electron gas in semiconductor heterostructures. The theory is complemented by up-to-date experimental data to help put it into context. Aimed at graduate students in physics, the book will enable readers to start their own research and apply the theoretical methods and results to their current experimental situation.

Binding and Scattering in Two-Dimensional Systems

Quantum engineering – the design and fabrication of quantum coherent structures – has emerged as a field in physics with important potential applications. This book provides a self-contained presentation of the theoretical methods and experimental results in quantum engineering. The book covers topics such as the quantum theory of electric circuits, theoretical methods of quantum optics in

application to solid state circuits, the quantum theory of noise, decoherence and measurements, Landauer formalism for quantum transport, the physics of weak superconductivity and the physics of two-dimensional electron gas in semiconductor heterostructures. The theory is complemented by up-to-date experimental data to help put it into context. Aimed at graduate students in physics, the book will enable readers to start their own research and apply the theoretical methods and results to their current experimental situation.

Solid State Physics

The fundamental concept of quantum coherence plays a central role in quantum physics, cutting across disciplines of quantum optics, atomic and condensed matter physics. Quantum coherence represents a universal property of the quantum s- tems that applies both to light and matter thereby tying together materials and p- nomena. Moreover, the optical coherence can be transferred to the medium through the light-matter interactions. Since the early days of quantum mechanics there has been a desire to control dynamics of quantum systems. The generation and c- trol of quantum coherence in matter by optical means, in particular, represents a viable way to achieve this longstanding goal and semiconductor nanostructures are the most promising candidates for controllable quantum systems. Optical generation and control of coherent light-matter states in semiconductor quantum nanostructures is precisely the scope of the present book. Recently, there has been a great deal of interest in the subject of quantum coh- ence. We are currently witnessing parallel growth of activities in different physical systems that are all built around the central concept of manipulation of quantum coherence. The burgeoning activities in solid-state systems, and semiconductors in particular, have been strongly driven by the unprecedented control of coherence that previously has been demonstrated in quantum optics of atoms and molecules, and is now taking advantage of the remarkable advances in semiconductor fabrication technologies. A recent impetus to exploit the coherent quantum phenomena comes from the emergence of the quantum information paradigm.

Quantum Generations

Solid state physics is the branch of physics that is primarily devoted to the study of matter in its solid phase, especially at the atomic level. This prestigious serial presents timely and state-of-the-art reviews pertaining to all aspects of solid state physics. This latest volume in the series is devoted to the science underpinning two cutting edge areas: protein crystallization and semiconductor nanostructures. The extended and very complete review by E. Runge was awarded this year's Karl-Scheel Prize for "the outstanding publication by a young physicist from Berlin".

Macroscopic Quantum Phenomena in Spintronics

This book features the proceedings of the NATO Advanced Study Institute "Manipulating Quantum Coherence in Solid State Systems", held in Cluj-Napoca, Romania, August 2005, which presented a fundamental introduction to solid-state approaches to achieving quantum computation. This proceedings volume describes the properties of quantum coherence in semiconductor spin-based systems and

the behavior of quantum coherence in superconducting systems.

Advances in Solid State Physics 46

Quantum coherence plays a crucial role in various forms of matter. The thriving field of quantum information as well as unconventional approaches to using mesoscopic systems in future optoelectronic devices provide the exciting background for this set of lectures. The lectures originate from the Schladming Winter Schools and are edited to address a broad readership ranging from the graduate student up to the senior scientist.

New Techniques in Solid-State NMR

Ultrafast Dynamical Processes in Semiconductors

From the initial observation of proton magnetic resonance in water and in paraffin, the discipline of nuclear magnetic resonance has seen unparalleled growth as an analytical method. Modern NMR spectroscopy is a highly developed, yet still evolving, subject which finds application in chemistry, biology, medicine, materials science and geology. In this book, emphasis is on the more recently developed methods of solution-state NMR applicable to chemical research, which are chosen for their wide applicability and robustness. These have, in many cases, already become established techniques in NMR laboratories, in both academic and industrial establishments. A considerable amount of information and guidance is given on the implementation and execution of the techniques described in this book.

Radiation and Solid State Physics, Nuclear and High Energy Physics, Mathematical Physics

This book is for those familiar with solution-state NMR who are encountering solid-state NMR for the first time. It presents the current understanding and applications of solid-state NMR with a rigorous but readable approach, making it easy for someone who merely wishes to gain an overall impression of the subject without details. This dual requirement is met through careful construction of the material within each chapter. The book is divided into two parts: "Fundamentals" and "Further Applications." The section on Fundamentals contains relatively long chapters that deal with the basic theory and practice of solid-state NMR. The essential differences and extra scope of solid-state NMR over solution-state is dealt with in an introductory chapter. The basic techniques that all chapters rely on are collected into a second chapter to avoid unnecessary repetition later. Remaining chapters in the "Fundamentals" part deal with the major areas of solid-state NMR which all solid-state NMR spectroscopists should know about. Each begins with an overview of the topic that puts the chapter in context. The basic principles upon which the techniques in the chapter rely are explained in a separate section. Each of these chapters exemplifies the principles and techniques with the applications most commonly found in current practice. The "Further Applications" section contains a series of shorter chapters which describe the NMR techniques used in

other, more specific areas. The basic principles upon which these techniques rely will be expounded only if not already in the Fundamentals part.

Solid State NMR

While applications rapidly change one to the next in our commercialized world, fundamental principles behind those applications remain constant. So if one understands those principles well enough and has ample experience in applying them, he or she will be able to develop a capacity for reaching results via conceptual thinking rather than having to

Solid State NMR Spectroscopy

The proceedings of this important conference consist of plenary and invited papers published in hard copy and CD-ROM versions. The contributed oral and poster presentations are included in the CD-ROM version only.

Optical Coherence and Quantum Optics

Although the discussion is general, this book focuses on the problem of macroscopic quantum phenomena using systems of spintronics. The spintronics considered are ferromagnetic and antiferromagnetic spintronics. To represent the macroscopic quantum phenomena in spintronics, transitions from one state to another of the magnetization of ferromagnetic spintronics are considered, and of the Néel vector of antiferromagnetic spintronics. The authors have studied transitions from a metastable state to a more stable one, as well as quantum coherence between two degenerate stable states. Quantum and classical rates of transitions are presented as functions of temperature, magnetic field and the spin-polarized current flowing through the spintronics. With this method, one can immediately observe the effect of the spin-polarized current on the transitions of the magnetization and the Néel vector when comparing the results to those of the earlier ones on magnetic systems that did not have spin-polarized current. Specifically, while dissipations in magnetic system are intrinsic, the book shows how the total dissipation in spintronics can be controlled and eliminated by varying the spin-polarized current appropriately that depends on the temperature. The study of transitions from a metastable state to a more stable one in ferromagnetic spintronics shows that the rate of transitions of the magnetization at low temperatures is low and vanishes at zero temperature, so that the magnetization is relatively more stable than that in ferromagnetic materials without existence of spin-polarized currents. In the case of antiferromagnetic spintronics, the behavior and characteristics of transitions of the Néel vector is in contrast to those of ferromagnetic spintronics, where the low-temperature rate of transitions in antiferromagnetic spintronics varies exponentially small in temperature, and is finite and non-vanishing at zero temperature. In addition to the theoretical aspects, the book also discusses experimental and technological aspects that one may obtain. Measurements of the rate of transitions can be used to provide an independent method to determine certain parameters being involved, such as the anisotropy parameter Kc of tetragonal crystals, which is an important parameter but usually difficult to obtain. Eliminating dissipation in ferromagnetic and

antiferromagnetic spintronics would be desired so as not to have unnecessary loss of energy. Low rate of transitions corresponds to the initial state that is relatively stable. Technologically, the stability of the states of the magnetization and Néel vector in spintronics are important, for example, for memory storage.

Quantum Engineering

An international team of experts describes the optical and electronic properties of semiconductors and semiconductor nanostructures at picosecond and femtosecond time scales. The contributions cover the latest research on a wide range of topics. In particular they include novel experimental techniques for studying and characterizing nanostructure materials. The contributions are written in a tutorial way so that not only researchers in the field but also researchers and graduate students outside the field can benefit.

Fundamentals of Quantum Mechanics

The advent of lasers in the 1960s led to the development of many new fields in optical physics. This book is a systematic treatment of one of these fields--the broad area that deals with the coherence and fluctuation of light. The authors begin with a review of probability theory and random processes, and follow this with a thorough discussion of optical coherence theory within the framework of classical optics. They next treat the theory of photoelectric detection of light and photoelectric correlation. They then discuss in some detail quantum systems and effects. The book closes with two chapters devoted to laser theory and one on the quantum theory of nonlinear optics. The sound introduction to coherence theory and the quantum nature of light and the chapter-end exercises will appeal to graduate students and newcomers to the field. Researchers will find much of interest in the new results on coherence-induced spectral line shifts, nonclassical states of light, higher-order squeezing, and quantum effects of down-conversion. Written by two of the world's most highly regarded optical physicists, this book is required reading of all physicists and engineers working in optics.

Towards Solid-State Quantum Repeaters

Towards Solid-State Quantum Repeaters: Ultrafast, Coherent Optical Control and Spin-Photon Entanglement in Charged InAs Quantum Dots summarizes several state-of-the-art coherent spin manipulation experiments in III-V quantum dots. Both high-fidelity optical manipulation, decoherence due to nuclear spins and the spin coherence extraction are discussed, as is the generation of entanglement between a single spin qubit and a photonic qubit. The experimental results are analyzed and discussed in the context of future quantum technologies, such as quantum repeaters. Single spins in optically active semiconductor host materials have emerged as leading candidates for quantum information processing (QIP). The quantum nature of the spin allows for encoding of stationary, memory quantum bits (qubits), and the relatively weak interaction with the host material preserves the spin coherence. On the other hand, optically active host materials permit direct interfacing with light, which can be used for all-optical qubit manipulation, and for efficiently mapping matter qubits into photonic qubits that are suited for long-

distance quantum communication.

Dynamics at Solid State Surfaces and Interfaces

Macroscopic Quantum Computing Conference Proceedings - June 2002, Naples, Italy

From Atomic to Mesoscale

This second edition is fully updated, covering in particular new types of coherent states (the so-called Gazeau-Klauder coherent states, nonlinear coherent states, squeezed states, as used now routinely in quantum optics) and various generalizations of wavelets (wavelets on manifolds, curvelets, shearlets, etc.). In addition, it contains a new chapter on coherent state quantization and the related probabilistic aspects. As a survey of the theory of coherent states, wavelets, and some of their generalizations, it emphasizes mathematical principles, subsuming the theories of both wavelets and coherent states into a single analytic structure. The approach allows the user to take a classical-like view of quantum states in physics. Starting from the standard theory of coherent states over Lie groups, the authors generalize the formalism by associating coherent states to group representations that are square integrable over a homogeneous space; a further step allows one to dispense with the group context altogether. In this context, wavelets can be generated from coherent states of the affine group of the real line, and higher-dimensional wavelets arise from coherent states of other groups. The unified background makes transparent an entire range of properties of wavelets and coherent states. Many concrete examples, such as coherent states from semisimple Lie groups, Gazeau-Klauder coherent states, coherent states for the relativity groups, and several kinds of wavelets, are discussed in detail. The book concludes with a palette of potential applications, from the quantum physically oriented, like the quantum-classical transition or the construction of adequate states in quantum information, to the most innovative techniques to be used in data processing. Intended as an introduction to current research for graduate students and others entering the field, the mathematical discussion is self-contained. With its extensive references to the research literature, the first edition of the book is already a proven compendium for physicists and mathematicians active in the field, and with full coverage of the latest theory and results the revised second edition is even more valuable.

Solid State and Quantum Theory for Optoelectronics

This volume presents the latest advancements and future developments of atomic, molecular and optical (AMO) physics and its vital role in modern sciences and technologies. The chapters are devoted to studies of a wide range of quantum systems, with an emphasis on understanding of quantum coherence and other quantum phenomena originated from light-matter interactions. The book intends to survey the current research landscape and to highlight major scientific trends in AMO physics as well as those interfacing with interdisciplinary sciences. The volume may be particularly useful for young researchers working on establishing their scientific interests and goals. Contents:Collective Phenomena and Long-

Range Interactions in Ultracold Atoms and Molecules:Quantum Magnetism with Ultracold Molecules (M L Wall, K R A Hazzard and A M Rey)Optical Manipulation of Light Scattering in Cold Atomic Rubidium (R G Olave, A L Win, K Kemp, S J Roof, S Balik, M D Havey, I M Sokolov and D V Kupriyanov)Seeing Spin Dynamics in Atomic Gases (D M Stamper-Kurn)Atom-like Coherent Solid State Systems:Precision Magnetic Sensing and Imaging Using NV-Diamond (R L Walsworth)Entanglement and Quantum Optics with Quantum Dots (A P Burgers, J R Schaibley and D G Steel)Coherent Nanophotonics and Plasmonics:Enhancement of Single-Photon Sources with Metamaterials (M Y Shalaginov, S Bogdanov, V V Vorobyov, A S Lagutchev, A V Kildishev, A V Akimov, A Boltassevaand V M Shalaev)Linear Optical Properties of Periodic Hybrid Materials at Oblique Incidence: A Numerical Approach (A Blake and M Sukharev)Fundamental Physics:An Introduction to Boson-Sampling (B T Gard, K R Motes, J P Olson, P P Rohde and J P Dowling)New Approach to Quantum Amplification by Superradiant Emission of Radiation (G Shchedrin, Y Rostovtsev, X Zhang and M O Scully)Ultrafast Dynamics in Strong Laser Fields:Circularly Polarized Attosecond Pulses and Molecular Atto-Magnetism (A D Bandrauk and K-J Yuan)Many-Electron Response of Gas-Phase Fullerene Materials to Ultraviolet and Soft X-ray Photons (H S Chakraborty and M Magrakvelidze)Ultracold Chemistry:Collisions and Reactions in Ultracold Gases (N Balakrishnan and J Hazra) Readership: For professional researchers as well as young academics in the field of Atomic, Molecular and Optical (AMO) physics. Key Features:The contributors for this volume are all internationally recognized experts in their fieldsThis book offers a unique overview of the state of current AMO physics, while outlining future directions. No comparable titles have been identified so far (by editors or by reviewers)All contributions include new unpublished research, and will be of interest for anyone pursuing the scientific investigations in the presented areasKeywords:Quantum Coherence;Amo;Atomic Physics;Quantum Control;Ultracold Atoms;Ultracold Molecules;Nv-diamonds;Quantum Dots;Quantum Magnetism;Nanophotonics;Plasmonics;Ultrafast Dynamics;Ultracold Chemistry

Solid State Physics

This two-volume work covers ultrafast structural and electronic dynamics of elementary processes at solid surfaces and interfaces, presenting the current status of photoinduced processes. Providing valuable introductory information for newcomers to this booming field of research, it investigates concepts and experiments, femtosecond and attosecond time-resolved methods, as well as frequency domain techniques. The whole is rounded off by a look at future developments.

Macroscopic Quantum Coherence and Quantum Computing

The basic concepts of quantum mechanics are explained in this book in a concise and easy-to-read manner, leading toward applications in solid-state electronics and optics. Following a logical sequence, the book focuses on key ideas and is conceptually and mathematically self-contained.

Quantum Coherence in Solid State Systems

This second, thoroughly revised, updated and enlarged edition provides a straightforward introduction to spectroscopy, showing what it can do and how it does it, together with a clear, integrated and objective account of the wealth of information that may be derived from spectra. It also features new chapters on spectroscopy in nano-dimensions, nano-optics, and polymer analysis. Clearly structured into sixteen sections, it covers everything from spectroscopy in nanodimensions to medicinal applications, spanning a wide range of the electromagnetic spectrum and the physical processes involved, from nuclear phenomena to molecular rotation processes. In addition, data tables provide a comparison of different methods in a standardized form, allowing readers to save valuable time in the decision process by avoiding wrong turns, and also help in selecting the instrumentation and performing the experiments. These four volumes are a must-have companion for daily use in every lab.

Solid-State NMR IV Methods and Applications of Solid-State NMR

A must-have textbook for any undergraduate studying solid state physics. This successful brief course in solid state physics is now in its second edition. The clear and concise introduction not only describes all the basic phenomena and concepts, but also such advanced issues as magnetism and superconductivity. Each section starts with a gentle introduction, covering basic principles, progressing to a more advanced level in order to present a comprehensive overview of the subject. The book is providing qualitative discussions that help undergraduates understand concepts even if they can?t follow all the mathematical detail. The revised edition has been carefully updated to present an up-to-date account of the essential topics and recent developments in this exciting field of physics. The coverage now includes ground-breaking materials with high relevance for applications in communication and energy, like graphene and topological insulators, as well as transparent conductors. The text assumes only basic mathematical knowledge on the part of the reader and includes more than 100 discussion questions and some 70 problems, with solutions free to lecturers from the Wiley-VCH website. The author's webpage provides Online Notes on x-ray scattering, elastic constants, the quantum Hall effect, tight binding model, atomic magnetism, and topological insulators. This new edition includes the following updates and new features: * Expanded coverage of mechanical properties of solids, including an improved discussion of the yield stress * Crystal structure, mechanical properties, and band structure of graphene * The coverage of electronic properties of metals is expanded by a section on the quantum hall effect including exercises. New topics include the tight-binding model and an expanded discussion on Bloch waves. * With respect to semiconductors, the discussion of solar cells has been extended and improved. * Revised coverage of magnetism, with additional material on atomic magnetism * More extensive treatment of finite solids and nanostructures, now including topological insulators * Recommendations for further reading have been updated and increased. * New exercises on Hall mobility, light penetrating metals, band structure

Quantum Engineering

The first of two volumes presenting an overview of the important research areas in which Professor H. Überall has done his life's work and constitutes a festschrift for this distinguished physicist. Each chapter is intended to serve as a bridge between advanced textbooks and the most recent research literature, thereby providing a valuable reference for active researchers as well as for graduate students.