

M. I. Monastyrsky (Ed.)

Topology in Condensed Matter

Topology In Condensed Matter Springer Series In Solid State Sciences

**Jiadong Zang, Vincent Cros, Axel
Hoffmann**



Topology In Condensed Matter Springer Series In Solid State Sciences:

Topology in Condensed Matter Michael I. Monastyrsky, 2006-02-04 This book reports new results in condensed matter physics for which topological methods and ideas are important. It considers on the one hand recently discovered systems such as carbon nanocrystals and on the other hand new topological methods used to describe more traditional systems such as the Fermi surfaces of normal metals, liquid crystals and quasicrystals. The authors of the book are renowned specialists in their fields and present the results of ongoing research, some of it obtained only very recently and not yet published in monograph form.

The Role of Topology in Materials Sanju Gupta, Avadh Saxena, 2019-02-08 This book presents the most important advances in the class of topological materials and discusses the topological characterization, modeling and metrology of materials. Further, it addresses currently emerging characterization techniques such as optical and acoustic vibrational spectroscopy, Brillouin, infrared, Raman, electronic, magnetic, fluorescence correlation imaging, laser lithography, small angle X-ray and neutron scattering, and other techniques including site selective nanoprobe. The book analyzes the topological aspects to identify and quantify these effects in terms of topology metrics. The topological materials are ubiquitous and range from i) de novo nanoscale allotropes of carbons in various forms such as nanotubes, nanorings, nanohorns, nanowalls, peapods, graphene, etc. to ii) metallo-organic frameworks, iii) helical gold nanotubes, iv) π -conjugated polymers, v) block copolymers, vi) supramolecular assemblies, to vii) a variety of biological and soft matter systems, e.g. foams and cellular materials, vesicles of different shapes and genera, biomimetic membranes and filaments, viii) topological insulators and topological superconductors, ix) a variety of Dirac materials including Dirac and Weyl semimetals, as well as x) knots and network structures. Topological databases and algorithms to model such materials have been also established in this book. In order to understand and properly characterize these important emergent materials, it is necessary to go far beyond the traditional paradigm of microscopic structure-property-function relationships to a paradigm that explicitly incorporates topological aspects from the outset to characterize and/or predict the physical properties and currently untapped functionalities of these advanced materials. Simulation and modeling tools including quantum chemistry, molecular dynamics, 3D visualization and tomography are also indispensable. These concepts have found applications in condensed matter physics, materials science and engineering, physical chemistry and biophysics, and the various topics covered in the book have potential applications in connection with novel synthesis techniques, sensing and catalysis. As such, the book offers a unique resource for graduate students and researchers alike.

Magnetism in the Solid State Peter Mohn, 2006-06-09 This book presents a phenomenological approach to the field of solid state magnetism. Beginning with basic concepts in statistical thermodynamics and electronic structure theory, the text discusses models for localized moments (Weiss, Heisenberg) and delocalized moments (Stoner). This is followed by a chapter about exchange and correlation in metals, again considering the results for the localized and delocalized limit. The book ends with a chapter about spin fluctuations, which are introduced as an alternative to the finite

temperature Stoner theory The book will be a useful reference for researchers and a valuable accompaniment to graduate courses on magnetism and magnetic materials

Symmetry And Perturbation Theory - Proceedings Of The International Conference On Spt2007 Giuseppe Gaeta, Sebastian Walcher, Raffaele Vitolo, 2007-11-12 This proceedings volume is devoted to the interplay of symmetry and perturbation theory as well as to cognate fields such as integrable systems normal forms n body dynamics and choreographies geometry and symmetry of differential equations and finite and infinite dimensional dynamical systems The papers collected here provide an up to date overview of the research in the field and have many leading scientists in the field among their authors including D Alekseevsky S Benenti H Broer A Degasperis M E Fels T Gramchev H Hanssmann J Krashil shchik B Kruglikov D Krupka O Krupkova S Lombardo P Morando O Morozov N N Nekhoroshev F Oliveri P J Olver J A Sanders M A Teixeira S Terracini F Verhulst P Winternitz B Zhilinskii

Perturbation Theory Giuseppe Gaeta, 2022-12-16 This volume in the Encyclopedia of Complexity and Systems Science Second Edition is devoted to the fundamentals of Perturbation Theory PT as well as key applications areas such as Classical and Quantum Mechanics Celestial Mechanics and Molecular Dynamics Less traditional fields of application such as Biological Evolution are also discussed Leading scientists in each area of the field provide a comprehensive picture of the landscape and the state of the art with the specific goal of combining mathematical rigor explicit computational methods and relevance to concrete applications New to this edition are chapters on Water Waves Rogue Waves Multiple Scales methods legged locomotion Condensed Matter among others while all other contributions have been revised and updated Coverage includes the theory of Poincare Birkhoff Normal Forms aspects of PT in specific mathematical settings Hamiltonian KAM theory Nekhoroshev theory and symmetric systems technical problems arising in PT with solutions convergence of series expansions diagrammatic methods parametric resonance systems with nilpotent real part PT for non smooth systems and on PT for PDEs write out this acronym partial differential equations Another group of papers is focused specifically on applications to Celestial Mechanics Quantum Mechanics and the related semiclassical PT Quantum Bifurcations Molecular Dynamics the so called choreographies in the N body problem as well as Evolutionary Theory Overall this unique volume serves to demonstrate the wide utility of PT while creating a foundation for innovations from a new generation of graduate students and professionals in Physics Mathematics Mechanics Engineering and the Biological Sciences

The Complexity of Dynamical Systems Johan Dubbeldam, Kirk Green, Daan Lenstra, 2011-02-21 Written by recognized experts this edited book covers recent theoretical experimental and applied issues in the growing field of Complex Systems and Nonlinear Dynamics It is divided into two parts with the first section application based incorporating the theory of bifurcation analysis numerical computations of instabilities in dynamical systems and discussing experimental developments The second part covers the broad category of statistical mechanics and dynamical systems Several novel exciting theoretical and mathematical insights and their consequences are conveyed to the reader

Topology in Magnetism Jiadong Zang, Vincent Cros, Axel

Hoffmann,2018-09-24 This book presents both experimental and theoretical aspects of topology in magnetism It first discusses how the topology in real space is relevant for a variety of magnetic spin structures including domain walls vortices skyrmions and dynamic excitations and then focuses on the phenomena that are driven by distinct topology in reciprocal momentum space such as anomalous and spin Hall effects topological insulators and Weyl semimetals Lastly it examines how topology influences dynamic phenomena and excitations such as spin waves magnons localized dynamic solitons and Majorana fermions The book also shows how these developments promise to lead the transformative revolution of information technology

Particle Penetration and Radiation Effects Peter Sigmund,2006-03-16 Drawing on the author's forty plus years of experience as a researcher in the interaction of charged particles with matter this book emphasizes the theoretical description of fundamental phenomena Special attention is given to classic topics such as Rutherford scattering the theory of particle stopping the statistical description of energy loss and multiple scattering and numerous more recent developments

Symmetry and Perturbation Theory Giuseppe Gaeta,Raffaele Vitolo,Sebastian Walcher,2008 This proceedings volume is devoted to the interplay of symmetry and perturbation theory as well as to cognate fields such as integrable systems normal forms n body dynamics and choreographies geometry and symmetry of differential equations and finite and infinite dimensional dynamical systems The papers collected here provide an up to date overview of the research in the field and have many leading scientists in the field among their authors including D Alekseevsky S Benenti H Broer A Degasperis M E Fels T Gramchev H Hanssmann J Krashil shchik B Kruglikov D Krupka O Krupkova S Lombardo P Morando O Morozov N N Nekhoroshev F Oliveri P J Olver J A Sanders M A Teixeira S Terracini F Verhulst P Winternitz B Zhilinskii

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Mathematics of Complexity and Dynamical Systems Robert A. Meyers,2011-10-05 Mathematics of Complexity and Dynamical Systems is an authoritative reference to the basic tools and concepts of complexity systems theory and dynamical systems from the perspective of pure and applied mathematics Complex systems are systems that comprise many interacting parts with the ability to generate a new quality of collective behavior through self organization e g the spontaneous formation of temporal spatial or functional structures These systems are often characterized by extreme sensitivity to initial conditions as well as emergent behavior that are not readily predictable or even completely deterministic The more than 100 entries in this wide

ranging single source work provide a comprehensive explication of the theory and applications of mathematical complexity covering ergodic theory fractals and multifractals dynamical systems perturbation theory solitons systems and control theory and related topics Mathematics of Complexity and Dynamical Systems is an essential reference for all those interested in mathematical complexity from undergraduate and graduate students up through professional researchers **Biomat 2010 - International Symposium On Mathematical And Computational Biology** Rubem P Mondaini, 2011-03-11 This volume contains the selected contributed papers of the BIOMAT 2010 International Symposium which has been organized as a joint conference with the 2010 Annual Meeting of the Society for Mathematical Biology www.smb.org by invitation of the Director Board of this Society The works presented at Tutorial and Plenary Sessions by expert keynote speakers have been also included This book contains state of the art articles on special research topics on mathematical biology biological physics and mathematical modelling of biosystems comprehensive reviews on interdisciplinary areas written by prominent leaders of scientific research groups The treatment is both pedagogical and sufficiently advanced to enhance future scientific research

Mathematical Biology And Biological Physics Rubem P Mondaini, 2017-07-14 This is a book on interdisciplinary topics of the Mathematical and Biological Sciences The treatment is both pedagogical and advanced in order to motivate research students as well as to fulfill the requirements of professional practitioners There are comprehensive reviews written by senior experts on the important problems of growth and agglomeration in biology on the algebraic modelling of the genetic code and on multi step biochemical pathways There are new results on the state of the art research in the pattern recognition of probability distribution of amino acids on somitogenesis through reaction diffusion models on the mathematical modelling of infectious diseases on the biophysical modelling of physiological disorders on the sensitive analysis of parameters of malaria models on the stability and hopf bifurcation of ecological and epidemiological models on the viral infection of bee colonies and on the structure and motion of proteins All these contributions are also strongly recommended to professionals from other scientific areas aiming to work on these interdisciplinary fields *Liquid Crystal Colloids* Igor Mušević, 2017-05-14 This book brings together the many concepts and discoveries in liquid crystal colloids contributed over the last twenty years and scattered across numerous articles and book chapters It provides both a historical overview of the development of the field and a clear perspective on the future applications in photonics The book covers all phenomena observed in liquid crystal colloids with an emphasis on experimental tools and applications of topology in condensed matter as well as practical micro photonics applications It includes a number of spectacular manifestations of new topological phenomena not found or difficult to observe in other systems Starting from the early works on nematic colloids it explains the basics of topological defects in ordered media charge and winding and the elastic forces between colloidal particles in nematics Following a detailed description of experimental methods such as optical tweezing and particle tracking the book eases the reader into the theoretical part which deals with elastic deformation of nematic liquid crystals due to

inclusions and surface alignment This is discussed in the context of basic mean field Landau de Gennes Q tensor theory with a brief explanation of the free energy minimization numerical methods There then follows an excursion into the topology of complex nematic colloidal structures colloidal entanglement knotting and linking Nematic droplets shells handlebodies and chiral topological structures are addressed in separate chapters The book concludes with an extensive chapter on the photonic properties of nematic dispersions presenting the concept of integrated soft matter photonics and discussing the concepts of nematic and chiral nematic microlasers surface sensitive photonic devices and smectic microfibers The text is complemented by a large bibliography explanatory sketches and beautiful micrographs

Magnetism Joachim Stöhr, Hans Christoph Siegmann, 2007-01-19 This text book gives a comprehensive account of magnetism one of the oldest yet most vibrant fields of physics It spans the historical development the physical foundations and the continuing research underlying the subject The book covers both the classical and quantum mechanical aspects of magnetism and novel experimental techniques Perhaps uniquely it discusses spin transport and magnetization dynamics phenomena associated with atomically and spin engineered nano structures against the backdrop of spintronics and magnetic storage and memory applications The book is for students and serves as a reference for scientists in academia and research laboratories

Quantum Chemistry of Solids Robert A. Evarestov, 2007-08-16 Quantum Chemistry of Solids delivers a comprehensive account of the main features and possibilities of LCAO methods for the first principles calculations of electronic structure of periodic systems The first part describes the basic theory underlying the LCAO methods applied to periodic systems and the use of wave function based Hartree Fock density based DFT and hybrid hamiltonians The translation and site symmetry consideration is included to establish connection between k space solid state physics and real space quantum chemistry methods in the framework of cyclic model of an infinite crystal The inclusion of electron correlation effects for periodic systems is considered on the basis of localized crystalline orbitals The possibilities of LCAO methods for chemical bonding analysis in periodic systems are discussed The second part deals with the applications of LCAO methods for calculations of bulk crystal properties including magnetic ordering and crystal structure optimization The discussion of the results of some supercell calculations of point defects in non metallic solids and of the crystalline surfaces electronic structure illustrates the efficiency of LCAO method for solids

Physical Acoustics in the Solid State Bruno Lüthi, 2007-08-14 Suitable for researchers and graduate students in physics and material science Physical Acoustics in the Solid State reviews the modern aspects in the field including many experimental results especially those involving ultrasonics Practically all fields of solid state physics are covered metals semiconductors magnetism superconductivity different kinds of phase transitions low dimensional systems and the quantum Hall effect After a review of the relevant experimental techniques and an introduction to the theory of elasticity emphasizing the symmetry aspects applications in the various fields of condensed matter physics are presented Also treated are Brillouin scattering results and results from thermodynamic investigations such as thermal expansion and specific heat

Quantum

Theory of Magnetism Robert M. White, 2007-01-23 Quantum Theory of Magnetism is the only book that deals with the phenomenon of magnetism from the point of view of linear response That is how does a magnetic material respond when excited by a magnetic field That field may be uniform or spatially varying static or time dependent Previous editions have dealt primarily with the magnetic response This edition incorporates the resistive response of magnetic materials as well It also includes problems to test the reader's or student's comprehension The rationale for a book on magnetism is as valid today as it was when the first two editions of Quantum Theory of Magnetism were published Magnetic phenomena continue to be discovered with deep scientific implications and novel applications Since the Second Edition for example Giant Magnetoresistance GMR was discovered and the new field of spintronics is currently expanding Not only do these phenomena rely on the concepts presented in this book but magnetic properties are often an important clue to our understanding of new materials e g high temperature superconductors Their magnetic properties studied by susceptibility measurements nuclear magnetic resonance neutron scattering etc have provided insight to the superconductivity state This updated edition offers revised emphasis on some material as a result of recent developments and includes new material such as an entire chapter on thin film magnetic multilayers Researchers and students once again have access to an up to date classic reference on magnetism the key characteristic of many modern materials Physics of Zero- and One-Dimensional Nanoscopic Systems

Sachindra Nath Karmakar, Santanu Kumar Maiti, Chowdhury Jayeeta, 2007-09-04 In recent years submicron and nanoscale systems have featured strongly on the research agenda due to the technological progress and new physics that have emerged from studies of ultra small systems A fundamental understanding of basic physical phenomena on the mesoscopic and nanoscopic scales is required to exploit the technological potential offered by these exotic materials The present book contains review like chapters by some of the leading experts in the field covering topics such as the Kondo effect electron transport disorder and quantum coherence with electron-electron interaction persistent current thermoelectric phenomena etc in quantum dots quantum wires carbon nanotubes and more This book will be valuable to researchers and students in condensed matter physics Spin Physics in Semiconductors

Mikhail I. Dyakonov, 2008-07-18 The purpose of this collective book is to present a non exhaustive survey of spin related phenomena in semiconductors with a focus on recent research In some sense it may be regarded as an updated version of the Optical Orientation book which was entirely devoted to spin physics in bulk semiconductors During the 24 years that have elapsed we have witnessed on the one hand an extraordinary development in the wonderful semiconductor physics in two dimensions with the accompanying revolutionary applications On the other hand during the last maybe 15 years there was a strong revival in the interest in spin phenomena in particular in low dimensional semiconductor structures While in the 1970s and 1980s the entire world population of researchers in the field never exceeded 20 persons now it can be counted by the hundreds and the number of publications by the thousands This explosive growth is stimulated to a large extent by the hopes that the electron and or nuclear spins in a semiconductor will

help to accomplish the dream of factorizing large numbers by quantum computing and eventually to develop a new spin based electronics or spintronics Whether any of this will happen or not still remains to be seen Anyway these ideas have resulted in a large body of interesting and exciting research which is a good thing by itself The field of spin physics in semiconductors is extremely rich and interesting with many spectacular effects in optics and transport Low-Dimensional Molecular Metals Naoki Toyota, Michael Lang, Jens Müller, 2007-04-21 This monograph assimilates new research in the field of low dimensional metals It provides a detailed overview of the current status of research on quasi one and two dimensional molecular metals describing normal state properties magnetic field effects superconductivity and the phenomena of interacting p and d electrons It includes a number of findings likely to become standard material in future textbooks on solid state physics

Topology In Condensed Matter Springer Series In Solid State Sciences Book Review: Unveiling the Power of Words

In some sort of driven by information and connectivity, the ability of words has are more evident than ever. They have the capacity to inspire, provoke, and ignite change. Such could be the essence of the book **Topology In Condensed Matter Springer Series In Solid State Sciences**, a literary masterpiece that delves deep to the significance of words and their affect our lives. Written by a renowned author, this captivating work takes readers on a transformative journey, unraveling the secrets and potential behind every word. In this review, we will explore the book is key themes, examine its writing style, and analyze its overall impact on readers.

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