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Magnetic Ions In Crystals:

Magnetic Ions in Crystals K. W. Stevens,2014-07-14 There have been many demonstrations particularly for magnetic impurity ions in crystals that spin Hamiltonians are able to account for a wide range of experimental results in terms of much smaller numbers of parameters Yet they were originally derived from crystal field theory which contains a logical flaw electrons on the magnetic ions are distinguished from those on the ligands Thus there is a challenge to replace crystal field theory with one of equal or greater predictive power that is based on a surer footing The theory developed in this book begins with a generic Hamiltonian one that is common to most molecular and solid state problems and that does not violate the symmetry requirements imposed on electrons and nuclei Using a version of degenerate perturbation theory due to Bloch and the introduction of Wannier functions projection operators and unitary transformations Stevens shows that it is possible to replace crystal field theory as a basis for the spin Hamiltonians of single magnetic ions and pairs and lattices of magnetic ions even when the nuclei have vibrational motion The power of the method is further demonstrated by showing that it can be extended to include lattice vibration and conduction by electron hopping such as probably occurs in high Tc superconductors Thus Stevens shows how an apparently successful ad hoc method of the past can be replaced by a much more soundly based one that not only incorporates all the previous successes but appears to open the way to extensions far outside the scope of the previously available methods So far only some of these have been explored The book should therefore be of great interest to all physicists and chemists concerned with understanding the special properties of molecules and solids that are imposed by the presence of magnetic ions Originally published in 1997 The Princeton Legacy Library uses the latest print on demand technology to again make available previously out of print books from the distinguished backlist of Princeton University Press These editions preserve the original texts of these important books while presenting them in durable paperback and hardcover editions The goal of the Princeton Legacy Library is to vastly increase access to the rich scholarly heritage found in the thousands of books published by Princeton University Press since its founding in 1905

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Magnetoelectric Interaction Phenomena in Crystals Manfred Fiebig,Victor V. Eremenko,Irina E. Chupis,2004-10-21 In the quest for higher data density in information technology manipulation of magnetization by other means than magnetic

fields has become an important challenge This lead to a startling revival of the magnetoelectric effect which characterizes induction of a polarization by a magnetic field or of a magnetization by an electric field The magnetoelectric crosslink of material properties opens just those degrees of freedom which are needed for the mutual control of magnetic and electric states The book gives a state of the art review on magnetoelectrics research classifies current research tendencies and points out possible future trends Novel compounds and growth techniques and new theoretical concepts for the understanding of magnetoelectric coupling phenomena are introduced Highlights are the discovery of gigantic magnetoelectric effects which are strong enough to trigger electric or magnetic phase transitions the concept of magnetochirality and development structural magnetoelectric effects in artificial multiphase compounds The book is addressed to condensed matter physicists with a particular focus on experts in highly correlated systems **High Magnetic Fields In The Physics Of Semiconductors - Proceedings Of The 12th International Conference (In 2 Volumes)** Gottfried Landwehr,Wolfgang Ossau,1997-04-23 This volume contains contributions presented at the 12th International Conference on High Magnetic Fields in Semiconductor Physics In order to give an overview 37 lecturers not only reviewed the latest results in their field but also gave a general introduction The rapid development of semiconductor physics and technology during the last few years has resulted in an extensive application of high magnetic fields in both fundamental and applied research more than 160 contributed papers were presented as posters Sixteen years after its discovery the quantum Hall effect QHE is still a subject of high activity Many new results on the fractional QHE were presented in addition to 6 invited papers there were 43 contributions Another field of high activity is magneto optics and 49 posters were presented Magnetotransport also turned out to be of high interest and magnetic semiconductors played a prominent role at the conference too Without doubt the availability of superconducting magnets in most laboratories contributed to the growth of semiconductor physics in high magnetic fields Because not all experiments can be performed in fields up to 10 or 15 teslas high magnetic field laboratories offering larger fields are indispensable There were reports from four laboratories on present work going on at these installations **Thermodynamics of Crystalline States** Minoru Fujimoto,2013-01-22 Thermodynamics is a well established discipline of physics for properties of matter in thermal equilibrium with the surroundings Applying to crystals however the laws encounter undefined properties of crystal lattice which therefore need to be determined for a clear and well defined description of crystalline states Thermodynamics of Crystalline States explores the roles played by order variables and dynamic lattices in crystals in a wholly new way The book begins by clarifying basic concepts for stable crystals Next binary phase transitions are discussed to study collective motion of order variables as described mostly as classical phenomena New to this edition is the examination of magnetic crystals where magnetic symmetry is essential for magnetic phase transitions The multi electron system is also discussed theoretically as a quantum mechanical example for superconductivity in metallic crystals Throughout the book the role played by the lattice is emphasized and studied in depth

Thermodynamics of Crystalline States is an introductory treatise and textbook on mesoscopic phenomena in solid states constituting a basic subject in condensed matter physics While this book serves as a guide for advanced students in physics and material science it can also be useful as a reference for all professionals in related fields Minoru Fujimoto is author of Physics of Classical Electromagnetism Springer 2007 and The Physics of Structural Phase Transitions Springer 2005

Crystal Symmetry, Lattice Vibrations, And Optical Spectroscopy Of Solids: A Group Theoretical Approach Baldassare Di Bartolo,Richard C Powell,2014-05-21 This book provides a comprehensive treatment of the two fundamental aspects of a solid that determine its physical properties lattice structure and atomic vibrations phonons The elements of group theory are extensively developed and used as a tool to show how the symmetry of a solid and the vibrations of the atoms in the solid lead to the physical properties of the material The uses of different types of spectroscopy techniques that elucidate the lattice structure of a solid and the normal vibrational modes of the atoms in the solid are described The interaction of light with solids optical spectroscopy is described in detail including how lattice symmetry and phonons affect the spectral properties and how spectral properties provide information about the material s symmetry and normal modes of lattice vibrations The effects of point defects doping on the lattice symmetry and atomic vibrations and thus the spectral properties are discussed and used to show how material symmetry and lattice vibrations are critical in determining the properties of solid state lasers

Proceedings of the Fifth International Symposium on Quantum Confinement, Nanostructures M. Cahay,1999

International Tables for Crystallography, Volume D A. Authier,2014-11-17 International Tables for Crystallography is the definitive resource and reference work for crystallography and structural science Each of the volumes in the series contains articles and tables of data relevant to crystallographic research and to applications of crystallographic methods in all sciences concerned with the structure and properties of materials Emphasis is given to symmetry diffraction methods and techniques of crystal structure determination and the physical and chemical properties of crystals The data are accompanied by discussions of theory practical explanations and examples all of which are useful for teaching Volume D is concerned with the influence of symmetry on the physical and tensor properties of crystals and on their structural phase transitions This role is very important in many different disciplines of the science of materials such as crystallography elasticity solid state physics magnetism optics ferroelectricity and mineralogy and Volume D deals with all these aspects in a unified way The volume is divided into 3 parts Part 1 Introduces the mathematical properties of tensors and group representations and gives their independent components for each of the crystallographic groups Part 2 Devoted to the symmetry aspects of excitations in reciprocal space phonons electrons Raman scattering and Brillouin scattering Part 3 Deals with the symmetry aspects of structural phase transitions and twinning A prominent feature is the joint description of twinning and domain structures which are usually presented in completely separate ways in handbooks of physics and mineralogy Supplementary software is provided to support and enhance Chapters 1 1 and 1 2 for the determination of irreducible group representations and tensor

components and Part 3 on structural phase transitions New to this edition This second edition of Volume D features a new chapter Chapter 1 11 on the tensorial properties of local crystal susceptibilities by V E Dmitrienko A Kirfel and E N Ovchinnikova This chapter describes the symmetry and physical phenomena that allow and restrict forbidden reflections excited at radiation energies close to the X ray absorption edges of atoms Reflections caused by magnetic scattering are also discussed In Part 1 Chapters 1 1 an introduction to the properties of tensors 1 2 on representations of crystallographic groups 1 3 elastic properties 1 5 magnetic properties and 1 10 on tensors in quasiperiodic structures have been revised In particular Chapter 1 5 features a new section on multiferroics by M Kenzelmann Chapter 3 3 on twinning of crystals has been updated and new sections on the effect of twinning in reciprocal space and on the relations between twinning and domain structure have been added Chapter 3 4 on domain structures has also been updated More information on the series can be found at http it iucr org **Physical Acoustics in the Solid State** Bruno Lüthi,2006-01-15 Physical Acoustics in the Solid State reviews the modern aspects in the field including many experimental results especially those involving ultrasonics It covers practically all fields of solid state physics After a review of the relevant experimental techniques and an introduction to the theory of elasticity the book details applications in the various fields of condensed matter physics **Handbook of Nanophysics** Klaus D. Sattler,2010-09-17 Providing the framework for breakthroughs in nanotechnology this landmark publication is the first comprehensive reference to cover both fundamental and applied physics at the nanoscale After discussing the theoretical principles and measurements of nanoscale systems the organization of the set follows the historical development of nanoscience Each peer reviewed chapter presents a didactic treatment of the physics underlying the nanoscale materials applications and detailed experimental results State of the art scientific content is enriched with fundamental equations and illustrations many in color III-Nitride Semiconductors M.O. Manasreh,2000-12-06 Research advances in III nitride semiconductor materials and device have led to an exponential increase in activity directed towards electronic and optoelectronic applications There is also great scientific interest in this class of materials because they appear to form the first semiconductor system in which extended defects do not severely affect the optical properties of devices The volume consists of chapters written by a number of leading researchers in nitride materials and device technology with the emphasis on the dopants incorporations impurities identifications defects engineering defects characterization ion implantation irradiation induced defects residual stress structural defects and phonon confinement This unique volume provides a comprehensive review and introduction of defects and structural properties of GaN and related compounds for newcomers to the field and stimulus to further advances for experienced researchers Given the current level of interest and research activity directed towards nitride materials and devices the publication of the volume is particularly timely Early pioneering work by Pankove and co workers in the 1970s yielded a metal insulator semiconductor GaN light emitting diode LED but the difficulty of producing p type GaN precluded much further effort The current level of activity in nitride

semiconductors was inspired largely by the results of Akasaki and co workers and of Nakamura and co workers in the late 1980s and early 1990s in the development of p type doping in GaN and the demonstration of nitride based LEDs at visible wavelengths These advances were followed by the successful fabrication and commercialization of nitride blue laser diodes by Nakamura et al at Nichia The chapters contained in this volume constitutes a mere sampling of the broad range of research on nitride semiconductor materials and defect issues currently being pursued in academic government and industrial laboratories worldwide Nonlinear Homogenization and Its Applications to Composites, Polycrystals and Smart Materials P. Ponte Castaneda,J.J. Telega,B. Gambin,2004-09-15 Although several books and conference proceedings have already appeared dealing with either the mathematical aspects or applications of homogenization theory there seems to be no comprehensive volume dealing with both aspects The present volume is meant to fill this gap at least partially and deals with recent developments in nonlinear homogenization emphasizing applications of current interest It contains thirteen key lectures presented at the NATO Advanced Workshop on Nonlinear Homogenization and Its Applications to Composites Polycrystals and Smart Materials The list of thirty one contributed papers is also appended The key lectures cover both fundamental mathematical aspects of homogenization including nonconvex and stochastic problems as well as several applications in micromechanics thin films smart materials and structural and topology optimization One lecture deals with a topic important for nanomaterials the passage from discrete to continuum problems by using nonlinear homogenization methods Some papers reveal the role of parameterized or Young measures in description of microstructures and in optimal design Other papers deal with recently developed methods both analytical and computational for estimating the effective behavior and field fluctuations in composites and polycrystals with nonlinear constitutive behavior All in all the volume offers a cross section of current activity in nonlinear homogenization including a broad range of physical and engineering applications The careful reader will be able to identify challenging open problems in this still evolving field For instance there is the need to improve bounding techniques for nonconvex problems as well as for solving geometrically nonlinear optimum shape design problems using relaxation and homogenization methods *Alkaline Earth Metals—Advances in Research and Application: 2013 Edition* ,2013-06-21 Alkaline Earth Metals Advances in Research and Application 2013 Edition is a ScholarlyEditions book that delivers timely authoritative and comprehensive information about Barium The editors have built Alkaline Earth Metals Advances in Research and Application 2013 Edition on the vast information databases of ScholarlyNews You can expect the information about Barium in this book to be deeper than what you can access anywhere else as well as consistently reliable authoritative informed and relevant The content of Alkaline Earth Metals Advances in Research and Application 2013 Edition has been produced by the world s leading scientists engineers analysts research institutions and companies All of the content is from peer reviewed sources and all of it is written assembled and edited by the editors at ScholarlyEditions and available exclusively from us You now have a source you can cite with authority

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