

Solid-State Sciences

R. A. Evarestov V. P. Smirnov

Site Symmetry in Crystals

Theory and Applications

Second Enlarged Edition



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Site Symmetry In Crystals Theory And Applications

Springer Series In Solidstate Sciences

Rachel Sandford



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Site Symmetry in Crystals Robert A. Evarestov, Vyacheslav P. Smirnov, 2012-12-06 Site Symmetry in Crystals is the first comprehensive account of the group theoretical aspects of the site local symmetry approach to the study of crystalline solids The efficiency of this approach which is based on the concepts of simple induced and band representations of space groups is demonstrated by considering newly developed applications to electron surface states point defects symmetry analysis in lattice dynamics the theory of second order phase transitions and magnetically ordered and non rigid crystals Tables of simple induced representations are given for the 24 most common space groups allowing the rapid analysis of electron and phonon states in complex crystals with many atoms in the unit cell Fundamentals of the Physics of Solids Jenő

Sólyom, 2007-09-19 This book is the first of a three volume series written by the same author It aims to deliver a comprehensive and self contained account of the fundamentals of the physics of solids In the presentation of the properties and experimentally observed phenomena together with the basic concepts and theoretical methods it goes far beyond most classic texts The essential features of various experimental techniques are also explained The text provides material for upper level undergraduate and graduate courses It will also be a valuable reference for researchers in the field of condensed matter physics

Quantum Chemistry of Solids Robert A. Evarestov, 2013-01-19 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 Hartree Fock HF Density Function theory 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 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 In the second edition two new chapters are added in the application part II of the book Chapter 12 deals with the recent LCAO calculations and illustrates the efficiency of the scalar relativistic LCAO method for solids containing heavy atoms Chapter 13 deals with the symmetry properties and the recent applications of LCAO method to inorganic nanotubes New material is added to chapter 9 devoted to LCAO calculations of perfect crystal properties The possibilities of LCAO method for calculation of the high frequency dielectric constants of crystals and the description of phase transitions in solids are discussed The efficiency of LCAO method in the quantum mechanics molecular dynamics approach to the interpretation of x ray absorption and EXAFS spectra is illustrated A new section is devoted to recent LCAO calculations of electronic vibrational and magnetic properties of tungstates MeWO_4 Me Fe Co Ni Cu Zn Cd Quantum Theory of the Solid State Lev Kantorovich, 2004-05-31 Quantum Physics of the Solid State an Introduction Draft foreword 26

09 03 If only this book had been available when I was starting out in science It would have saved me countless hours of struggle in trying to apply the general ideas of the standard solid state text books to solve real problems The fact is that most of the texts stop at the point where the real difficulties begin The great merit of this book is that it describes in an honest and detailed way what one really has to do in order to understand the multifarious properties of solids in terms of the fundamental physical theory of quantum mechanics University students of the physical sciences are taught about the fundamental theories and know that quantum mechanics together with relativity is our basis for understanding the physical world But the practical difficulties of using quantum mechanics to do anything useful are usually not very well explained The truth is that the application of quantum theory to achieve our present detailed understanding of solids has required the development of a large array of mathematical techniques This is closely analogous to the challenge faced long ago by theoretical astronomers in trying to apply Newton's equations of motion to the heavens they too had to develop a battery of theoretical and computational techniques to do calculations that could be compared with observation

Physical Properties of Quasicrystals Zbigniew M. Stadnik, 2012-12-06 Quasicrystals are a new form of the solid state which differ from the other two known forms crystalline and amorphous by possessing a new type of long range translational order called quasiperiodicity and a noncrystallographic orientational order This book provides an up to date description of the unusual physical properties of these new materials Emphasis is placed on the experimental results which are compared with those of the corresponding crystalline and amorphous systems and discussed in terms of modern theoretical models Written by leading authorities in the field the book will be of great use both to experienced workers in the field and to uninitiated graduate students

Introduction to Solid-State Theory Otfried Madelung, 2012-12-06 Introduction to Solid State Theory is a textbook for graduate students of physics and materials science It also provides the theoretical background needed by physicists doing research in pure solid state physics and its applications to electrical engineering The fundamentals of solid state theory are based on a description by delocalized and localized states and within the concept of delocalized states by elementary excitations The development of solid state theory within the last ten years has shown that by a systematic introduction of these concepts large parts of the theory can be described in a unified way This form of description gives a pictorial formulation of many elementary processes in solids which facilitates their understanding

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

Electronic Conduction in Oxides N. Tsuda, K. Nasu, A. Fujimori, K. Siratori, 2013-03-09 This is a revised version of the first edition published in 1991 At the same time this is a revised version of the Syokabo edition which was written in Japanese and published in 1993 as a revised version of the original edition published in 1983 Compared with the first edition the following revisions have been made a new chapter on electron-electron interaction has been prepared by a new co-author A. Fujimori The substances in the previous Chap 4 have been changed and $\text{La}_{1-x}\text{Sr}_x\text{MnO}_3$ substituted for V_2O_5 which has been extensively reviewed in Reviews of Modern Physics Vol 70 p 1039 1998 by M. Imada, A. Fujimori and Y. Tokura Section 4.6 NiO was rewritten by A. Fujimori The other chapters have also been revised by each author to accommodate new developments which have appeared since the publication of the first edition As a result the references have been increased from 1088 to 1293 and 83 figures are new or improved The authors are N. Tsuda for Chaps 1, 2 and Sects 5.1, 5.5 and 5.9 K. Nasu for Chap 2 A. Fujimori for Chap 3 and Sects 5.6 and 5.7 and K. Siratori for Sect 5.8 The authors would like to express their gratitude to many authors and publishers for allowing them to reproduce their diagrams and to H. K. V. Latsch and C. E. Ascheron for their encouragement to complete this book

Advanced Electronic Technologies and Systems Based on Low-Dimensional Quantum Devices M. Balkanski, Nikolai Andreev, 2013-03-14 This volume on Advanced Electronic Technologies and Systems based on Low Dimensional Quantum Devices closes a three years series of NATO ASI's The first year was focused on the fundamental properties and applications The second year was devoted to Devices Based on Low Dimensional Semiconductor Structures The third year is covering Systems Based on Low Dimensional Quantum Semiconductor Devices The three volumes containing the lectures given at the three successive NATO ASI's constitute a complete review on the latest advances in semiconductor Science and Technology from the methods of fabrication of the quantum structures through the fundamental physics and basic knowledge of properties and projection of performances to the technology of devices and systems In the first volume Fabrication Properties and Application of Low Dimensional Semiconductors are described the practical ways in which quantum structures are produced the present status of the technology difficulties encountered and advances to be expected The basic theory of Quantum Wells Double Quantum Wells and Superlattices is introduced and the fundamental aspects of their optical properties are presented The effect of reduction of dimensionality on lattice dynamics of quantum structures is also discussed In the second volume Devices Based on Low Dimensional Structures the fundamentals of quantum structures and devices in the two major fields Electro Optical Devices and Pseudomorphic High Electron Mobility Transistors are extensively discussed

THEORY OF MAGNETISM. Kei Yosida, 1996-06-04 Translated from the Japanese this title is the first modern book on magnetism a topic of increasing importance The book provides the foundation for further development in this field covering magnetic ions in crystals and magnetism of spin systems metals and dilute alloys

Symmetries in Physics Wolfgang Ludwig, Claus Falter, 2012-12-06 Symmetries in Physics presents the fundamental theories of symmetry together with many examples of applications taken from several different branches of physics Emphasis

is placed on the theory of group representations and on the powerful method of projection operators. The exercises are intended to stimulate readers to apply the techniques demonstrated in the text.

Magnetic Flux Structures in Superconductors R.P. Huebener, 2013-03-14 The first edition of this book provided an introduction to the many static and dynamic features of magnetic flux structures in what are now called classical or low temperature superconductors. It went out of print not long after the discovery of high temperature superconductors in 1986 by J G Bednorz and K A Müller, a discovery which resulted worldwide in an explosive growth of research and development in the field of superconductivity. Because of this upsurge of activities a strong demand for this book clearly continued. Since the contents of the fourteen chapters of the first edition are still valid and continue to represent a useful introduction into the various subjects it was felt that a reprinting of these chapters in this second edition would be highly attractive. In this way the reader is also able to trace the earlier scientific developments themselves constituting important ideas sometimes forgotten by the new community dealing with high temperature superconductivity. However because of the exciting and important recent progress in the field of high temperature superconductivity an extensive chapter has been added in this second edition. It provides a summary of the new developments and a discussion of the highlights. Here keywords such as vortex matter, vortex imaging and half integer magnetic flux quanta describe surprising new issues.

Computational Materials Science Eugene Kotomin, 2003

Physics of Transition Metal Oxides Sadamichi Maekawa, Takami Tohyama, Stewart Edward Barnes, Sumio Ishihara, Wataru Koshibae, Giniyat Khaliullin, 2013-03-09 The fact that magnetite Fe_3O_4 was already known in the Greek era as a peculiar mineral is indicative of the long history of transition metal oxides as useful materials. The discovery of high temperature superconductivity in 1986 has renewed interest in transition metal oxides. High temperature superconductors are all cuprates. Why is it? To answer to this question we must understand the electronic states in the cuprates. Transition metal oxides are also familiar as magnets. They might be found stuck on the door of your kitchen refrigerator. Magnetic materials are valuable not only as magnets but as electronics materials. Manganites have received special attention recently because of their extremely large magnetoresistance, an effect so large that it is called colossal magnetoresistance (CMR). What is the difference between high temperature superconducting cuprates and CMR manganites? Elements with incomplete d shells in the periodic table are called transition elements. Among them the following eight elements with the atomic numbers from 22 to 29, i.e. Ti, V, Cr, Mn, Fe, Co, Ni, and Cu are the most important. These elements make compounds with oxygen and present a variety of properties. High temperature superconductivity and CMR are examples. Most of the textbooks on magnetism discuss the magnetic properties of transition metal oxides. However when one studies magnetism using traditional textbooks one finds that the transport properties are not introduced in the initial stages.

Physics and Chemistry of Transition Metal Oxides Hidetoshi Fukuyama, Naoto Nagaosa, 2012-12-06 *Physics and Chemistry of Transition Metal Oxides* includes both theoretical and experimental approaches to the variety of phenomena found in the transition metal oxides including high

temperature superconductivity colossal magnetoresistance and metal insulator transition These are the central issues in materials science and condensed matter physics chemistry and readers can obtain up to date information on what is happening in this field of research

Optics of Semiconductors and Their Nanostructures Heinz Kalt, Michael Hetterich, 2013-04-09 In recent years the field of semiconductor optics has been pushed to several extremes The size of semiconductor structures has shrunk to dimensions of a few nanometers the semiconductor light interaction is studied on timescales as fast as a few femtoseconds and transport properties on a length scale far below the wavelength of light have been revealed These advances were driven by rapid improvements in both semiconductor and optical technologies and were further facilitated by progress in the theoretical description of optical excitations in semiconductors This book written by leading experts in the field provides an up to date introduction to the optics of semiconductors and their nanostructures so as to help the reader understand these exciting new developments It also discusses recently established applications such as blue light emitters as well as the quest for future applications in areas such as spintronics quantum information processing and third generation solar cells

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

Green's Functions in Quantum Physics Eleftherios N. Economou, 2006-08-02 Of interest to advanced students this book focuses on Green's functions for obtaining simple and general solutions to basic problems in quantum physics It demonstrates the unifying formalism of Green's functions across many applications including transport properties carbon nanotubes and photonics and photonic crystals

Symmetry and Condensed Matter Physics M. El-Batanouny, F. Wooten, 2008-03-13 Unlike existing texts this book blends for the first time three topics in physics symmetry condensed matter physics and computational methods into one pedagogical textbook It includes new concepts in mathematical crystallography experimental methods capitalizing on symmetry aspects non conventional applications such as Fourier crystallography color groups quasicrystals and incommensurate systems as well as concepts and techniques behind the Landau theory of phase transitions Adopting a computational approach to the application of group theoretical techniques to solving symmetry related problems it dramatically alleviates the need for intensive calculations usually found in the presentation of symmetry Writing computer programs helps the student achieve a firm understanding of the underlying

concepts and sample programs based on Mathematica are presented throughout the book. Containing over 150 exercises, this textbook is ideal for graduate students in condensed matter physics, materials science, and chemistry. Solutions and computer programs are available online at www.cambridge.org/9780521828451. **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.

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