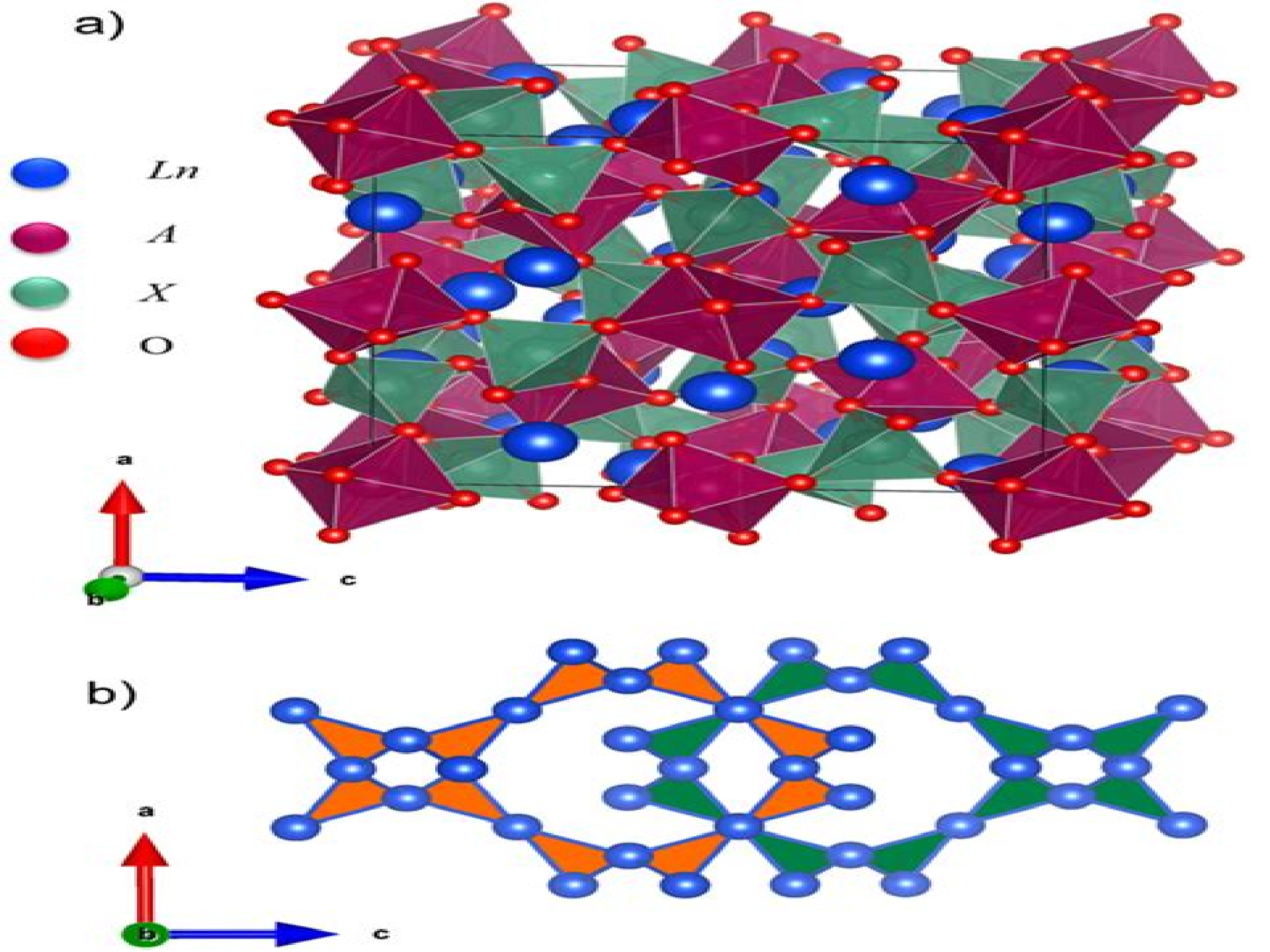
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Magnetic Ions In Crystals

Naveen Kumar Chogondahalli Muniraju

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

Magnetic Ions in Crystals K. W. H. Stevens,1997 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 paperback editions preserve the original texts of these important books while presenting them in durable paperback 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 **Physics of Semiconductors in High Magnetic Fields** Noboru Miura,2008 This book summarizes most of the fundamental physical phenomena which semiconductors and their modulated structures exhibit in high magnetic fields Readers can learn not only the basic theoretical background but also the present state of the art from the most advanced data in this rapidly growing research area **Spectroscopy of Crystals Containing Rare Earth Ions** A.A. Kaplyanskii,R.M. McFarlane,2012-12-02 Spectroscopy of Crystals Containing Rare Earth Ions contains chapters on some key problems selected from a broad range of spectroscopic studies of RE activated solids including both crystalline and glassy materials Progress in crystal field theory is surveyed an area which is basic to our understanding of the energy levels The treatment of dynamical properties includes studies of coherence phenomena in isolated ions energy transfer between ions and co operative phenomena associated with ion ion and ion lattice interactions In addition the role of electron spins and nuclear spins is studied by light scattering and double resonance techniques The presence of inhomogeneous broadening of spectral lines is observed and studied in many contexts leading to new insights into general problems of the disordered state Considerable attention is devoted to describing new experimental techniques whose development is of prime importance for progress in the spectroscopy of RE activated solids Many of these rely on the development and application of tunable lasers At the moment this is a very active field of spectroscopy with more exciting developments likely to occur in the future **THEORY OF MAGNETISM.** Kei Yosida,1996-06-04 Translated from the Japanese this title is the first modern book on magnetics 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 *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 *Elements of Slow-Neutron Scattering* J. M. Carpenter,C.-K. Loong,2015-09-24 This book provides a comprehensive and up to date introduction to the fundamental theory and applications of slow neutron scattering **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 **Concise Encyclopedia of Magnetic and Superconducting Materials** K.H.J. Buschow,2005-12-28 Magnetic and superconducting materials pervade every avenue of the technological world from microelectronics and mass data storage to medicine and heavy engineering Both areas have experienced a recent revitalisation of interest due to the discovery of new materials and the re evaluation of a wide range of basic mechanisms and phenomena This Concise Encyclopedia draws its material from the award winning Encyclopedia of Materials and Engineering and includes updates and revisions not available in the original set making it the ideal reference companion for materials scientists and engineers with an interest in magnetic and superconducting materials Contains in excess of 130 articles taken from the award winning Encyclopedia of Materials Science and Technology including ScienceDirect updates not available in the original set Each article discusses one aspect of magnetic and superconducting materials and includes photographs line drawings and tables to aid the understanding of the topic at hand Cross referencing guides readers to articles covering subjects of related interest *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 **Rare Earth Magnetism** Jens Jensen,Allan R. Mackintosh,1991-06-13 This monograph presents a unified and coherent account of a limited but important area of rare earth magnetism the magnetic structures and excitations which both reflect the nature of the fundamental magentic interactions of the metals

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 *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 **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 **ESR and NMR of Paramagnetic Species in Biological and Related Systems** I. Bertini,R. Drago,2012-12-06 Proceedings of the NATO Advanced Study Institute Acquafredda di Maratea Italy June 3 15 1979 **Crystal and Spin Structure and Their Relation to Physical Properties in Some Geometrical and Spin Spiral Multiferroics** Naveen Kumar Chogondahalli Muniraju,2012 *Magnetic*

Resonance and Related Phenomena E. Kundla,E. Lippmaa,T. Saluvere,2014-01-13 **Semimagnetic Semiconductors and Diluted Magnetic Semiconductors** M. Averous,M. Balkanski,2012-12-06 Semimagnetic semiconductors SMSC and diluted magnetic semiconductors DMS have in the past decade attracted considerable attention because they confer many new physical properties on both bulk materials and heterostructures These new effects are due either to exchange interactions between magnetic moments on magnetic ions or to exchange interactions between magnetic moments and the spin of the charge carrier These effects vary with the transition metal Mn Fe Co or rare earth Eu Gd etc used and thus provide a range of different situations The field is very large zero gap small gap wide gap and the magnetic properties also are very rich paramagnetic spin glass antiferromagnetism These materials are very convenient for studying the magnetism the magnetism is diluted or the superlattices SL with a continuous change from type II SL to type III SL This Course attempted to provide a complete overview of the topic The participants of this summer school held in Erice came from ten countries and were from various backgrounds and included theoreticians experimentalists physicists and chemists Consequently an attempt was made to make the Course as thorough as possible but at the same time attention was devoted to basic principles The lecturers drawn from all the groups in the world involved in the field were asked to be very didactic in their presentation After two introductory lectures Dr

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