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Frank J. Owens,
Charles P. Poole, Jr.,
and
Horacio A. Farach

Magnetic Resonance of Phase Transitions

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Stephen Z.D. Cheng



Magnetic Resonance Of Phase Transitions:

Magnetic Resonance of Phase Transitions Frank J. Owens, Charles P. Poole, Horacio A. Farach, 2013-10-22 Magnetic Resonance of Phase Transitions shows how the effects of phase transitions are manifested in the magnetic resonance data. The book discusses the basic concepts of structural phase and magnetic resonance, various types of magnetic resonances and their underlying principles, and the radiofrequency methods of nuclear magnetic resonance. The text also describes quadrupole methods, the microwave technique of electron spin resonance, and the Mossbauer effect. Phase transitions in various systems such as fluids, liquid crystals, and crystals, including paramagnets and ferroelectrics, are also considered. Physicists and scientists working in energetic materials laboratories will find the book invaluable. *MAGNETIC RESONANCE OF PHASE TRANSITIONS*. FJ OWENS (ED.), 1979

Magnetic Resonance of Phase Transitions Frank J. Owens, Charles P. Poole, Horacio A. Farach, 1979 Magnetic Resonance of Phase Transitions shows how the effects of phase transitions are manifested in the magnetic resonance data. The book discusses the basic concepts of structural phase and magnetic resonance, various types of magnetic resonances and their underlying principles, and the radiofrequency methods of nuclear magnetic resonance. The text also describes quadrupole methods, the microwave technique of electron spin resonance, and the Mossbauer effect. Phase transitions in various systems such as fluids, liquid crystals, and crystals, including paramagnets and ferroelectrics, are also considered. *The Physics of Structural Phase Transitions* Minoru Fujimoto, 2013-04-09 Phase transitions in which crystalline solids undergo structural changes present an interesting problem in the interplay between the crystal structure and the ordering process. This text, intended for readers with some prior knowledge of condensed matter physics, emphasizes the basic physics behind such spontaneous structural changes in crystals. Starting with the relevant thermodynamic principles, the book discusses the nature of order variables and their collective motion in a crystal lattice. In a structural phase transition, a singularity in such a collective mode is responsible for the lattice instability as revealed by soft phonons. This mechanism is analogous to the interplay of a charge density wave and a periodically deformed lattice in low-dimensional conductors. The text also describes experimental methods for modulated crystal structures and gives examples of structural changes in representative systems. The book is divided into two parts. The first theoretical part includes such topics as the Landau theory of phase transitions, statistics, correlations, and the mean field approximation, pseudospins, and their collective modes, soft lattice modes, and pseudospin condensates, lattice imperfections, and their role in the phase transitions of real crystals. The second part discusses experimental studies of modulated crystals using x-ray diffraction, neutron inelastic scattering, light scattering, dielectric measurements, and magnetic resonance spectroscopy. While the presence of modulated structures in the critical region was not particularly suggested in the published literature, *Special Issue on Incommensurate Phase Transitions* A. R. Bishop, V. Dvorak, Y. Ishibashi, 1986

Phase Transitions in Polymers: The Role of Metastable States Stephen Z.D. Cheng, 2008-09-10 A classical metastable state possesses a local free energy minimum at infinite sizes but not a

global one This concept is phase size independent We have studied a number of experimental results and proposed a new concept that there exists a wide range of metastable states in polymers on different length scales where their metastability is critically determined by the phase size and dimensionality Metastable states are also observed in phase transformations that are kinetically impeded on the pathway to thermodynamic equilibrium This was illustrated in structural and morphological investigations of crystallization and mesophase transitions liquid liquid phase separation vitrification and gel formation as well as combinations of these transformation processes The phase behaviours in polymers are thus dominated by interlinks of metastable states on different length scales This concept successfully explains many experimental observations and provides a new way to connect different aspects of polymer physics Written by a leading scholar and industry expert Presents new and cutting edge material encouraging innovation and future research Connects hot topics and leading research in one concise volume

The Physics of Phase Transitions Pierre Papon, Jacques Leblond, Paul H.E. Meijer, 2013-06-29 We learned in school that matter exists in three forms solid liquid and gas as well as other more subtle things such as the fact that evaporation produces cold The science of the states of matter was born in the 19th century It has now grown enormously in two directions 1 The transitions have multiplied first between a solid and a solid particularly for metallurgists Then for magnetism illustrated in France by Louis Neel and ferroelectricity In addition the extraordinary phenomenon of superconductivity in certain metals appeared at the beginning of the 20th century And other superfluids were recognized later helium 4 helium 3 the matter constituting atomic nuclei and neutron stars There is now a real zoology of transitions but we know how to classify them based on Landau's superb idea 2 Our profound view of the mechanisms has evolved in particular the very universal properties of fluctuations near a critical point described by Kadanoff's qualitative analysis and specified by an extraordinary theoretical tool the renormalization group Without exaggerating we can say that our view of condensed matter has undergone two revolutions in the 20th century first the introduction of quantum physics in 1930 then the recognition of self similar structures and the resulting scaling laws around 1970

Structural Phase Transitions II K. Alex Müller, Harry Thomas, 2013-03-14 Structural Phase Transitions II like its predecessor Topics in Current Physics Vol 23 presents selected methods and recent advances in the experimental investigation of phase transitions in solids The two chapters in this volume deal with electron paramagnetic resonance EPR and with nuclear magnetic and nuclear quadrupole resonance NMR NQR Both techniques are particularly sensitive to local properties The chapter on EPR concentrates largely on the investigation of static properties including mean field behaviour critical and multicritical phenomena whilst NMR is shown to be a powerful tool for studying nonlinear dynamics incommensurate transitions and disordered systems This book will serve as an excellent introduction to the methodology and applications of EPR and NMR NQR for all those wishing to become acquainted with these important tools for studying structural phase transitions

Ferroelectrics Literature
Index T. F. Connolly, 2012-12-06 Research on ferroelectricity and ferroelectric materials started in 1920 with the discovery

by Valasek that the variation of spontaneous polarization in Rochelle salt with sign and magnitude of an applied electric field traced a complete and reproducible hysteresis loop. Activity in the field was sporadic until 1935 when Busch and co workers announced the observation of similar behavior in potassium dihydrogen phosphate and related compounds. Progress thereafter continued at a modest level with the undertaking of some theoretical as well as further experimental studies. In 1944 von Hippel and co workers discovered ferroelectricity in barium titanate. The technological importance of ceramic barium titanate and other perovskites led to an upsurge of interest with many new ferroelectrics being identified in the following decade. By 1967 about 2000 papers on various aspects of ferroelectricity had been published. The bulk of this widely dispersed literature was concerned with the experimental measurement of dielectric, crystallographic, thermal, electromechanical, elastic, optical, and magnetic properties. A critical and excellently organized compilation based on these data appeared in 1969 with the publication of Landolt Bornstein Volume 11 3. This superb tabulation gave instant access to the results in the literature on nearly 450 pure substances and solid solutions of ferroelectric and antiferroelectric materials. Continuing interest in ferroelectrics spurred by the growing importance of electrooptic crystals resulted in the publication of almost as many additional papers by the end of 1969 as had been surveyed in Landolt Bornstein.

Light Scattering Near Phase Transitions H.Z. Cummins, A.P. Levanyuk, 2012-12-02. Since the development of the laser in the early 1960s, light scattering has played an increasingly crucial role in the investigation of many types of phase transitions, and the published work in this field is now widely dispersed in a large number of books and journals. A comprehensive overview of contemporary theoretical and experimental research in this field is presented here. The reviews are written by authors who have actively contributed to the developments that have taken place in both Eastern and Western countries.

Ferroelectric Materials and Ferroelectricity T. F. Connolly, 2013-11-11. This volume is a joint effort of the Research Materials Information Center (RMIC) of the Solid State Division at Oak Ridge National Laboratory and the Libraries and Information Systems Center at Bell Telephone Laboratories (BTL), Murray Hill, N.J. The Research Materials Information Center has since 1963 been answering inquiries on the availability, preparation, and properties of inorganic solid state research materials. The preparation of bibliographies has been essential to this function, and the interest in ferroelectrics led to the compilation of the journal and report literature on that subject. The 1962 book *Ferroelectric Crystals* by Jona and Shirane was taken as a cutoff point, and all papers through mid 1969 received by the Center have been included. The Libraries and Information Systems Center of BTL has over a period of years developed a proprietary package of computer programs called BELDEX which formats and generates indexes to bibliographic material. This group therefore undertook to process RMIC's ferroelectric references by BELDEX so that both laboratories could have the benefit of an indexed basic bibliography in this important research area.

Phase Transitions in Ferroelastic and Co-elastic Crystals E. K. Salje, 1993-04-22. This textbook describes the fundamental principles of structural phase transitions in materials in an easily understandable form suitable for

both undergraduate and graduate students **NMR-MRI, μ SR and Mössbauer Spectroscopies in Molecular Magnets** Pietro Carretta, Alessandro Lascialfari, 2007-12-15 In this book an extensive overview on the results obtained during the last decade and on recent achievements in the study of molecular magnets by means of Nuclear Magnetic Resonance Muon Spin Rotation Magnetic Resonance Imaging and Mossbauer techniques is presented The aim is to introduce the reader to these techniques and to give a general background on their application to molecular spin systems *Air Force Research Resumés* , **Glass Transition and Phase Transitions in Food and Biological Materials** Jasim Ahmed, Mohammad Shafiur Rahman, Yrjo H. Roos, 2017-04-24 Glass and State Transitions in Food and Biological Materials describes how glass transition has been applied to food micro structure food processing product development storage studies packaging development and other areas This book has been structured so that readers can initially grasp the basic principles and instrumentation before moving through the various applications In summary the book will provide the missing link between food science and material science polymer engineering This will allow food scientists to better understand the concept and applications of thermal properties **Library of Congress Subject Headings** Library of Congress, 2013 **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>

Magnetic Resonance Microscopy Sabina Haber-Pohlmeier, Bernhard Blümich, Luisa Ciobanu, 2022-04-20 Magnetic Resonance Microscopy Explore the interdisciplinary applications of magnetic resonance microscopy in this one of a kind resource In *Magnetic Resonance Microscopy Instrumentation and Applications in Engineering Life Science and Energy Research* a team of distinguished researchers delivers a comprehensive exploration of the use of magnetic resonance microscopy MRM and similar techniques in an interdisciplinary milieu Opening with a section on hardware and methodology the book moves on to consider developments in the field of mobile nuclear magnetic resonance Essential processes including filtration multi phase flow and transport and a wide range of systems from biomarkers via single cells to plants and biofilms are discussed next After a fulsome treatment of MRM in the field of energy research the editors conclude the book with a chapter extolling the virtues of a holistic treatment of theory and application in MRM *Magnetic Resonance Microscopy Instrumentation and Applications in Engineering Life Science and Energy Research* also includes A thorough introduction to recent developments in magnetic resonance microscopy hardware and methods including ceramic coils for MR microscopy Comprehensive explorations of applications in chemical engineering including ultra fast MR techniques to image multi phase flow in pipes and reactors Practical discussions of applications in the life sciences including MRI of single cells labelled with super paramagnetic iron oxide nanoparticles In depth examinations of new applications in energy research including spectroscopic imaging of devices for electrochemical storage Perfect for practicing scientists from all fields *Magnetic Resonance Microscopy Instrumentation and Applications in Engineering Life Science and Energy Research* is an ideal resource for anyone seeking a one stop guide to magnetic resonance microscopy for engineers life scientists and energy researchers

Phase Transitions and Structure of Polymer Systems in External Fields Sergey A. Vshivkov, 2019-05-14 Generalized extensive experimental and theoretical data regarding the phase transitions of polymer systems in mechanical and magnetic fields provide the possibility to predict the results of external field effects on the structure and mutual solubility of components The data on dynamic structuring in deformed polymer blends and solutions allow for the use of found regularities by the processing of polymer systems The methods offered in this book allow for the connection of shift of phase diagrams in the mechanical field with changes in macromolecule sizes The tutorials described here will help the reader to correctly build the phase diagrams of polymer systems using a variety of methods

Phase Transitions in Surface Films J.G. Dash, J. Ruvalds, 2012-12-06 The Advanced Study Institute on Phase Transitions in Surface Films was held at the Ettore Majorana Centre for Scientific Culture in Erice Sicily during June 11 to June 25 1979 This Institute was the second course of the International School of Low Temperature Physics which was established at the Centre in 1977 with the guidance and inspiration of T Regge and A Zichichi The 1979 course selected a topic on one of the most rapidly advancing fields of condensed matter physics in the late 70 s The program of topics and speakers was developed with the advice of the Organizing Committee composed of J Friedel N D Mermin R E Peierls T Regge and J Wheatley These two weeks were memorable for the range and depth of the lectures and seminars and the sustained high interest of the students and faculty through a demanding schedule of over 5 hours a day of formal sessions A large fraction of the leading researchers in the field were there It would have been impossible to gather such a large group five years earlier for the field itself is hardly 10 years old Although the foundations of the thermodynamics of surface films were laid down by Gibbs about 100 years ago and experiments on oil water monolayers were carried out by Pockels and Rayleigh at about the same time the beginnings of the modern field were much more recent

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