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The Physics of Phase Transitions Phase Transitions in Materials Phase Transitions and Critical Phenomena **New Kinds of Phase Transitions: Transformation in Disordered Substances Phase Transitions and Critical Phenomena** The Physics of Phase Transitions *Phase Transitions* Statistical Mechanics of Phase Transitions Quantum Phase Transitions **Understanding Quantum Phase Transitions** Lectures On Phase Transitions And The Renormalization Group **Kinetics of Phase Transitions** *The Physics of Structural Phase Transitions Magnetic Resonance of Phase Transitions Elements of Phase Transitions and Critical Phenomena* Phase Transition Dynamics **Phase Transitions in Polymers: The Role of Metastable States Phase Transitions and Renormalization Group Phase Transitions in Foods Phase Transition Dynamics Phase Transitions in Cell Biology Non-Equilibrium Phase Transitions Gibbs Measures and Phase Transitions Phase Transitions in Ferroelastic and Co-elastic Crystals** *Non-Equilibrium Phase Transitions* **Hysteresis and Phase Transitions Evolution of Phase Transitions** Quantum Phase Transitions in Cold Atoms and Low Temperature Solids **Phase Transitions in Machine Learning Continuum Models for Phase Transitions and Twinning in Crystals** *Structural Phase Transitions in Layered Transition Metal Compounds* **Phase Transitions in Liquid Crystals Electronic Phase Transitions** *Quantum Phase Transitions in Transverse Field Models* **Microcanonical Thermodynamics: Phase Transitions In "Small" Systems** *Phase Transitions in Solids Under High Pressure* **Fluctuations, Instabilities, and Phase Transitions First Order Phase Transitions of Magnetic Materials Conductor Insulator Quantum Phase Transitions** *Fundamentals of Solid-State Phase Transitions, Ferromagnetism and Ferroelectricity*

Phase Transitions in Cell Biology Feb 12 2021 Phase transitions occur throughout nature. The most familiar example is the one that occurs in water – the abrupt, discontinuous transition from a liquid to a gas or a solid, induced by a subtle environmental change. Practically magical, the ever-so-slight shift of temperature or pressure can induce an astonishing transition from one entity to another entity that bears little resemblance to the first. So "convenient" a feature is seen throughout the domains of physics and chemistry, and one is therefore led to wonder whether it might also be common to biology. Indeed, many of the most fundamental cellular processes are arguably attributable to radical structural shifts triggered by subtle changes that cross a critical threshold. These processes include transport, motion, signaling, division, and other fundamental aspects of cellular function. Largely on the basis of this radical concept, a symposium was organized in Poitiers, France, to bring together people who have additional evidence for the role of phase transitions in biology, and this book is a compendium of some of the more far-reaching of those presentations, as well as several others that seemed to the editors to be compelling. The book should be suitable for anyone interested in the nature of biological function, particularly those who tire of lumbering along well trodden pathways of pursuit, and are eager to hear something fresh. The book is replete with fresh interpretations of familiar phenomena, and should serve as an excellent gateway to deeper understanding.

Gibbs Measures and Phase Transitions Dec 13 2020 The series is devoted to the publication of monographs and high-level textbooks in mathematics, mathematical methods and their applications. Apart from covering important areas of current interest, a major aim is to make topics of an interdisciplinary nature accessible to the non-specialist. The works in this series are addressed to advanced students and researchers in mathematics and theoretical physics. In addition, it can serve as a guide for lectures and seminars on a graduate level. The series de Gruyter Studies in Mathematics was founded ca. 30 years ago by the late Professor Heinz Bauer and Professor Peter Gabriel with the aim to establish a series of monographs and textbooks of high standard, written by scholars with an international reputation presenting current fields of research in pure and applied mathematics. While the editorial board of the Studies has changed with the years, the aspirations of the Studies are unchanged. In times of rapid growth of mathematical knowledge carefully written monographs and textbooks written by experts are needed more than ever, not least to pave the way for the next generation of mathematicians. In this sense the editorial board and the publisher of the Studies are devoted to continue the Studies as a service to the mathematical community. Please submit any book proposals to Niels Jacob.

Microcanonical Thermodynamics: Phase Transitions In "Small" Systems Dec 01 2019 Boltzmann's formula S = In[W(E)] defines the microcanonical ensemble. The usual textbooks on statistical mechanics start with the microensemble but rather quickly switch to the canonical ensemble introduced by Gibbs. This has the main advantage of easier analytical calculations, but there is a price to pay — for example, phase transitions can only be defined in the thermodynamic limit of infinite system size. The question how phase transitions show up from systems with, say, 100 particles with an increasing number towards the bulk can only be answered when one finds a way to define and classify phase transitions in small systems. This is all possible within Boltzmann's original definition of the microcanonical ensemble.Starting from Boltzmann's formula, the book formulates the microcanonical thermodynamics entirely within the frame of mechanics. This way the thermodynamic limit is avoided and the formalism applies to small as well to other nonextensive systems like gravitational ones. Phase transitions of first order, continuous transitions, critical lines and multicritical points can be unambiguously defined by the curvature of the entropy S(E,N). Special attention is given to the fragmentation of nuclei and atomic clusters as a peculiar phase transition of small systems controlled, among others, by angular momentum.The dependence of the liquid-gas transition of small atomic clusters under prescribed pressure is treated. Thus the analogue to the bulk transition can be studied. The book also describes the microcanonical statistics of the collapse of a self-gravitating system under large angular momentum.

Fundamentals of Solid-State Phase Transitions, Ferromagnetism and Ferroelectricity Jun 26 2019 The author's experimental discoveries in the field of solid-state phase transitions have brought about a thorough explanation of this phenomenon, including the puzzling nature of "lamda-anomalies." These phase transitions are found to be always a nucleation and crystal growth in a solid medium, while "second (or higher) order" phase transitions are a misconception: they do not exist. Ramifications of this new understanding are substatial. In this book the reader will find the first unified account for fundamentals of the three great areas of solid-state physics? Phase transitions, ferromagnetism and ferroelectricity, free of the inconsistencies of the conventional theories.

Phase Transition Dynamics Mar 16 2021 This book is an introduction to a comprehensive and unified dynamic transition theory for dissipative systems and to applications of the theory to a range of problems in the nonlinear sciences. The main objectives of this book are to introduce a general principle of dynamic transitions for dissipative systems, to establish a systematic dynamic transition theory, and to explore the physical implications of applications of the theory to a range of problems in the nonlinear sciences. The basic philosophy of the theory is to search for a complete set of transition states, and the general principle states that dynamic transitions of all dissipative systems can be classified into three categories: continuous, catastrophic and random. The audience for this book includes advanced graduate students and researchers in mathematics and physics as well as in other related fields.

Quantum Phase Transitions in Transverse Field Models Jan 02 2020 This book establishes the fundamental connections between the physics of quantum phase transitions and the technological promise of quantum information.

Non-Equilibrium Phase Transitions Jan 14 2021 This book describes two main classes of non-equilibrium phase-transitions: static and dynamics of transitions into an absorbing state, and dynamical scaling in far-from-equilibrium relaxation behavior and ageing.

Phase Transitions in Ferroelastic and Co-elastic Crystals Nov 11 2020 This textbook describes the fundamental principles of structural phase transitions in materials in an easily understandable form, suitable for both undergraduate and graduate students.

Phase Transitions in Polymers: The Role of Metastable States Jun 18 2021 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 Nov 04 2022 The Physics of Phase Transitions occupies an important place at the crossroads of several fields central to materials sciences. This second edition incorporates new developments in the states of matter physics, in particular in the domain of nanomaterials and atomic Bose-Einstein condensates where progress is accelerating. New information and application examples are included. This work deals with all classes of phase transitions in fluids and solids, containing chapters on evaporation, melting, solidification, magnetic transitions, critical phenomena, superconductivity, and more. End-of-chapter problems and complete answers are included.

Kinetics of Phase Transitions Nov 23 2021 Providing a comprehensive introduction with the necessary background material to make it accessible for a wide scientific audience, Kinetics of Phase Transitions discusses developments in domain-growth kinetics. This book combines pedagogical chapters from leading experts in this area and focuses on incorporating various experimentally relevant effects—such as disorder, strain fields, and wetting surfaces—into studies of phase ordering dynamics. In addition, it highlights topics garnering recent interest, such as the growth of nanostructures on surfaces. This book also provides a comprehensive overview of numerical techniques, which have proven useful in studying these complex nonlinear problems.

Phase Transitions and Critical Phenomena Sep 02 2022 The field of phase transitions and critical phenomena continues to be active in research, producing a steady stream of interesting and fruitful results. No longer an area of specialist interest, it has acquired a central focus in condensed matter studies. The major aim of this serial is to provide review articles that can serve as standard references for research workers in the field, and for graduate students and others wishing to obtain reliable information on important recent developments. The two review articles in this volume complement each other in a remarkable way. Both deal with what might be called the modern geometric approach to the properties of macroscopic systems. The first article by Georgii (et al.) describes how recent advances in the application of geometric ideas leads to a better understanding of pure phases and phase transitions in equilibrium systems. The second article by Alava (et al.) deals with geometrical aspects of multi-body systems in a hands-on way, going beyond abstract theory to obtain practical answers. The combination of computers and geometrical ideas described in this volume will doubtless play a major role in the development of statistical mechanics in the twenty-first century.

Phase Transition Dynamics Jul 20 2021 Phase transition dynamics is centrally important to condensed matter physics. This 2002 book treats a wide variety of topics systematically by constructing time-dependent Ginzburg-Landau models for various systems in physics, metallurgy and polymer science. Beginning with a summary of advanced statistical-mechanical theories including the renormalization group theory, the book reviews dynamical theories, and covers the kinetics of phase ordering, spinodal decomposition and nucleation in depth. The phase transition dynamics of real systems are discussed, treating interdisciplinary problems in a unified manner. Topics include supercritical fluid dynamics, stress-diffusion coupling in polymers and mesoscopic dynamics at structural phase transitions in solids. Theoretical and experimental approaches to shear flow problems in fluids are reviewed. Phase Transition Dynamics provides a comprehensive account, building on the statistical mechanics of phase transitions covered in many introductory textbooks. It will be essential reading for researchers and advanced graduate students in physics, chemistry, metallurgy and polymer science.

Phase Transitions in Foods Apr 16 2021 Phase Transitions in Foods, Second Edition, assembles the most recent research and theories on the topic, describing the phase and state transitions that affect technological properties of biological materials occurring in food processing and storage. It covers the role of water as a plasticizer, the effect of transitions on mechanical and chemical changes, and the application of modeling in predicting stability rates of change. The volume presents methods for detecting changes in the physical state and various techniques used to analyze phase behavior of biopolymers and food components. It should become a valuable resource for anyone involved with food engineering, processing, storage, and quality, as well as those working on related properties of pharmaceuticals and other biopolymers. Contains descriptions of non-fat food solids as "biopolymers" which exhibit physical properties that are highly dependent on temperature, time, and water content Details the effects of water on the state and stability of foods Includes information on changes occurring in state and physicochemical properties during processing and storage The only book on phase and state transitions written specifically for the applications in food industry, product development, and research

Phase Transitions in Solids Under High Pressure Oct 30 2019 The use of high-pressure techniques has become popular for studying the nature of substances and phenomena occurring in them, especially as a means of obtaining new materials (synthesis under high pressure) and processing known materials (hydroextrusion). A product of many years of research by the authors and their colleagues, Phase Transitions in Solids under High Pressure discusses the relationships of phase transformations in solids under high pressure, the mechanism of these transformations, crystal geometry, the effect of deformation, the conditions of formation, and preservation of the high-pressure phases under normal pressure. The book begins with an introduction that describes the relationship of the thermodynamics of phase transformations and the kinetics of the transformations. This is followed by a chapter explaining the equipment and mostly original procedures for investigating phase transformation in solids under high hydrostatic and quasi-hydrostatic pressures. The book covers phase transformations under high pressure in a wide temperature range in the elements carbon, silicon, germanium, titanium, zirconium, iron, gallium, and cerium as well as in titanium- and iron-based alloys and AIBVII, AIIBVI, and AIIIBV compounds. In addition, the book examines the kinetics of phase transformations in iron-based alloys in isobaric–isothermal conditions. The authors present results for phase transformations in deformation under high pressure, describe several non-trivial effects associated with phase transformations under high pressure, and analyze the kinetics and hysteresis of high-temperature and low-temperature phase transformations. They conclude by describing the role of investigations under high pressure for determining general relationships governing phase transformations in solids.

Electronic Phase Transitions Feb 01 2020 Electronic Phase Transitions deals with topics, which are presently at the forefront of scientific research in modern solid-state theory. Anderson localization, which has fundamental implications in many areas of solid-state physics as well as spin glasses, with its influence on quite different research activities such as neural networks, are two examples that are reviewed in this book. The ab initio statistical mechanics of structural phase transitions is another prime example, where the interplay and connection of two unrelated disciplines of solid-state theory - first principle electronic structure calculations and critical phenomena - has given rise to impressive new insights. Clearly, there is more and more need for accurate, stable numerical simulations of models of interacting electrons, presently discussed with great vigor in connection with high-Tc superconductors where the superconducting transition is close to a magnetic transition, i.e. an antiferromagnetic spin structure. These topics and others are discussed and reviewed by leading experts in the field.

Phase Transitions and Renormalization Group May 18 2021 No further information has been provided for this title.

Evolution of Phase Transitions Aug 09 2020 This 2006 work began with the author's exploration of the applicability of the finite deformation theory of elasticity when various standard assumptions such as convexity of various energies or ellipticity of the field equations of equilibrium are relinquished. The finite deformation theory of elasticity turns out to be a natural vehicle for the study of phase transitions in solids where thermal effects can be neglected. This text will be of interest to those interested in the development and application of continuum-mechanical models that describe the macroscopic response of materials capable of undergoing stress- or temperature-induced transitions between two solid phases. The focus is on the evolution of phase transitions which may be either dynamic or quasi-static, controlled by a kinetic relation which in the framework of classical thermomechanics represents information that is supplementary to the usual balance principles and constitutive laws of conventional theory.

The Physics of Phase Transitions May 30 2022 The physics of phase transitions is an important area at the crossroads of several fields that play central roles in materials sciences. This work deals with broad classes of phase transitions in fluids and solids. It contains chapters on evaporation, melting, solidification, magnetic transitions, critical phenomena, superconductivity, etc., and is intended for graduate students in physics and engineering; for scientists it will serve both as an introduction and an overview. End-of-chapter problems and complete answers are included.

First Order Phase Transitions of Magnetic Materials Aug 28 2019 This book introduces new concepts in the phenomenon of 1st order phase transitions. It discusses the concept of kinetic arrest at a certain temperature, with this temperature being dependent on the second control variable (magnetic field, or pressure). It discusses interesting manifestations of this phenomenon when the 1st order transition is broadened, i.e. occurs over a finite range of temperatures. Many examples of this phenomenon, observed recently in many materials, will also be discussed.

The Physics of Structural Phase Transitions Oct 23 2021 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.

Quantum Phase Transitions in Cold Atoms and Low Temperature Solids Jul 08 2020

Phase Transitions in Materials Oct 03 2022 A clear, concise and rigorous textbook covering phase transitions in the context of advances in electronic structure and statistical mechanics.

Hysteresis and Phase Transitions Sep 09 2020 Hysteresis is an exciting and mathematically challenging phenomenon that oc curs in rather different situations: jt, can be a byproduct offundamental physical mechanisms (such as phase transitions) or the consequence of a degradation or imperfection (like the play in a mechanical system), or it is built deliberately into a system in order to monitor its behaviour, as in the case of the heat control via thermostats. The delicate interplay between memory effects and the occurrence of hys teresis loops has the effect that hysteresis is a genuinely nonlinear phenomenon which is usually non-smooth and thus not easy to treat mathematically. Hence it was only in the early seventies that the group of Russian scientists around M. A. Krasnoselskii initiated a systematic mathematical investigation of the phenomenon of hysteresis which culminated in the fundamental monograph Krasnoselskii-Pokrovskii (1983). In the meantime, many mathematicians have contributed to the mathematical theory, and the important monographs of 1. Mayergoyz (1991) and A. Visintin (1994a) have appeared. We came into contact with the notion of hysteresis around the year 1980.

Phase Transitions in Liquid Crystals Mar 04 2020 The Nato Advanced Study Institute "Phase Transitions in Liquid Crystals" was held May 2-12, 1991, in Erice, Sicily. This was the 16th conference organized by the International School of Quantum Electronics, under the auspices of the "Ettore Majorana" Centre for Scientific Culture. The subject of "Liquid Crystals" has made amazing progress since the last ISQE Course on this subject in 1985. The present Proceedings give a tutorial introduction to today's most important areas, as well as a review of current results by leading researchers. We have brought together some of the world's acknowledged experts in the field to summarize both the present state of their research and its background. Most of the lecturers attended all the lectures and devoted their spare hours to stimulating discussions. We would like to thank them all for their admirable contributions. The Institute also took advantage of a very active audience; most of the students were active researchers in the field and contributed with discussions and seminars. Some of these student seminars are also included in these Proceedings. We did not modify the original manuscripts in editing this book, but we did group them according to the following topics: 1) "Theoretical Foundations"; 2) "Thermotropic Liquid Crystals"; 3) "Ferroelectric Liquid Crystals"; 4) "Polymeric Liquid Crystals"; and 5) "Lyotropic Liquid Crystals".

Magnetic Resonance of Phase Transitions Sep 21 2021 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 Mössbauer 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.

Phase Transitions and Critical Phenomena Jun 30 2022 The field of phase transitions and critical phenomena continues to be active in research, producing a steady stream of interesting and fruitful results. It has moved into a central place in condensed matter studies. Statistical physics, and more specifically, the theory of transitions between states of matter, more or less defines what we know about 'everyday' matter and its transformations. The major aim of this serial is to provide review articles that can serve as standard references for research workers in the field, and for graduate students and others wishing to obtain reliable information on important recent developments.

Statistical Mechanics of Phase Transitions Mar 28 2022 The book provides an introduction to the physics which underlies phase transitions and to the theoretical techniques currently at our disposal for understanding them. It will be useful for advanced undergraduates, for post-graduate students undertaking research in related fields, and for established researchers in experimental physics, chemistry, and metallurgy as an exposition of current theoretical understanding. - ;Recent developments have led to a good understanding of universality; why phase transitions in systems as diverse as magnets, fluids, liquid crystals, and superconductors can be brought under the same theoretical umbrella and well described by simple models. This book describes the physics underlying universality and then lays out the theoretical approaches now available for studying phase transitions. Traditional techniques, mean-field theory, series expansions, and the transfer matrix, are described; the Monte Carlo method is covered, and two chapters are devoted to the renormalization group, which led to a break-through in the field. The book will be useful as a textbook for a course in `Phase Transitions', as an introduction for graduate students undertaking research in related fields, and as an overview for scientists in other disciplines who work with phase transitions but who are not aware of the current tools in the armoury of the theoretical physicist. - ;Introduction; Statistical mechanics and thermodynamics; Models; Mean-field theories; The transfer matrix; Series expansions; Monte Carlo simulations; The renormalization group; Implementations of the renormalization group. -

Fluctuations, Instabilities, and Phase Transitions Sep 29 2019 This book contains the papers presented at the NATO Advanced Study Institute held at Geilo, Norway, 11th - 20th April 1975. The institute was the third in a row devoted to phase transitions. The previous two dealt with 2nd- and 1st-order transitions in equilibrium systems and the proceedings have been published.i~ In order to make an overlap wi th those institutes, the first part of this institute was devoted to 1st -or der transitions with an emphasis on the problems of metast abi l i t y and instability en countered i n spinodal decomposition, nucleation etc. The main topic was, however, that of non-equilibrium systems, and the present institute was to our knowledge the first one devoted to the physics of such systems. The discovery of the analogy between phase transitions in equilibrium systems and instabilities in non-equilibrium systems was first made by Rolf Landauer in 1961 and later independently by others. The analogy was first pointed out for electronic devices (tunnel diodes, Gunn oscillators, lasers, etc.) and the treatment of hydrodynamic instabilities followed later.

New Kinds of Phase Transitions: Transformation in Disordered Substances Aug 01 2022 Proceedings of the NATO Advanced Research Workshop, held in Volga River, Russia, 24-28 May 2001

Continuum Models for Phase Transitions and Twinning in Crystals May 06 2020 Continuum Models for Phase Transitions and Twinning in Crystals presents the fundamentals of a remarkably successful approach to crystal thermomechanics. Developed over the last two decades, it is based on the mathematical theory of nonlinear thermoelasticity, in which a new viewpoint on material symmetry, motivated by molecular theories, plays a central role. This is the first organized presentation of a nonlinear elastic approach to twinning and displacive phase transition in crystalline solids. The authors develop geometry, kinematics, and energy invariance in crystals in strong connection and with the purpose of investigating the actual mechanical aspects of the phenomena, particularly in an elastostatics framework based on the minimization of a thermodynamic potential. Interesting for both mechanics and mathematical analysis, the new theory offers the possibility of investigating the formation of microstructures in materials undergoing martensitic phase transitions, such as shape-memory alloys. Although phenomena such as twinning and phase transitions were once thought to fall outside the range of elastic models, research efforts in these areas have proved quite fruitful. Relevant to a variety of disciplines, including mathematical physics, continuum mechanics, and materials science, Continuum Models for Phase Transitions and Twinning in Crystals is your opportunity to explore these current research methods and topics.

Lectures On Phase Transitions And The Renormalization Group Dec 25 2021 Covering the elementary aspects of the physics of phases transitions and the renormalization group, this popular book is widely used both for core graduate statistical mechanics courses as well as for more specialized courses. Emphasizing understanding and clarity rather than technical manipulation, these lectures de-mystify the subject and show precisely "how things work." Goldenfeld keeps in mind a reader who wants to understand why things are done, what the results are, and what in principle can go wrong. The book reaches both experimentalists and theorists, students and even active researchers, and assumes only a prior knowledge of statistical mechanics at the introductory graduate level.Advanced, never-before-printed topics on the applications of renormalization group far from equilibrium and to partial differential equations add to the uniqueness of this book.

Phase Transitions in Machine Learning Jun 06 2020 Phase transitions typically occur in combinatorial computational problems and have important consequences, especially with the current spread of statistical relational learning as well as sequence learning methodologies. In Phase Transitions in Machine Learning the authors begin by describing in detail this phenomenon, and the extensive experimental investigation that supports its presence. They then turn their attention to the possible implications and explore appropriate methods for tackling them. Weaving together fundamental aspects of computer science, statistical physics and machine learning, the book provides sufficient mathematics and physics background to make the subject intelligible to researchers in AI and other computer science communities. Open research issues are also discussed, suggesting promising directions for future research.

Quantum Phase Transitions Feb 24 2022 Describing the physical properties of quantum materials near critical points with long-range many-body quantum entanglement, this book introduces readers to the basic theory of quantum phases, their phase transitions and their observable properties. This second edition begins with a new section suitable for an introductory course on quantum phase transitions, assuming no prior knowledge of quantum field theory. It also contains several new chapters to cover important recent advances, such as the Fermi gas near unitarity, Dirac fermions, Fermi liquids and their phase transitions, quantum magnetism, and solvable models obtained from string theory. After introducing the basic theory, it moves on to a detailed description of the canonical quantum-critical phase diagram at non-zero temperatures. Finally, a variety of more complex models are explored. This book is ideal for graduate students and researchers in condensed matter physics and particle and string theory.

Elements of Phase Transitions and Critical Phenomena Aug 21 2021 As an introductory account of the theory of phase transitions and critical phenomena, this book reflects lectures given by the authors to graduate students at their departments and is thus classroom-tested to help beginners enter the field. Most parts are written as self-contained units and every new concept or calculation is explained in detail without assuming prior knowledge of the subject. The book significantly enhances and revises a Japanese version which is a bestseller in the Japanese market and is considered a standard textbook in the field. It contains new pedagogical presentations of field theory methods, including a chapter on conformal field theory, and various modern developments hard to find in a single textbook on phase transitions. Exercises are presented as the topics develop, with solutions found at the end of the book, making the text useful for self-teaching, as well as for classroom learning.

Understanding Quantum Phase Transitions Jan 26 2022 Quantum phase transitions (QPTs) offer wonderful examples of the radical macroscopic effects inherent in quantum physics: phase changes between different forms of matter driven by quantum rather than thermal fluctuations, typically at very low temperatures. QPTs provide new insight into outstanding problems such as high-temperature superconductivit

Non-Equilibrium Phase Transitions Oct 11 2020 “The importance of knowledge consists not only in its direct practical utility but also in the fact the it promotes a widely contemplative habit of mind; on this ground,

utility is to be found in much of the knowledge that is nowadays labelled ‘useless’. ” Bertrand Russel, In Praise of Idleness, London (1935) “Why are scientists in so many cases so deeply interested in their work ? Is it merely because it is useful ? It is only necessary to talk to such scientists to discover that the utilitarian possibilities of their work are generally of secondary interest to them. Something else is primary. ” David Bohm, On creativity, Abingdon (1996) In this volume, the dynamical critical behaviour of many-body systems far from equilibrium is discussed. Therefore, the intrinsic properties of the - namics itself, rather than those of the stationary state, are in the focus of 1 interest. Characteristically, far-from-equilibrium systems often display - namical scaling, even if the stationary state is very far from being critical. A 1 As an example of a non-equilibrium phase transition, with striking practical c- sequences, consider the allotropic change of metallic ?-tin to brittle ?-tin. At o equilibrium, the gray ?-Sn becomes more stable than the silvery ?-Sn at 13. 2 C. Kinetically, the transition between these two solid forms of tin is rather slow at higher temperatures. It starts from small islands of ?-Sn, the growth of which proceeds through an auto-catalytic reaction.
Structural Phase Transitions in Layered Transition Metal Compounds Apr 04 2020 The structural phase transition is one of the most fundamental problems in solid state physics. Layered transition-metal dichalcogenides provide us with a most exciting area for the study of structural phase transitions that are associated with the charge density wave (CDW). A large variety of structural phase transitions, such as commensurate and incommensurate transitions, and the physical proper ties related to the formation of a CDW, have been an object of intense study made for many years by methods employing modem microscopic techniques. Rather recently, efforts have been devoted to the theoretical understanding of these experimental results. Thus, McMillan, for example, has developed an elegant phenomenological theory on the basis of the Landau free energy expansion. An extension of McMillan's theory has provided a successful understanding of the successive phase transitions observed in the IT- and 2H-compounds. In addition, a microscopic theory of lattice instability, lattice dynamics, and lattice distortion in the CDW state of the transition-metal dichalcogenides has been developed based on their electronic structures. As a result, the driving force of the CDW formation in the IT- and 2H-compounds has become clear. Furthermore, the effect of lattice fluctuations on the CDW transition and on the anomalous behavior of various physical properties has been made clear microscopically.
Conductor Insulator Quantum Phase Transitions Jul 28 2019 When many particles come together how do they organize themselves? And what destroys this organization? Combining experiments and theory, this book describes intriguing quantum phases - metals, superconductors and insulators - and transitions between them. It captures the excitement and the controversies on topics at the forefront of research.
Phase Transitions Apr 28 2022 Phase transitions--changes between different states of organization in a complex system--have long helped to explain physics concepts, such as why water freezes into a solid or boils to become a gas. How might phase transitions shed light on important problems in biological and ecological complex systems? Exploring the origins and implications of sudden changes in nature and society, Phase Transitions examines different dynamical behaviors in a broad range of complex systems. Using a compelling set of examples, from gene networks and ant colonies to human language and the degradation of diverse ecosystems, the book illustrates the power of simple models to reveal how phase transitions occur. Introductory chapters provide the critical concepts and the simplest mathematical techniques required to study phase transitions. In a series of example-driven chapters, Ricard Solé shows how such concepts and techniques can be applied to the analysis and prediction of complex system behavior, including the origins of life, viral replication, epidemics, language evolution, and the emergence and breakdown of societies. Written at an undergraduate mathematical level, this book provides the essential theoretical tools and foundations required to develop basic models to explain collective phase transitions for a wide variety of ecosystems.