Ginzburg Landau Phase Transition Theory And Superconductivity International Series Of Numerical Mathematics

Self-contained treatment of nonrelativistic many-particle systems discusses both formalism and applications in terms of ground-state (zero-temperature) formalism, finite-temperature formalism, canonical transformations, and applications to physical systems. 1971 edition. This book reviews some of the classic aspects in the theory of phase transitions and critical phenomena, which has a long history. Recently, these aspects are attracting much attention due to essential new contributions. The topics presented in this book include: mathematical theory of the Ising model; equilibrium and non-equilibrium criticality of one-dimensional quantum spin chains; influence of structural disorder on the critical behaviour of the Potts model; criticality, fractality and multifractality of linked polymers; field-theoretical approaches in the superconducting phase transitions. The book is based on the review lectures that were given in Lviv (Ukraine) in March 2002 at the “Ising lectures” — a traditional annual workshop on phase transitions and critical phenomena which aims to bring together scientists working in the field of phase transitions with university students and those who are interested in the subject. Contents:Mathematical Theory of the Ising Model and Its Generalizations: An Introduction (Y Kozitsky)Relaxation in Quantum Spin Chains: Free Fermionic Models (D Karevski)Quantum Phase Transitions in Alternating Transverse Ising Chains (O Derzhko)Phase Transitions in Two-Dimensional Random Potts Models (B Berche & C Chatelain)Scaling of Miktoarm Star Polymers (C von Ferber)Field Theoretic Approaches to the Superconducting Phase Transition (F S Nogueira & H Kleinert) Readership: Researchers, academics and graduate students in condensed matter physics. Keywords:Phase Transitions;Disorder;Critical Phenomena;Renormalization Group;Ising Model;Potts Model

The contents of this book stems from three different objectives. First, it is an introduction to the basic principles and techniques of Landau's theory, which is intended for teaching purposes. A second purpose of the book provides the practical methods for applying Landau's theory to complex systems. The last objective of the book is to incorporate the developments which have arisen in the last fifteen years from the extensive application of the theory to a variety of physical systems.

Superconductivity covers the nature of the phenomenon of superconductivity. The book discusses the fundamental principles of superconductivity; the essential features of the superconducting state-the phenomena of zero resistance and perfect diamagnetism; and the properties of the various classes of superconductors, including the organics, the buckministerfullerenes, and the precursors to the cuprates. The text also describes superconductivity from the viewpoint of thermodynamics and provides expressions for the free energy; the Ginzburg-Landau and BCS theories; and the structures of the high temperature superconductors. The band theory; type II superconductivity and magnetic properties; and the intermediate and mixed states are also considered. The book further tackles critical state models; various types of tunneling and the Josephson effect; and other transport properties. The text concludes by looking into spectroscopic properties. Physicists and astronomers will find the book invaluable.

Theory of Superconductivity is primarily intended to serve as a background for reading the literature in which detailed applications of the microscopic theory of superconductivity are made to specific problems.

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.

Superconductivity of Metals and Cuprates covers the basic physics of superconductivity, both the theoretical and experimental aspects. The book concentrates on important facts and ideas, including Ginzburg-Landau equations, boundary energy, Green's function methods, and spectroscopy. Avoiding lengthy or difficult presentations of theory, it is written in a clear and lucid style with many useful, informative diagrams. The book is designed to be accessible to senior undergraduate students, making it a helpful tool for teaching superconductivity as well as serving as an introduction to those entering the field.

A Nobel Laureate presents his view of developments in the field of superconductivity, superfluidity and related theory. The book contains Ginzburg's amended version of the Nobel lecture in Physics 2003, as well as his expanded autobiography.

Written by the leading experts in computational materials science, this handy reference concisely reviews the most

important aspects of plasticity modeling: constitutive laws, phase transformations, texture methods, continuum approaches and damage mechanisms. As a result, it provides the knowledge needed to avoid failures in critical systems udner mechanical load. With its various application examples to micro- and macrostructure mechanics, this is an invaluable resource for mechanical engineers as well as for researchers wanting to improve on this method and extend its outreach.
Over the past few years, finite-size scaling has become an increasingly important tool in studies of critical systems. This is partly due to an increased understanding of finite-size effects by analytical means, and partly due to our ability to treat larger systems with large computers. The aim of this volume was to collect those papers which have been important for this progress and which illustrate novel applications of the method. The emphasis has been placed on relatively recent developments, including the use of the &egr;-expansion and of conformal methods.
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.

This comprehensive text covers the basic physics of the solid state starting at an elementary level suitable for undergraduates but then advancing, in stages, to a graduate and advanced graduate level. In addition to treating the fundamental elastic, electrical, thermal, magnetic, structural, electronic, transport, optical, mechanical and compositional properties, we also discuss topics like superfluidity and superconductivity along with special topics such as strongly correlated systems, high-temperature superconductors, the quantum Hall effects, and graphene. Particular emphasis is given to so-called first principles calculations utilizing modern density functional theory which for many systems now allow accurate calculations of the electronic, magnetic, and thermal properties.

A Primer to the Theory of Critical Phenomena provides scientists in academia and industry, as well as graduate students in physics, chemistry, and geochemistry with the scientific fundamentals of critical phenomena and phase transitions. The book helps readers broaden their understanding of a field that has developed tremendously over the last forty years. The book also makes a great resource for graduate level instructors at universities. Provides a thorough and accessible treatment of the fundamentals of critical phenomena Offers an in-depth exposition on renormalization and field theory techniques Includes experimental observations of critical effects Includes live examples illustrating the applications of the theoretical material

The Landau Institute for Theoretical Physics was created in 1965 by a group of LD Landau's pupils. Very soon, it was widely recognized as one of the world's leading centers in theoretical physics. According to Science Magazine, the Institute in the eighties had the highest citation index among all the scientific organizations in the former Soviet Union. This collection of the best papers of the Institute reflects the development of the many directions in the exact sciences during the last 30 years. The reader can find the original formulations of well-known notions in condensed matter theory, quantum field theory, mathematical physics and astrophysics, which were introduced by members of the Landau Institute.The following are some of the achievements described in this book: monopoles (A Polyakov), instantons (A Belavin et al.), weak crystallization (S Brazovskii), spin superfluidity (I Fomin), finite band potentials (S Novikov) and paraconductivity (A Larkin, L Aslamasov).

This monograph compiles, rearranges, and refines recent research results in the complex G-L theory with or without immediate applications to the theory of superconductivity. An authoritative reference for applied mathematicians, theoretical physicists and engineers interested in the quantitative description of superconductivity using Ginzburg-Landau theory.

Topological defects formed at symmetry-breaking phase transitions play an important role in many different fields of physics. They appear in many condensed-matter systems at low temperature; examples include vortices in superfluid helium-4, a rich variety of defects in helium-3, quantized mag netic flux tubes in type-II superconductors, and disclination lines and other defects in liquid crystals. In cosmology, unified gauge theories of particle interactions suggest a sequence of phase transitions in the very early uni verse some of which may lead to defect formation. In astrophysics, defects play an important role in the dynamics of neutron stars. In 1997 the European Science Foundation started the scientific network "Topological defects" headed by Tom Kibble. This network has provided us with a unique opportunity of establishing a collaboration between the representatives of these very different branches of modern physics. The NATO-ASI

(Advanced Study Institute), held in Les Houches in February 1999 thanks to the support of the Scientific Division of NATO, the European Science Foundation and the CNRS, represents a key event of this ESF network. It brought together participants from widely different fields, with diverse expertise and vocabulary, fostering the exchange of ideas. The lectures given by particle physicists, cosmologists and condensed matter physicists are the result of the fruitful collaborations established since 1997 between groups in several European countries and in the U.S.A.

Critical phenomena is one of the most exciting areas of modern physics. This 2007 book provides a thorough but economic introduction into the principles and techniques of the theory of critical phenomena and the renormalization group, from the perspective of modern condensed matter physics. Assuming basic knowledge of quantum and statistical mechanics, the book discusses phase transitions in magnets, superfluids, superconductors, and gauge field theories. Particular attention is given to topics such as gauge field fluctuations in superconductors, the Kosterlitz-Thouless transition, duality transformations, and quantum phase transitions - all of which are at the forefront of physics research. This book contains numerous problems of varying degrees of difficulty, with solutions. These problems provide readers with a wealth of material to test their understanding of the subject. It is ideal for graduate students and more experienced researchers in the fields of condensed matter physics, statistical physics, and many-body physics.

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While many scientists are familiar with fractals, fewer are familiar with scale-invariance and universality which underlie the ubiquity of their shapes. These properties may emerge from the collective behaviour of simple fundamental constituents, and are studied using statistical field theories.

Initial chapters connect the particulate perspective developed in the companion volume, to the coarse grained statistical fields studied here. Based on lectures taught by Professor Kardar at MIT, this textbook demonstrates how such theories are formulated and studied. Perturbation theory, exact solutions, renormalization groups, and other tools are employed to demonstrate the emergence of scale invariance and universality, and the non-equilibrium dynamics of interfaces and directed paths in random media are discussed. Ideal for advanced graduate courses in statistical physics, it contains an integrated set of problems, with solutions to selected problems at the end of the book and a complete set available to lecturers at www.cambridge.org/9780521873413. The discovery of superconductivity at 30 K by Bednorz and Müller in 1986 ignited an explosion of interest in high temperature superconductivity. The initial development rapidly evolved into an intensive worldwide research effort — which still persists after more than a decade — to understand the phenomenon of cuprate superconductivity, to search for ways to raise the transition temperature and to produce materials which have the potential for technological applications. During the past decade of research on this subject, significant progress has been made on both the fundamental science and technological application fronts. A great deal of experimental data is now available on the cuprates, and various properties have been well characterized using high quality single crystals and thin films. Despite this enormous research effort, however, the underlying mechanisms responsible for superconductivity in the cuprates are still open to question. This book offers an understanding from the phase transition point of view, surveys and identifies thermal and quantum fluctuation effects, identifies material-independent universal properties and provides constraints for the microscopic description of the

various phenomena. The text is presented in a format suitable for use in a graduate level course. Contents:Ginzburg–Landau PhenomenologyGaussian Thermal FluctuationsSuperfluidity and the n-Vector ModelUniversality and Scaling Theory of Classical Critical Phenomena at Finite TemperatureExperimental Evidence for Classical Critical BehaviorQuantum Phase TransitionsImplicationsMean Field TreatmentXY ModelQuantum Phase TransitionsBCS TheorySuperconducting Properties of the Attractive Hubbard Model Readership: Researchers and graduate students interested in superconductivity. Keywords:High Temperature Superconductivity;Cuprate Superconductors;Ginzburg-Landau Phenomenology;Gaussian Thermal Fluctuations
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.

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 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.
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. -
This book describes the theory of superconducting fluctuations, which connects two major topics in statistical physics - the theory of phase transitions and the theory of superconductivity. It presents a complete encyclopedia of superconducting fluctuations, summarising the last thirty-five years of work in the field.
This modern textbook provides a complete survey of the broad field of statistical mechanics. Based on a series of lectures, it adopts a special pedagogical approach. The authors, both excellent lecturers, clearly distinguish between general principles and their applications in solving problems. Analogies between phase transitions in fluids and magnets using continuum and spin models are emphasized, leading to a better understanding. Such

special features as historical notes, summaries, problems, mathematical appendix, computer programs and order of magnitude estimations distinguish this volume from competing works. Due to its ambitious level and an extensive list of references for technical details on advanced topics, this is equally a must for researchers in condensed matter physics, materials science, polymer science, solid state physics, and astrophysics. From the contents Thermostatics: phase stability, phase equilibria, phase transitions; Statistical Mechanics: calculation, correlation functions, ideal classical gases, ideal quantum gases; Interacting Systems: models, computer simulation, mean-field approximation; Interacting Systems beyond Mean-field Theory: scaling and renormalization group, foundations of statistical mechanics "The present book, however, is unique that it both is written in a very pedagogic, easily comprehensible style, and, nevertheless, goes from the basic principles all the way to these modern topics, containing several chapters on the various approaches of mean field theory, and a chapter on computer simulation. A characteristic feature of this book is that often first some qualitative arguments are given, or a "pedestrians's approach", and then a more general and/or more rigorous derivation is presented as well. Particularly useful are also "supplementary notes", pointing out interesting applications and further developments of the subject, a detailed bibliography, problems and historical notes, and many pedagogic figures."

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.
Collected Papers of L. D. Landau brings together the collected papers of L. D. Landau in the field of physics. The discussion is divided into the following sections: low-temperature physics (including superconductivity); solid-state physics; plasma physics; hydrodynamics; astrophysics; nuclear physics and cosmic rays; quantum mechanics; quantum field theory; and miscellaneous works. Topics covered include the intermediate state of supraconductors; the absorption of sound in solids; the properties of metals at very low temperatures; and production of showers by heavy particles. This volume is comprised of 100 chapters and begins with Landau's paper on the theory of the spectra of diatomic molecules, followed by his studies on the damping problem in wave mechanics; quantum electrodynamics in configuration

space; electron motion in crystal lattices; and the internal temperature of stars. Some of Landau's theories, such as those of stars, energy transfer on collisions, phase transitions, and specific heat anomalies are discussed. Subsequent chapters focus on the structure of the undisplaced scattering line; the transport equation in the case of Coulomb interactions; scattering of light by light; and the origin of stellar energy. This book will be a valuable resource for physicists as well as physics students and researchers.

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.

The experimental discovery of the fractional quantum Hall effect (FQHE) at the end of 1981 by Tsui, Stormer and Gossard was absolutely unexpected since, at this time, no theoretical work existed that could predict new struc tures in the magnetotransport coefficients under conditions representing the extreme quantum limit. It is more than thirty years since investigations of bulk semiconductors in very strong magnetic fields were begun. Under these conditions, only the lowest Landau level is occupied and the theory predicted a monotonic variation of the resistivity with increasing magnetic field, depending sensitively on the scattering mechanism. However, the ex perimental data could not be analyzed accurately since magnetic freeze-out effects and the transitions from a degenerate to a nondegenerate system complicated the interpretation of the data. For a two-dimensional electron gas, where the positive background charge is well separated from the two dimensional system, magnetic freeze-out effects are barely visible and an analysis of the data in the extreme quantum limit seems to be easier. First measurements in this magnetic field region on silicon field-effect transistors were not successful because the disorder in these devices was so large that all electrons in the lowest Landau level were localized. Consequently, models of a spin glass and finally of a Wigner solid were developed and much effort was put into developing the technology for improving the quality of semi conductor materials and devices, especially in the field of two-dimensional electron systems.

Theory of Phase Transitions: Rigorous Results is inspired by lectures on mathematical problems of statistical physics presented in the Mathematical Institute of the Hungarian Academy of Sciences, Budapest. The aim of the book is to expound a series of rigorous results

about the theory of phase transitions. The book consists of four chapters, wherein the first chapter discusses the Hamiltonian, its symmetry group, and the limit Gibbs distributions corresponding to a given Hamiltonian. The second chapter studies the phase diagrams of lattice models that are considered at low temperatures. The notions of a ground state of a Hamiltonian and the stability of the set of the ground states of a Hamiltonian are also introduced. Chapter 3 presents the basic theorems about lattice models with continuous symmetry, and Chapter 4 focuses on the second-order phase transitions and on the theory of scaling probability distributions, connected to these phase transitions. Specialists in statistical physics and other related fields will greatly benefit from this publication.
Unconventional superconductivity (or superconductivity with a nontrivial Cooper pairing) is believed to exist in many heavy-fermion materials as well as in high temperature superconductors, and is a subject of great theoretical and experimental interest. The remarkable progress achieved in this field has not been reflected in published monographs and textbooks, and there is a gap between current research and the standard education of solid state physicists in the theory of superconductivity. This book is intended to meet this information need and includes the authors' original results.
What is superconductivity? How was it discovered? What are the properties of superconductors, how are they applied now, and how are they likely to become widely used in the near future? These are just some of the questions which this important book sets out to answer.

Starting with the discovery of superconductivity over ninety years ago, the book guides the readers through the many years of subsequent exploration, right up to the latest sensational findings. Written in a lively, nontechnical style, this book makes ideal background reading for any school or college level study of superconductivity. The authors, who are leading authorities in the field, paint detailed pictures of the phenomena involved without mathematical formalism, appealing instead to physical intuition.
An extensive summary of mathematical functions that occur in physical and engineering problems
Superconductivity: Physics and Applications brings together major developments that have occurred within the field over the past twenty years. Taking a truly modern approach to the subject the authors provide an interesting and accessible introduction. Brings a fresh approach to the physics of superconductivity based both on the well established and convergent picture for most low-Tc superconductors, provided by the BCS theory at the microscopic level, and London and Ginzburg-Landau theories at the phenomenological level, as well as on experiences gathered in high-Tc research in recent years. Includes end of chapter problems and numerous relevant examples Features brief interviews with key researchers in the field A prominent feature of the book is the use of SI units throughout, in contrast to many of the current textbooks on the subject which tend to use cgs units and are considered to be outdated
This textbook series has been designed for final year undergraduate and first year graduate students,

providing an overview of the entire field showing how specialized topics are part of the wider whole, and including references to current areas of literature and research.

A comprehensive introduction to this important subject, presenting the fundamentals of classical and statistical thermodynamics through carefully developed concepts which are supported by many examples and applications. * Each chapter includes numerous carefully worked out examples and problems * Takes a more applied approach rather than theoretical * Necessary mathematics is left simple * Accessible to those fairly new to the subject