Statistical Physics Second Revised And Enlarged Edition

Statistical Physics provides an introduction to the basic principles of statistical mechanics. Statistical mechanics is one of the fundamental branches of theoretical physics and chemistry, and deals with many systems such as gases, liquids, solids, and even molecules which have many atoms. The book consists of three parts. Part I gives the principles, with elementary applications to noninteracting systems. It begins with kinetic theory and discusses classical and quantum systems in equilibrium and nonequilibrium. In Part II, classical statistical mechanics is developed for interacting systems in equilibrium and nonequilibrium. Finally, in Part III, quantum statistics is presented to an extent which enables the reader to proceed to advanced many-body theories. This book is written for a one-year graduate course in statistical mechanics or a half-year course followed by a half-year course on related subjects, such as special topics and applications or elementary many-body theories. Efforts are made such that discussions of each subject start with an elementary level and end at an advanced level.

Statistical physics has its origins in attempts to describe the thermal properties of matter in terms of its constituent particles, and has played a fundamental role in the development of quantum mechanics. Based on lectures taught by Professor Kardar at MIT, this textbook introduces the central concepts and tools of statistical physics. It contains a chapter on probability and related issues such as the central limit theorem and information theory, and covers interacting particles, with an extensive description of the van der Waals equation and its derivation by mean field approximation. It also contains an integrated set of problems, with solutions to selected problems at the end of the book and a complete set of solutions is available to lecturers on a password protected website at www.cambridge.org/9780521873420. A companion volume, Statistical Physics of Fields, discusses non-mean field aspects of scaling and critical phenomena, through the perspective of renormalization group.

The original work by M.D. Sturge has been updated and expanded to include new chapters covering non-equilibrium and biological systems. This second edition re-organizes the material in a more natural manner into four parts that continues to assume no previous knowledge of thermodynamics. The four divisions of the material introduce the subject inductively and rigorously, beginning with key concepts of equilibrium thermodynamics such as heat, temperature and entropy. The second division focuses on the fundamentals of modern thermodynamics: free energy, chemical potential and the partition function. The second half of the book is then designed with the flexibility to meet the needs of both the instructor and the students, with a third section focused on the different types of gases: ideal, Fermi-Dirac, Bose-Einstein, Black Body Radiation and the Photon gases. In the fourth and final division of the book, modern thermostatistical applications

are addressed: semiconductors, phase transitions, transport processes, and finally the new chapters on non-equilibrium and biological systems. Key Features: Provides the most readable, thorough introduction to statistical physics and thermodynamics, with magnetic, atomic, and electrical systems addressed alongside development of fundamental topics at a non-rigorous mathematical level Includes brand-new chapters on biological and chemical systems and non-equilibrium thermodynamics, as well as extensive new examples from soft condensed matter and correction of typos from the prior edition Incorporates new numerical and simulation exercises throughout the book Adds more worked examples, problems, and exercises

This book aims to provide a compact and unified introduction to the most important aspects in the physics of non-equilibrium systems. It first introduces stochastic processes and some modern tools and concepts that have proved their usefulness to deal with non-equilibrium systems from a purely probabilistic angle. The aim is to show the important role played by fluctuations in far-from-equilibrium situations, where noise can promote order and organization, switching among non-equilibrium states, etc. The second part adopts a more historical perspective, retracing the first steps taken from the purely thermodynamic as well as from the kinetic points of view to depart (albeit slightly) from equilibrium. The third part revisits the path outlined in the first one, but now undertakes the mesoscopic description of extended systems, where new phenomena (patterns, long-range correlations, scaling far from equilibrium, etc.) are observed. This book is a revised and extended version of an earlier edition published in 1994. It includes topics of current research interest in far-from-equilibrium situations like noise-induced phenomena and free energy-like functionals, surface growth and roughening, etc. It can be used as an advanced textbook by graduate students in physics. It also covers topics of current interest in other disciplines and interdisciplinary approaches in engineering, biophysics, and economics, among others. The level of detail in the book is enough to capture the interest of the reader and facilitate the path to more learning by exploring the modern research literature provided. At the same time, the book is also complete enough to be self-contained for those readers who just need an overview of the subject.

Standard text opens with clear, concise chapters on classical statistical mechanics, quantum statistical mechanics, and the relation of statistical mechanics to thermodynamics. Further topics cover fluctuations, the theory of imperfect gases and condensation, distribution functions and the liquid state, nearest neighbor (Ising) lattice statistics, and more.

In each generation, scientists must redefine their fields: abstracting, simplifying and distilling the previous standard topics to make room for new advances and methods. Sethna's book takes this step for statistical mechanics - a field rooted in physics and chemistry whose ideas and methods are now central to information theory, complexity, and modern biology. Aimed at advanced undergraduates and early graduate students in all of these fields, Sethna limits his main presentation

to the topics that future mathematicians and biologists, as well as physicists and chemists, will find fascinating and central to their work. The amazing breadth of the field is reflected in the author's large supply of carefully crafted exercises, each an introduction to a whole field of study: everything from chaos through information theory to life at the end of the universe.

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.

Statistical Mechanics: Fundamentals and Model Solutions, Second Edition Fully updated throughout and with new chapters on the Mayer expansion for classical gases and on cluster expansion for lattice models, this new edition of Statistical Mechanics: Fundamentals and Model Solutions provides a comprehensive introduction to equilibrium statistical mechanics for advanced undergraduate and graduate students of mathematics and physics. The author presents a fresh approach to the subject, setting out the basic assumptions clearly and emphasizing the importance of the thermodynamic limit and the role of convexity. With problems and solutions, the book clearly explains the role of models for physical systems, and discusses and solves various models. An understanding of these models is of increasing importance as they have proved to have applications in many areas of mathematics and physics. Features Updated throughout with new content from the field An established and well-loved textbook Contains new problems and solutions for further learning opportunity Author Professor Teunis C. Dorlas is at the Dublin Institute for Advanced Studies, Ireland.

A self-contained, mathematical introduction to the driving ideas in equilibrium statistical mechanics, studying important models in detail.

Thermal and statistical physics has established the principles and procedures needed to understand and explain the properties of systems consisting of macroscopically large numbers of particles. By developing microscopic statistical physics and macroscopic classical thermodynamic descriptions in tandem, Statistical and Thermal Physics: An Introduction provides insight into basic concepts and relationships at an advanced undergraduate level. This second

edition is updated throughout, providing a highly detailed, profoundly thorough, and comprehensive introduction to the subject and features exercises within the text as well as end-of-chapter problems. Part I of this book consists of nine chapters, the first three of which deal with the basics of equilibrium thermodynamics, including the fundamental relation. The following three chapters introduce microstates and lead to the Boltzmann definition of the entropy using the microcanonical ensemble approach. In developing the subject, the ideal gas and the ideal spin system are introduced as models for discussion. The laws of thermodynamics are compactly stated. The final three chapters in Part I introduce the thermodynamic potentials and the Maxwell relations. Applications of thermodynamics to gases, condensed matter, and phase transitions and critical phenomena are dealt with in detail. Initial chapters in Part II present the elements of probability theory and establish the thermodynamic equivalence of the three statistical ensembles that are used in determining probabilities. The canonical and the grand canonical distributions are obtained and discussed. Chapters 12-15 are concerned with quantum distributions. By making use of the grand canonical distribution, the Fermi–Dirac and Bose–Einstein quantum distribution functions are derived and then used to explain the properties of ideal Fermi and Bose gases. The Planck distribution is introduced and applied to photons in radiation and to phonons on solids. The last five chapters cover a variety of topics: the ideal gas revisited, nonideal systems, the density matrix, reactions, and irreversible thermodynamics. A flowchart is provided to assist instructors on planning a course. Key Features: Fully updated throughout, with new content on exciting topics, including black hole thermodynamics, Heisenberg antiferromagnetic chains, entropy and information theory, renewable and nonrenewable energy sources, and the mean field theory of antiferromagnetic systems Additional problem exercises with solutions provide further learning opportunities Suitable for advanced undergraduate students in physics or applied physics. Michael J.R. Hoch spent many years as a visiting scientist at the National High Magnetic Field Laboratory at Florida State University, USA. Prior to this, he was a professor of physics and the director of the Condensed Matter Physics Research Unit at the University of the Witwatersrand, Johannesburg, where he is currently professor emeritus in the School of Physics.
This textbook familiarizes the students with the general laws of thermodynamics, kinetic theory & statistical physics, and their applications to physics. Conceptually strong, it is flourished with numerous figures and examples to facilitate understanding of concepts. Written primarily for B.Sc. Physics students, this textbook would also be a useful reference for students of engineering.
Statistical Mechanics discusses the fundamental concepts involved in understanding the physical properties of matter in bulk on the basis of the dynamical behavior of its microscopic constituents. The book emphasizes the equilibrium states of physical systems. The text first details the statistical basis of thermodynamics, and then proceeds to discussing the

elements of ensemble theory. The next two chapters cover the canonical and grand canonical ensemble. Chapter 5 deals with the formulation of quantum statistics, while Chapter 6 talks about the theory of simple gases. Chapters 7 and 8 examine the ideal Bose and Fermi systems. In the next three chapters, the book covers the statistical mechanics of interacting systems, which includes the method of cluster expansions, pseudopotentials, and quantized fields. Chapter 12 discusses the theory of phase transitions, while Chapter 13 discusses fluctuations. The book will be of great use to researchers and practitioners from wide array of disciplines, such as physics, chemistry, and engineering.

This is the definitive treatise on the fundamentals of statistical mechanics. A concise exposition of classical statistical mechanics is followed by a thorough elucidation of quantum statistical mechanics: postulates, theorems, statistical ensembles, changes in quantum mechanical systems with time, and more. The final two chapters discuss applications of statistical mechanics to thermodynamic behavior. 1930 edition.

Geared toward graduate students in physics, this text covers such important topics as the properties of the Fermi-Dirac and Bose-Einstein distributions; the interrelated subjects of fluctuations, thermal noise, and Brownian movement; and the thermodynamics of irreversible processes. Most sections include illustrative problems. 1958 edition.

Suitable for graduate students in chemical physics, statistical physics, and physical chemistry, this text develops an innovative, probabilistic approach to statistical mechanics. The treatment employs Gauss's principle and incorporates Bose-Einstein and Fermi-Dirac statistics to provide a powerful tool for the statistical analysis of physical phenomena. The treatment begins with an introductory chapter on entropy and probability that covers Boltzmann's principle and thermodynamic probability, among other topics. Succeeding chapters offer a case history of black radiation, examine quantum and classical statistics, and discuss methods of processing information and the origins of the canonical distribution. The text concludes with explorations of statistical equivalence, radiative and material phase transitions, and the kinetic foundations of Gauss's error law. Bibliographic notes complete each chapter.

Statistical physics is a core component of most undergraduate (and some post-graduate) physics degree courses. It is primarily concerned with the behavior of matter in bulk-from boiling water to the superconductivity of metals. Ultimately, it seeks to uncover the laws governing random processes, such as the snow on your TV screen. This essential new textbook guides the reader quickly and critically through a statistical view of the physical world, including a wide range of physical applications to illustrate the methodology. It moves from basic examples to more advanced topics, such as broken symmetry and the Bose-Einstein equation. To accompany the text, the author, a renowned expert in the field, has written a Solutions Manual/Instructor's Guide, available free of charge to lecturers who adopt this book for their courses. Introduction to Statistical Physics will appeal to students and researchers in physics, applied mathematics and statistics.

Building on the material learned by students in their first few years of study, Topics in Statistical Mechanics (Second Edition) presents an advanced level course on statistical and thermal physics. It begins with a review of the formal structure of statistical mechanics and thermodynamics considered from a unified viewpoint. There is a brief revision of non-interacting systems, including quantum gases and a discussion of negative temperatures. Following this, emphasis is on interacting systems. First, weakly interacting systems are considered, where the interest is in seeing how small interactions cause small deviations from the non-interacting case. Second, systems are examined where interactions lead to drastic changes, namely phase transitions. A number of specific examples is given, and these are unified within the Landau theory of phase transitions. The final chapter of the book looks at non-equilibrium systems, in particular the way they evolve towards equilibrium. This is framed within the context of linear response theory. Here fluctuations play a vital role, as is formalised in the fluctuation-dissipation theorem.The second edition has been revised particularly to help students use this book for self-study. In addition, the section on non-ideal gases has been expanded, with a treatment of the hard-sphere gas, and an accessible discussion of interacting quantum gases. In many cases there are details of Mathematica calculations, including Mathematica Notebooks, and expression of some results in terms of Special Functions.

An Introduction to Statistical Mechanics and Thermodynamics returns with a second edition which includes new chapters, further explorations, and updated information into the study of statistical mechanics and thermal dynamics. The first part of the book derives the entropy of the classical ideal gas, using only classical statistical mechanics and an analysis of multiple systems first suggested by Boltzmann. The properties of the entropy are then expressed as "postulates" of thermodynamics in the second part of the book. From these postulates, the formal structure of thermodynamics is developed. The third part of the book introduces the canonical and grand canonical ensembles, which are shown to facilitate calculations for many model systems. An explanation of irreversible phenomena that is consistent with time-reversal invariance in a closed system is presented. The fourth part of the book is devoted to quantum statistical mechanics, including black-body radiation, the harmonic solid, Bose-Einstein and Fermi-Dirac statistics, and an introduction to band theory, including metals, insulators, and semiconductors. The final chapter gives a brief introduction to the theory of phase transitions. Throughout the book, there is a strong emphasis on computational methods to make abstract concepts more concrete.

The sixth edition of this highly successful textbook provides a detailed introduction to Monte Carlo simulation in statistical physics, which deals with the computer simulation of many-body systems in condensed matter physics and related fields of physics and beyond (traffic flows, stock market fluctuations, etc.). Using random numbers generated by a computer, these powerful simulation methods calculate probability distributions, making it possible to estimate the thermodynamic properties of various systems. The book describes the theoretical background of these methods, enabling newcomers to perform such simulations and to analyse their results. It features a modular structure, with two chapters providing a basic pedagogic introduction plus exercises suitable for university courses; the remaining chapters cover major recent developments in the field. This edition has been updated with two new chapters dealing with recently developed powerful special algorithms and with finite size scaling tools for the study of interfacial phenomena, which are important for nanoscience. Previous editions have been highly praised and widely used by both students and advanced researchers.

In this revised and enlarged second edition, Tony Guénault provides a clear and refreshingly readable introduction to statistical physics. The treatment itself is self-contained and concentrates on an understanding of the physical ideas, without requiring a high level of mathematical sophistication. The book adopts a straightforward quantum approach to statistical averaging from the outset. The initial part of the book is

geared towards explaining the equilibrium properties of a simple isolated assembly of particles. The treatment of gases gives full coverage to Maxwell-Boltzmann, Fermi-Dirac and Bose-Einstein statistics.

Statistics links microscopic and macroscopic phenomena, and requires for this reason a large number of microscopic elements like atoms. The results are values of maximum probability or of averaging. This introduction to statistical physics concentrates on the basic principles, and attempts to explain these in simple terms supplemented by numerous examples. These basic principles include the difference between classical and quantum statistics, a priori probabilities as related to degeneracies, the vital aspect of indistinguishability as compared with distinguishability in classical physics, the differences between conserved and non-conserved elements, the different ways of counting arrangements in the three statistics (Maxwell–Boltzmann, Fermi–Dirac, Bose–Einstein), the difference between maximization of the number of arrangements of elements, and averaging in the Darwin–Fowler method. Significant applications to solids, radiation and electrons in metals are treated in separate chapters, as well as Bose–Einstein condensation. This revised second edition contains an additional chapter on the Boltzmann transport equation along with appropriate applications. Also, more examples have been added throughout, as well as further references to literature.

Going beyond traditional textbook topics, 'A Modern Course in Statistical Physics' incorporates contemporary research in a basic course on statistical mechanics. From the universal nature of matter to the latest results in the spectral properties of decay processes, this book emphasizes the theoretical foundations derived from thermodynamics and probability theory underlying all concepts in statistical physics. This completely revised and updated third edition continues the comprehensive coverage of numerous core topics and special applications, allowing professors flexibility in designing individualized courses. The inclusion of advanced topics and extensive references makes this an invaluable resource for researchers as well as students -- a textbook that will be kept on the shelf long after the course is completed.

This completely revised edition of the classical book on Statistical Mechanics covers the basic concepts of equilibrium and non-equilibrium statistical physics. In addition to a deductive approach to equilibrium statistics and thermodynamics based on a single hypothesis this book treats the most important elements of non-equilibrium phenomena. Intermediate calculations are presented in complete detail. Problems at the end of each chapter help students to consolidate their understanding of the material. Beyond the fundamentals, this text demonstrates the breadth of the field and its great variety of applications.

This revised and expanded edition of one of the important textbook in statistical physics, is a graduate level text suitable for students in physics, chemistry, and materials science. After a short review of basic concepts, the authors begin the discussion on strongly interacting condensed matter systems with a thorough treatment of mean field and Landau theories of phase transitions. Many examples are worked out in considerable detail. Classical liquids are treated next. Along with traditional approaches to the subject such as the virial expansion and integral equations, newer theories such as perturbation theory and density functional theories are introduced. The modern theory of phase transitions occupies a central place in this book. The development is along historical lines, beginning with the Onsager solution of the two-dimensional Ising model, series expansions, scaling theory, finite-size scaling, and the universality hypothesis. A separate chapter is devoted to the renormalization group approach to critical phenomena. The development of the basic tools is completed in a new chapter on computer simulations in which both Monte Carlo and molecular dynamics techniques are introduced. The remainder of the book is concerned with a discussion of some of the more important modern problems in condensed matter theory. A chapter on quantum fluids deals with Bose condensation, superfluidity, and the BCS and Landau-Ginzburg theories of superconductivity. A new chapter on polymers and membranes

contains a discussion of the Gaussian and Flory models of dilute polymer mixtures, the connection of polymer theory to critical phenomena, a discussion of dense polymer mixtures and an introduction to the physical properties of solid and fluid membranes. A chapter on linear response includes the Kubo formalism, the fluctuation-dissipation theorem, Onsager relations and the Boltzmann equation. The last chapter is devoted to disordered materials. Each chapter contains a substantial number of exercises. A manual with a complete set of solutions to these problems is available under separate cover.

Textbook on statistical field theories for advanced graduate courses in statistical physics.

A Modern Course in Statistical Physics is a textbook that illustrates the foundations of equilibrium and non-equilibrium statistical physics, and the universal nature of thermodynamic processes, from the point of view of contemporary research problems. The book treats such diverse topics as the microscopic theory of critical phenomena, superfluid dynamics, quantum conductance, light scattering, transport processes, and dissipative structures, all in the framework of the foundations of statistical physics and thermodynamics. It shows the quantum origins of problems in classical statistical physics. One focus of the book is fluctuations that occur due to the discrete nature of matter, a topic of growing importance for nanometer scale physics and biophysics. Another focus concerns classical and quantum phase transitions, in both monatomic and mixed particle systems. This fourth edition extends the range of topics considered to include, for example, entropic forces, electrochemical processes in biological systems and batteries, adsorption processes in biological systems, diamagnetism, the theory of Bose-Einstein condensation, memory effects in Brownian motion, the hydrodynamics of binary mixtures. A set of exercises and problems is to be found at the end of each chapter and, in addition, solutions to a subset of the problems is provided. The appendices cover Exact Differentials, Ergodicity, Number Representation, Scattering Theory, and also a short course on Probability.

The Manchester Physics Series General Editors: D. J. Sandiford; F. Mandl; A. C. Phillips Department of Physics and Astronomy, University of Manchester Properties of Matter B. H. Flowers and E. Mendoza Optics Second Edition F. G. Smith and J. H. Thomson Statistical Physics Second Edition E. Mandl Electromagnetism Second Edition I. S. Grant and W. R. Phillips Statistics R. J. Barlow Solid State Physics Second Edition J. R. Hook and H. E. Hall Quantum Mechanics F. Mandl Particle Physics Second Edition B. R. Martin and G. Shaw The Physics of Stars Second Edition A. C. Phillips Computing for Scientists R. J. Barlow and A. R. Barnett Statistical Physics, Second Edition develops a unified treatment of statistical mechanics and thermodynamics, which emphasises the statistical nature of the laws of thermodynamics and the atomic nature of matter. Prominence is given to the Gibbs distribution, leading to a simple treatment of quantum statistics and of chemical reactions. Undergraduate students of physics and related sciences will find this a stimulating account of the basic physics and its applications. Only an elementary knowledge of kinetic theory and atomic physics, as well as the rudiments of quantum theory, are presupposed for an understanding of this book. Statistical Physics, Second Edition features: A fully integrated treatment of thermodynamics and statistical mechanics. A flow diagram allowing topics to be studied in different orders or omitted altogether. Optional "starred" and highlighted sections containing more advanced and specialised material for the more ambitious reader. Sets of problems at the end of each chapter to

help student understanding. Hints for solving the problems are given in an Appendix.

Classic text combines thermodynamics, statistical mechanics, and kinetic theory in one unified presentation. Topics include equilibrium statistics of special systems, kinetic theory, transport coefficients, and fluctuations. Problems with solutions. 1966 edition.

This volume provides a compact presentation of modern statistical physics at an advanced level, from the foundations of statistical mechanics to the main modern applications of statistical physics. Special attention is given to new approaches, such as quantum field theory methods and non-equilibrium problems. This second, revised edition is expanded with biographical notes contextualizing the main results in statistical physics.

This book covers the foundations of classical thermodynamics, with emphasis on the use of differential forms of classical and quantum statistical mechanics, and also on the foundational aspects. In both contexts, a number of applications are considered in detail, such as the general theory of response, correlations and fluctuations, and classical and quantum spin systems. In the quantum case, a self-contained introduction to path integral methods is given. In addition, the book discusses phase transitions and critical phenomena, with applications to the Landau theory and to the Ginzburg-Landau theory of superconductivity, and also to the phenomenon of Bose condensation and of superfluidity. Finally, there is a careful discussion on the use of the renormalization group in the study of critical phenomena.

Four-part treatment covers principles of quantum statistical mechanics, systems composed of independent molecules or other independent subsystems, and systems of interacting molecules, concluding with a consideration of quantum statistics.

The purpose of this textbook is to bring together, in a self-contained introductory form, the scattered material in the field of stochastic processes and statistical physics. It offers the opportunity of being acquainted with stochastic, kinetic and nonequilibrium processes. Although the research techniques in these areas have become standard procedures, they are not usually taught in the normal courses on statistical physics. For students of physics in their last year and graduate students who wish to gain an invaluable introduction on the above subjects, this book is a necessary tool. Contents:Stochastic Processes and the Master Equation:Stochastic ProcessesMarkovian ProcessesMaster EquationsKramers Moyal ExpansionBrownian Motion, Langevin and Fokker-Planck EquationsDistributions, BBGKY Hierarchy, Density Operator:Probability Density as a FluidBBGKY HierarchyMicroscopic Balance EquationsDensity OperatorLinear Nonequilibrium Thermodynamics and Onsager Relations:Onsager Regression to Equilibrium HypothesisOnsager RelationsMinimum Production of EntropyLinear Response Theory, Fluctuation-Dissipation Theorem:Correlation Functions: Definitions and PropertiesLinear Response TheoryFluctuation-Dissipation TheoremInstabilities and Far from Equilibrium Phase-Transitions:Limit Cycles, Bifurcations, Symmetry BreakingNoise Induced TransitionsFormation and Propagation of Patterns in Far from Equilibrium Systems:Reaction-Diffusion Descriptions and Pattern FormationPattern Propagation Readership: Graduate students in physics and chemistry. keywords:Stochastic Processes;Langevin and Fokker-Planck Equations;Statistical Physics;Onsager Relations;Linear Response;Nonequilibrium

Statistical Physics;Transport Processes;Noise Induced Transitions;Instabilities;Pattern Formation and Propagation "This book introduces ways to investigate nonequilibrium statistical physics, mainly via stochastic processes, and presents results achieved with such methodology … it is suitable for seminars directed towards relatively mature students in theoretical physics or applied mathematics." H Muthsam "The present book is a good choice for a single book covering the field … suitable for undergraduate students in the last year and graduate students. They will find in it a suggestive introduction that motivates them to dig deeper into the field and to look for those topics omitted from the text … highly recommended to anyone interested in becoming acquainted with nonequilibrium statistical physics." Journal of Statistical Physics

This invaluable book explores the delicate interplay between geometry and statistical mechanics in materials such as microemulsions, wetting and growth interfaces, bulk lyotropic liquid crystals, chalcogenide glasses and sheet polymers, using tools from the fields of polymer physics, differential geometry, field theory and critical phenomena. Several chapters have been updated relative to the classic 1989 edition. Morever, there are now three entirely new chapters -- on effects of anisotropy and heterogeneity, on fixed connectivity membranes and on triangulated surface models of fluctuating membranes.

This textbook gradually introduces students to the statistical mechanical study of the different phases of matter and to the phase transitions between them. It uses simple yet fully detailed models of both hard and soft matter systems to demonstrate core concepts, developing the subject matter in a thorough and accessible pedagogical manner throughout. Starting from an introduction to basic thermodynamics and statistical physics, the book progresses from ideal, non-interacting systems to real systems exhibiting classical interactions and phase transitions. It concludes with a selection of more advanced topics, such as the renormalisation group approach to critical phenomena, the density functional theory of interfaces, and kinematic aspects of the phase transformation process. This updated second edition features a considerably expanded study of the topology of the phases, including applications to modern problems such as topological defects of nematic liquid crystals and the topological phase transition of a two-dimensional spin system. Along with a complete introductory overview of the theory of phase transitions, this textbook provides students with ample material for deeper study. References include suggestions for more detailed treatments and six appendices supply overviews of the mathematical tools employed in the text.

This second edition extends and improves on the first, already an acclaimed and original treatment of statistical concepts insofar as they impact theoretical physics and form the basis of modern thermodynamics. This book illustrates through myriad examples the principles and logic used in extending the simple laws of idealized Newtonian physics and quantum physics into the real world of noise and thermal fluctuations. In response to the many helpful comments by users of the first edition, important features have been added in this second, new and revised edition. These additions allow a more coherent picture of thermal physics to emerge. Benefiting from the expertise of the new co-author, the present edition includes a detailed exposition — occupying two separate chapters — of the renormalization group and Monte-Carlo numerical techniques, and of their applications to the study of phase transitions. Additional figures have been included throughout, as have new problems. A new Appendix presents fully worked-out solutions to representative problems; these illustrate various methodologies that are peculiar to physics at finite temperatures, that is, to statistical physics. This new edition incorporates important aspects of many-body theory and of phase transitions. It should better serve the contemporary student, while offering to the instructor a wider selection of topics from which to craft lectures on topics ranging from thermodynamics and random matrices to thermodynamic Green functions and critical

exponents, from the propagation of sound in solids and fluids to the nature of quasiparticles in quantum liquids and in transfer matrices. This classic book marks the beginning of an era of vigorous mathematical progress in equilibrium statistical mechanics. Its treatment of the infinite system limit has not been superseded, and the discussion of thermodynamic functions and states remains basic for more recent work. The conceptual foundation provided by the Rigorous Results remains invaluable for the study of the spectacular developments of statistical mechanics in the second half of the 20th century. Contents:Thermodynamic Behavior. EnsemblesThe Thermodynamic Limit for Thermodynamic Functions: Lattice SystemsThe Thermodynamic Limit for Thermodynamic Functions: Continuous SystemsLow Density Expansions and Correlation FunctionsThe Problem of Phase TransitionsGroup Invariance of Physical StatesThe States of Statistical MechanicsAppendix: Some Mathematical Tools Readership: Statistical and theoretical physicists. Keywords:Equilibrium Statistical Mechanics;Thermodynamic Limit;Pure Phase;Phase Transition;Activity Expansion;Virial Expansion;Ergodic State;Gibbs Phase Rule;KMS ConditionReviews: "… it continues to be a classical reference where researchers and students find information, enlightenment and inspiration … In addition, Ruelle's presentation of many of the issues of the book has become the standard treatment … Rueller's Statistical Mechanics remains the leading reference for a motivated informed reader, or lecturer, wishing to grasp, in a concise but complete manner, the supporting arcs of this beautiful mathematical theory." Mathematical Reviews

Treating mechanics through a clearly written introduction of the theory of microscopic bodies based on the fundamental atomic laws, this book contains a brief but self-contained discussion of thermodynamics and the classical kinetic theory of gases. An introduction to the modern theory of critical phenomena is featured that is concise and pedagogically orientated. This second edition contains up-to-date coverage of recent major advances and important applications, such as superfluids and the Quantum Hall Effect. A large part of the text is devoted to selected applications of statistical mechanics and its value as an illustration of calculating techniques.

A completely revised edition that combines a comprehensive coverage of statistical and thermal physics with enhanced computational tools, accessibility, and active learning activities to meet the needs of today's students and educators This revised and expanded edition of Statistical and Thermal Physics introduces students to the essential ideas and techniques used in many areas of contemporary physics. Ready-to-run programs help make the many abstract concepts concrete. The text requires only a background in introductory mechanics and some basic ideas of quantum theory, discussing material typically found in undergraduate texts as well as topics such as fluids, critical phenomena, and computational techniques, which serve as a natural bridge to graduate study. Completely revised to be more accessible to students Encourages active reading with guided problems tied to the text Updated open source programs available in Java, Python, and JavaScript Integrates Monte Carlo and molecular dynamics simulations and other numerical techniques Self-contained introductions to thermodynamics and probability, including Bayes' theorem A fuller discussion of magnetism and the Ising model than other undergraduate texts Treats ideal classical and quantum gases within a uniform framework Features a new chapter on transport coefficients and linear response theory Draws on findings from contemporary research Solutions manual (available only to instructors)

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