Swendsen Statistical Mechanics Made Simple

Statistical Mechanics Made Simple
Basics Of Statistical Physics (Third Edition)
Thermal Physics
A Guide for Students and Researchers
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An Introduction to Statistical Mechanics and Thermodynamics
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Statistical Mechanics Made Simple

CRC Press

A self-

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

Basics Of Statistical Physics (Third Edition)

Oxford University Press, USA

The structural mechanics of proteins that fold into functional shapes, polymers that aggregate and form clusters, and organic macromolecules that bind to inorganic matter can only be understood through statistical physics and thermodynamics. This book reviews the statistical mechanics concepts and tools necessary for the study of structure formation processes in macromolecular systems that are essentially influenced by finite-size and surface effects. Readers are introduced to molecular modeling approaches, advanced Monte Carlo simulation techniques, and systematic statistical analyses of numerical data. Applications to folding, aggregation, and substrate adsorption processes of polymers and proteins are discussed in great detail. Particular emphasis is placed on the reduction of complexity by coarse-grained modeling, which allows for the efficient, systematic

investigation of structural phases and transitions. Providing insight into modern research at this interface between physics, chemistry, biology, and nanotechnology, this book is an excellent reference for graduate students and researchers.

Thermal Physics

Cambridge University Press

The random-cluster model has emerged as a key tool in the mathematical study of ferromagnetism. It may be viewed as an extension of percolation to include Ising and Potts models, and its analysis is a mix of arguments from probability and geometry. The Random-Cluster Model contains accounts of the subcritical and supercritical phases, together with clear statements of important open problems. The book includes treatment of the first-order (discontinuous) phase transition.

A Guide for Students and Researchers

Springer Science & Business Media

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. In this latest edition, apart from a general revision, the topic of thermal radiation has been expanded with a new section on black bodies and an additional chapter on black holes. Other additions are more examples with applications of statistical mechanics in solid state physics and superconductivity. Throughout the presentation,

the introduction carries almost all details for calculations.

An Introduction

World Scientific

This book is an elaboration of the author's lecture notes in a graduate course in statistical physics and thermodynamics, augmented by some material suitable for self-teaching as well as for undergraduate study. The first 4 or 5 chapters are suitable for an undergraduate course for engineers and physicists in Thermodynamics and Statistical Physics and include detailed study of the various ensembles and their connections to applied thermodynamics. The Debye law of specific heats and reasons for deviations from the Debye formulas are covered, as are the Einstein theories of Brownian motion, black-body radiation and specific heat of solids. Van der Waals gases and the reason for the apparent failure of his Law of Corresponding States are discussed. The last 5 chapters treat topics of recent interest to researchers, including: the Ising and Potts models, spin waves in ferromagnetic and anti-ferromagnetic media, sound propagation in non-ideal gases and the decay of sound waves, introduction to the understanding of glasses and spin glasses, superfluidity and

superconductivity. The selection of material is wide-ranging and the mathematics for handling it completely self-contained, ranging from counting (probability theory) to quantum field theory as used in the study of fermions, bosons and as an adjunct in the solutions of the equations of classical diffusion-reaction theory. In addition to the standard material found in most recent books on statistical physics the constellation of topics covered in this text includes numerous original items: • Generalization of “negative temperature” to interacting spins • Derivation of Gibbs' factor from first principles • Exact free energy of interacting particles in 1D (e.g., classical and quantum Tonk's gas) • Introduction to virial expansions, Equations of State, Correlation Functions and “critical exponents” • Superfluidity in ideal and non-ideal fluids (both Bogolubov and Feynman theories) • Superconductivity: thermodynamical approach and the BCS theory • Derivation of “Central Limit Theorem” and its applications • Boltzmann's “H-Theorem” and the nonlinear Boltzmann equation • Exact solution of nonlinear Boltzmann Equation for electrons in time-

dependent electric field and the derivation of Joule heating, transport parameters in crossed electric and magnetic fields, etc. • Frequency spectrum and decay of sound waves in gases • Exact evaluation of free energy and thermodynamic properties of the two-dimensional Ising model in regular and fully frustrated (spin-glass like) lattices • The “zipper” model of crystal fracture or polymer coagulation — calculation of Tc • Potts model in 2D: duality and Tc • “Doi's theory” of diffusion-limited chemical reactions with some exact results — including the evaluation of statistical fluctuations in radioactive decay • Thermodynamic Green Functions and their applications to fermions and bosons with an example drawn from random matrix theory and much more. Clarendon Press
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 renormalizatio n 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.

Problems and Solutions on Thermodynamics and Statistical Mechanics

Elsevier

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 Theory of Magnetism Made Simple Courier Corporation This text presents statistical mechanics and thermodynamics as a theoretically integrated field of study. It stresses deep coverage of fundamentals, providing a natural foundation for advanced topics.

An Introduction to Statistical Mechanics and Thermodynamics World Scientific Although the basic theories of thermodynamics are adequately covered by a number of existing texts, there is little literature that addresses more advanced topics. In this comprehensive work the author

redresses this balance, drawing on his twenty-five years of experience of teaching thermodynamics at undergraduate and postgraduate level, to produce a definitive text to cover thoroughly, advanced syllabuses. The book introduces the basic concepts which apply over the whole range of new technologies, considering: a new approach to cycles, enabling their irreversibility to be taken into account; a detailed study of combustion to show how the chemical energy in a fuel is converted into thermal energy and emissions; an analysis of fuel cells to give an understanding of the direct conversion of chemical energy to electrical power; a detailed study of property relationships to enable more sophisticated analyses to be made of both high and low temperature plant and irreversible thermodynamics, whose principles might hold a key to new ways of efficiently covering energy to power (e.g. solar energy, fuel cells). Worked examples are included in most of the chapters, followed by exercises with solutions. By developing thermodynamics from an explicitly equilibrium perspective, showing how all systems attempt to

reach a state of equilibrium, and the effects of these systems when they cannot, the result is an unparalleled insight into the more advanced considerations when converting any form of energy into power, that will prove invaluable to students and professional engineers of all disciplines.

Entropy, Order Parameters and Complexity

OUP Oxford

This new version of a classic updates much of the material in earlier editions, including the first chapter, on the history of the field. Important modifications reflect major discoveries of the past decades. A historical perspective is maintained throughout. The reader is drawn into the process of discovery: starting with a phenomenon, finding plausible explanations and competing theories — and finally, the solution. The theory of magnetism is practically a metaphor for theoretical physics. The very first quantum many-body theory (Bethe's ansatz) was devised for magnetic chains, just as mean-field theory was invented a century ago by Weiss to explain Curie's Law. The first two chapters of this book are immensely readable, taking us from prehistory to the “spin valves” of the most recent

past. Topics in subsequent chapters include: angular momenta and spin (Chapter 3), quantum theory of simple systems, followed by increasingly technical insights into ordered and random systems, thermal fluctuations, phase transitions, chaos and the like. Contemporary developments in nanotechnology now seek to take advantage of the electron's spin as well as of its charge. The time is not far off when nano-circuits made entirely of silicon exhibit such many-body properties as superconductivity or ferromagnetism — without any superconducting materials or magnetic ions being present. The reader of this book will be prepared for such exotic twenty-first century applications. Daniel C Mattis, BS, MS, PhD, Fellow of the American Physical Society (APS), is a frequent lecturer at research institutions and the author of several textbooks and numerous research articles. His expertise includes many-body theory, electrical conductivity, quantum theory of magnetism and most recently, nanotechnology. Prof. Mattis is on the editorial panel for high-temperature superconducti

vity of the International Journal of Modern Physics B and Modern Physics Letters B, both published by World Scientific. Currently serving as Professor in the Physics department at the University of Utah in Salt Lake City, Utah, USA, at various times he has been visiting Professor at Yale University (New Haven), State University of New York (Buffalo), Temple University (Philadelphia), and served as "Wei-Lun Visiting Professor" at the Chinese University of Hong Kong. A founding member of the "Few-Body Physics" section of the APS, he has also served as Chair of the standing committee of the APS for the "International Freedom of Scientists."

The Random-Cluster Model

World Scientific Publishing Company

This updated edition deals with the Monte Carlo simulation of complex physical systems encountered in condensed-matter physics, statistical mechanics, and related fields. It contains many applications, examples, and exercises to help the reader. It is an excellent guide for graduate students and researchers who use computer simulations in their research.

Statistical Mechanics Made Simple

PHI Learning Pvt. Ltd.
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.
Part 1 Alpha Science Int'l Ltd.
This book provides an introduction to Monte Carlo simulations in classical statistical physics and is aimed both at students beginning work in the field and at more experienced researchers who wish to learn more about Monte Carlo methods. The material covered includes methods for both equilibrium and out of equilibrium systems, and common algorithms like the Metropolis and heat-bath algorithms are discussed in detail, as well as more sophisticated ones such as continuous time Monte Carlo, cluster algorithms, multigrid methods, entropic sampling and simulated tempering. Data analysis techniques are also explained starting with straightforward measurement and error-estimation techniques and progressing to topics such as the single and multiple histogram methods and finite size

scaling. The last few chapters of the book are devoted to implementation issues, including discussions of such topics as lattice representations, efficient implementation of data structures, multispin coding, parallelization of Monte Carlo algorithms, and random number generation. At the end of the book the authors give a number of example programmes demonstrating the applications of these techniques to a variety of well-known models.

Rotational Spectroscopy of Diatomic Molecules Elsevier

Table of contents

Thermodynamics and an Introduction to Thermostatistics An Introduction to Statistical Mechanics and Thermodynamics

Deals with the computer simulation of complex physical systems encounteredin condensed-matter physics and statistical mechanics as well as in related fields such as metallurgy, polymer research, lattice gauge theory and quantummechanics.

An Introduction to Physical Concepts and to Some Useful Mathematical Methods Oxford University Press

In Thermal Physics: Thermodynamics and Statistical Mechanics for Scientists and Engineers, the

fundamental laws of thermodynamics are stated precisely as postulates and subsequently connected to historical context and developed mathematically. These laws are applied systematically to topics such as phase equilibria, chemical reactions, external forces, fluid-fluid surfaces and interfaces, and anisotropic crystal-fluid interfaces. Statistical mechanics is presented in the context of information theory to quantify entropy, followed by development of the most important ensembles: microcanonical, canonical, and grand canonical. A unified treatment of ideal classical, Fermi, and Bose gases is presented, including Bose condensation, degenerate Fermi gases, and classical gases with internal structure. Additional topics include paramagnetism, adsorption on dilute sites, point defects in crystals, thermal aspects of intrinsic and extrinsic semiconductors, density matrix formalism, the Ising model, and an introduction to Monte Carlo simulation. Throughout the book, problems are posed and solved to illustrate specific results and problem-solving techniques. Includes applications of interest to physicists, physical

chemists, and materials scientists, as well as materials, chemical, and mechanical engineers Suitable as a textbook for advanced undergraduates, graduate students, and practicing researchers Develops content systematically with increasing order of complexity Self-contained, including nine appendices to handle necessary background and technical details

A Dynamic Duo World Scientific Energy is typically regarded as understandable, despite its multiple forms of storage and transfer. Entropy, however, is an enigma, in part because of the common view that it represents disorder. That view is flawed and hides entropy's connection with energy. In fact, macroscopic matter stores internal energy, and that matter's entropy is determined by how the energy is stored. Energy and entropy are intimately linked. Energy and Entropy: A Dynamic Duo illuminates connections between energy and entropy for students, teachers, and researchers. Conceptual understanding is emphasised where possible through examples, analogies, figures, and key points. Features: Qualitative demonstration that entropy is linked to

spatial and temporal energy spreading, with equilibrium corresponding to the most equitable distribution of energy, which corresponds to maximum entropy Analysis of energy and entropy of matter and photons, with examples ranging from rubber bands, cryogenic cooling, and incandescent lamps to Hawking radiation of black holes Unique coverage of numerical entropy, the 3rd law of thermodynamics, entropic force, dimensionless entropy, free energy, and fluctuations, from Maxwell's demon to Brownian ratchets, plus attempts to violate the second law of thermodynamics

Statistical Mechanics

Springer Science & Business Media

This volume comprises a collection of papers by world-renowned experts on image analysis. The papers range from survey articles to research papers, and from theoretical topics such as simulated annealing through to applied image reconstruction. It covers applications as diverse as biomedicine, astronomy, and geophysics. As a result, any researcher working on image analysis will find this book provides an up-to-date overview of the field and

in addition, the extensive bibliographies will make this a useful reference.

Monte Carlo Methods in Statistical Physics

World Scientific

The only text to cover both thermodynamic and statistical mechanics--allowing students to fully master thermodynamics at the macroscopic level. Presents essential ideas on critical phenomena developed over the last decade in simple, qualitative terms. This new edition maintains the simple structure of the first and puts new emphasis on pedagogical considerations. Thermostatistics is incorporated into the text without eclipsing macroscopic thermodynamics, and is integrated into the conceptual framework of physical theory.

Foundations and Selected Applications

Springer Science & Business Media

This book discusses the computational approach in modern statistical physics, adopting simple language and an attractive format with many illustrations, tables and printed algorithms. The style will appeal to students, teachers and researchers in the physical sciences. The focus is on orientation, with implementation details kept

to a minimum.

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