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## Microcanonical Thermodynamics

### Phase Transitions in "small" Systems

*World Scientific* Boltzmann's formula  $S = \ln[W(E)]$  defines the microcanonical ensemble. The usual textbooks on statistical mechanics start with the microensemble but rather quickly switch to the canonical ensemble introduced by Gibbs. This has the main advantage of easier analytical calculations, but there is a price to pay — for example, phase transitions can only be defined in the thermodynamic limit of infinite system size. The question how phase transitions show up from systems with, say, 100 particles with an increasing number towards the bulk can only be answered when one finds a way to define and classify phase transitions in small systems. This is all possible within Boltzmann's original definition of the microcanonical ensemble. Starting from Boltzmann's formula, the book formulates the microcanonical thermodynamics entirely within the frame of mechanics. This way the thermodynamic limit is avoided and the formalism applies to small as well to other nonextensive systems like gravitational ones. Phase transitions of first order, continuous transitions, critical lines and multicritical points can be unambiguously defined by the curvature of the entropy  $S(E, N)$ . Special attention is given to the fragmentation of nuclei and atomic clusters as a peculiar phase transition of small systems controlled, among others, by angular momentum. The dependence of the liquid-gas transition of small atomic clusters under prescribed pressure is treated. Thus the analogue to the bulk transition can be studied. The book also describes the microcanonical statistics of the collapse of a self-gravitating system under large angular momentum. Contents: The Mechanical Basis of Thermodynamics; Micro-Canonical Thermodynamics of Phase Transitions Studied in the Potts Model; Liquid-Gas Transition and Surface Tension Under Constant Pressure; Statistical Fragmentation Under Repulsive Forces of Long Range; The Collapse Transition in Self-Gravitating Systems First Model-Studies; Appendices: On the Historical Development of Statistical Nuclear Multifragmentation Models; The Micro-Canonical Ensemble of Na-Clusters; Some General Technical Aspects of Micro-Canonical Monte Carlo Simulation on a Lattice. Readership: Advanced level graduate students, lecturers and researchers in statistical and condensed matter physics."

### Microcanonical Thermodynamics: Phase Transitions In "Small" Systems

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## Thermodynamics and Statistical Mechanics of Small Systems

*MDPI* This book is a printed edition of the Special Issue "Thermodynamics and Statistical Mechanics of Small Systems" that was published in *Entropy*

### Nonequilibrium Physics at Short Time Scales

### Formation of Correlations

*Springer Science & Business Media* This introductory level text addresses the broad range of nonequilibrium phenomena observed at short time scales. It focuses on the important questions of correlations and memory effects in dense interacting systems. Experiments on very short time scales are characterized, in particular, by strong correlations far from equilibrium, by nonlinear dynamics, and by the related phenomena of turbulence and chaos. The impressive successes of experiments using pulsed lasers to study the properties of matter and of the new methods of analysis of the early phases of heavy ion reactions have necessitated a review of the available many-body theoretical methods. The aim of this book is thus to provide an introduction to the experimental and theoretical methods that help us to understand the behaviour of such systems when disturbed on very short time scales.

### Critical Phenomena and Collective Observables

*World Scientific* CRIS (Catania Relativistic Ion Studies) is a new series of Topical Conferences to be held at regular intervals in Catania or in its environs. Aim of the CRIS Conferences is to gather active researchers from several countries to discuss specific hot topics in the field of heavy ion physics. The first CRIS Conference, CRIS '96, has been devoted to "Critical Phenomena and Collective Observables", a quite hot topic after the recent experimental evidences of a liquid-gas phase transition in finite nuclei found by the EOS and ALADiN Collaborations and the progress made in the understanding of the relevance of collective observables, like flow and balance energy for the study of the Nuclear Equation of State. Contents: The Nuclear Liquid-Gas Phase Transition: Present Status and Future Perspectives (J Pochodzalla et al.)Universal Features in the Nuclear Multifragmentation Phase Transition (A Atalmi et al.)Probing Low Density Nuclear Matter (M B Tsang et al.)Instabilities in Finite Systems (M Belkacem et al.)Caloric Curve in Molecular Dynamics (J P Bondorf et al.)Collective Observables in Heavy-Ion Collisions (D Keane)Fragment-Fragment Correlations and Fragment Flow in Heavy Ion Collisions Described within Molecular Dynamics (H W Barz et al.)Reaction Mechanisms in Medium Energy Collisions: Influence of

Dynamical Fluctuations (M Colonna et al.) Microscopic Nuclear EOS and Neutron Star Structure (M Baldo et al.) and other papers Readership: Scientists and researchers in nuclear physics. keywords:

## Dynamics and Thermodynamics of Systems with Long Range Interactions

*Springer* Properties of systems with long range interactions are still poorly understood despite being of importance in most areas of physics. The present volume introduces and reviews the effort of constructing a coherent thermodynamic treatment of such systems by combining tools from statistical mechanics with concepts and methods from dynamical systems. Analogies and differences between various systems are examined by considering a large range of applications, with emphasis on Bose-Einstein condensates. Written as a set of tutorial reviews, the book will be useful for both the experienced researcher as well as the nonexpert scientist or postgraduate student.

## Statistical Mechanics And The Physics Of Many-particle Model Systems

*World Scientific* The book is devoted to the study of the correlation effects in many-particle systems. It presents the advanced methods of quantum statistical mechanics (equilibrium and nonequilibrium), and shows their effectiveness and operational ability in applications to problems of quantum solid-state theory, quantum theory of magnetism and the kinetic theory. The book includes description of the fundamental concepts and techniques of analysis following the approach of N N Bogoliubov's school, including recent developments. It provides an overview that introduces the main notions of quantum many-particle physics with the emphasis on concepts and models. This book combines the features of textbook and research monograph. For many topics the aim is to start from the beginning and to guide the reader to the threshold of advanced researches. Many chapters include also additional information and discuss many complex research areas which are not often discussed in other places. The book is useful for established researchers to organize and present the advanced material disseminated in the literature. The book contains also an extensive bibliography. The book serves undergraduate, graduate and postgraduate students, as well as researchers who have had prior experience with the subject matter at a more elementary level or have used other many-particle techniques.

## Geometry and Phase Transitions in Colloids and Polymers

*World Scientific* This monograph represents an extension of the author's original PhD thesis and includes a more thorough discussion on the concepts and mathematics behind his research works on the foam model, as applied to studying issues of phase stability and elasticity for various non-closed packed structures found in fuzzy and colloidal crystals, as well as on a renormalization-group analysis regarding the critical behavior of loop polymers upon which topological constraints are imposed. The common thread behind these two research works is their demonstration of the importance and effectiveness of utilizing geometrical and topological concepts for modeling and understanding soft systems undergoing phase transitions.

## Generalised Thermostatistics

*Springer Science & Business Media* The domain of non-extensive thermostatistics has been subject to intensive research over the past twenty years and has matured significantly. Generalised Thermostatistics cuts through the traditionalism of many statistical physics texts by offering a fresh perspective and seeking to remove elements of doubt and confusion surrounding the area. The book is divided into two parts - the first covering topics from conventional statistical physics, whilst adopting the perspective that statistical physics is statistics applied to physics. The second developing the formalism of non-extensive thermostatistics, of which the central role is played by the notion of a deformed exponential family of probability distributions. Presented in a clear, consistent, and deductive manner, the book focuses on theory, part of which is developed by the author himself, but also provides a number of references towards application-based texts. Written by a leading contributor in the field, this book will provide a useful tool for learning about recent developments in generalized versions of statistical mechanics and thermodynamics, especially with respect to self-study. Written for researchers in theoretical physics, mathematics and statistical mechanics, as well as graduates of physics, mathematics or engineering. A prerequisite knowledge of elementary notions of statistical physics and a substantial mathematical background are required.

## Effective Field Approach to Phase Transitions and Some Applications to Ferroelectrics

*World Scientific* This book begins by introducing the effective field approach, the simplest approach to phase transitions. It provides an intuitive approximation to the physics of such diverse phenomena as liquid-vapor transitions, ferromagnetism, superconductivity, order-disorder in alloys, ferroelectricity, superfluidity and ferroelasticity. The connection between the effective field approach and Landau's theory is stressed. The main coverage is devoted to specific applications of the effective field concept to ferroelectric systems, both hydrogen bonded ferroelectrics, like those in the TGS family, and oxide ferroelectrics, like pure and mixed perovskites.

## Proceedings of the Conference Foundations of Probability and Physics

Växjö, Sweden, 25 November-1 December, 2000

*World Scientific* In this volume, leading experts in experimental as well as theoretical physics (both classical and quantum) and probability theory give their views on many intriguing (and still mysterious) problems regarding the probabilistic foundations of physics. The problems discussed during the conference include Einstein-Podolsky-Rosen paradox, Bell's inequality, realism, nonlocality, role of Kolmogorov model of probability theory in quantum physics, von Mises frequency theory, quantum information, computation, quantum effects in classical physics.

## Foundations of Probability and Physics

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Larsson); Quantum Stochastics. The New Approach to the Description of Quantum Measurements (E Loubenets); Is Random Event a Core Question? Some Remarks and a Proposal (P Rocchi); Quantum Cryptography in Space and Bell's Theorem (I Volovich); and other papers. Readership: Graduate students and researchers in quantum physics, mathematical physics, theoretical physics, stochastic processes, and probability & statistics."

## Nucleus-nucleus Collisions, Procs Of The Conf "Bologna 2000: Structure Of The Nucleus At The Dawn Of The Century" (Vol 1)

*World Scientific* The Conference "Bologna 2000: Structure of the Nucleus at the Dawn of the Century" was devoted to a discipline which has seen a strong revival of research activities in the last decade. New experimental results and theoretical developments in nuclear physics will certainly make important contributions to our knowledge and understanding of Nature's fundamental building blocks. The interest aroused by the Conference among the scientific community was clearly reflected in the large number of participants. These represented the most important nuclear physics laboratories in the world. The Conference covered five major topics of modern nuclear physics: nuclear structure, nucleus-nucleus collisions, hadron dynamics, nuclear astrophysics, and transdisciplinary and peaceful applications of nuclear science. It reviewed recent progress in the field and provided a forum for the discussion of current and future research projects.

## Nucleus-nucleus Collisions

### Proceedings of the Conference, Bologna 2000, Structure of the Nucleus at the Dawn of the Century : Bologna, Italy, 29 May-3 June 2000

*World Scientific* The Conference OC Bologna 2000: Structure of the Nucleus at the Dawn of the CenturyOCO was devoted to a discipline which has seen a strong revival of research activities in the last decade. New experimental results and theoretical developments in nuclear physics will certainly make important contributions to our knowledge and understanding of Nature's fundamental building blocks. The interest aroused by the Conference among the scientific community was clearly reflected in the large number of participants. These represented the most important nuclear physics laboratories in the world. The Conference covered five major topics of modern nuclear physics: nuclear structure, nucleusOnucleus collisions, hadron dynamics, nuclear astrophysics, and transdisciplinary and peaceful applications of nuclear science. It reviewed recent progress in the field and provided a forum for the discussion of current and future research projects. Contents: Quark and GluonOCoPlasma Phase Transition and Relativistic Heavy-Ion Reactions; LiquidOCoGas Phase Transitions in Nuclear Matter; Nuclear Caloric Curve and Thermodynamics of Heavy Ion Collisions; Statistical and Dynamics Aspects of Fragmentation; Intermediate Energy Heavy-Ion Reactions; Reaction Mechanisms around the Barrier. Fusion and Fission in Heavy-Ion Reactions. Readership: Nuclear physicists."

## Computer Algebra in Scientific Computing

### 10th International Workshop, CASC 2007, Bonn, Germany, September 16-20, 2007, Proceedings

*Springer* This book constitutes the refereed proceedings of the 10th International Workshop on Computer Algebra in Scientific Computing, CASC 2007, held in Bonn, Germany, in September 2007. The volume is dedicated to Professor Vladimir P. Gerdt on the occasion of his 60th birthday. The papers cover not only various expanding applications of computer algebra to scientific computing but also the computer algebra systems themselves and the CA algorithms.

## Nanoalloys

### From Fundamentals to Emergent Applications

*Elsevier* Nanoalloys, Second Edition, provides a self-contained reference on the physics and chemistry of nanoscale alloys, dealing with all important aspects that range from the theoretical concepts and the practical synthesis methods to the characterization tools. The book also covers modern applications of nanoalloys in materials science, catalysis or nanomedicine and discusses their possible toxicity. Covers fundamentals and applicative aspects of nanoalloys in a balanced presentation, including theoretical and experimental perspectives Describes physical and chemical approaches, synthesis and characterization tools Illustrates the potential benefit of alloying on various applications ranging from materials science to energy production and nanomedicine Updates and adds topics not fully developed at the time of the 1st edition, such as toxicity and energy applications

## Nanoscopic Materials

### Size-Dependent Phenomena

*Royal Society of Chemistry* Nanotechnology has been hailed as a key technology of the 21st century. The scope of this field is huge and could have a wide influence on many aspects of life. Nanoscience; the manipulation of matter at the atomic and molecular level, and nanomaterials; materials so small that their behaviour and characteristics deviate from those of macroscopic specimens and may be predicted by scaling laws or by quantum confinement effects, are discussed in Nanoscopic Materials: Size - Dependent Phenomena. The book focuses on a qualitative and quantitative approach discussing all areas of nanotechnology with particular emphasis on the underlying physico-chemical and physical principles of nanoscience. Topics include electronic structure, magnetic properties, thermodynamics of size dependence and catalysis. There is also a section discussing the future potential of the field and the ethical implications of nanotechnology. The book is ideal for graduate students of chemistry and materials science and researchers new to the field of nanoscience and nanotechnology.

## Multi-Robot Systems. From Swarms to Intelligent Automata, Volume III

### Proceedings from the 2005 International Workshop on Multi-Robot Systems

*Springer Science & Business Media* providing the administrative support to the workshop.

## Advances in Chemical Physics

*John Wiley & Sons* The **Advances in Chemical Physics** series provides the chemical physics field with a forum for critical, authoritative evaluations of advances in every area of the discipline. This special volume focuses on atoms and photos near meso- and nanobodies, an important area of nontechnology. Nanoscale particles are those between 1 and 100 nm, and they obey neither the laws of quantum physics nor of classical physics due to an extensive delocalization of the valence electrons, which can vary depending on size. This means that different physical properties can be obtained from the same atoms or molecules existing in a nanoscale particle size due entirely to differing sizes and shapes. Nanostructured materials have unique optical, magnetic, and electronic properties depending on the size and shape of the nanomaterials. A great deal of interest has surfaced in this arena as of late due to the potential technological applications.

### Complexity, Metastability and Nonextensivity

## Handbook of Nanophysics

### Principles and Methods

*CRC Press* Covering the key theories, tools, and techniques of this dynamic field, **Handbook of Nanophysics: Principles and Methods** elucidates the general theoretical principles and measurements of nanoscale systems. Each peer-reviewed chapter contains a broad-based introduction and enhances understanding of the state-of-the-art scientific content through fundamental equations and illustrations, some in color. This volume explores the theories involved in nanoscience. It also discusses the properties of nanomaterials and nanosystems, including superconductivity, thermodynamics, nanomechanics, and nanomagnetism. In addition, leading experts describe basic processes and methods, such as atomic force microscopy, STM-based techniques, photopolymerization, photoisomerization, soft x-ray holography, and molecular imaging. Nanophysics brings together multiple disciplines to determine the structural, electronic, optical, and thermal behavior of nanomaterials; electrical and thermal conductivity; the forces between nanoscale objects; and the transition between classical and quantum behavior. Facilitating communication across many disciplines, this landmark publication encourages scientists with disparate interests to collaborate on interdisciplinary projects and incorporate the theory and methodology of other areas into their work.

### Dynamics and Thermodynamics of Systems with Long Range Interactions: Theory and Experiments

*American Institute of Physics* The workshop was about the developments of the thermodynamical and dynamical behavior of many-body systems in which the interactions decay very slowly with the distance: they present very strange properties, not found in the other systems. The possibility of testing the theoretical ideas in laboratory systems was the most innovative issue.

### Nuclear Matter in Different Phases and Transitions

## Proceedings of the Workshop Nuclear Matter in Different Phases and Transitions, March 31–April 10, 1998, Les Houches, France

*Springer Science & Business Media* This understandable and inspiring book brings together both theorists and experimentalists working on the properties of nuclear and hadronic matter produced in heavy-ion collisions in various energy ranges. The main focus is on experimental signals revealing the possible phase changes of the matter.

### Thermodynamics and Statistical Mechanics of Macromolecular Systems

*Cambridge University Press* Reviewing statistical mechanics concepts for analysis of macromolecular structure formation processes, for graduate students and researchers in physics and biology.

### Condensed Matter Theories

*Nova Science Pub Incorporated* Proceedings of the Sixteenth International Workshop held in San Juan, Puerto Rico in June 1992. Papers are divided into a broad range of topics: solid state physics, superconductivity, quantum fluids, nuclear physics, atoms and molecules, classical fluids, polymers, plasmas, lattice theories, phase transitions, cellular automata, and fundamental quantum mechanics. Participants discussed density function theory, dynamics of metal films, coulomb coupling, nucleonic superfluids, time-dependent n-level systems, fluids of hard convex molecules, and line tension at wetting and pre-wetting transitions.

### The Conceptual Foundations of the Statistical Approach in Mechanics

*Courier Corporation* Classic 1912 article reformulated the foundations of the statistical approach in mechanics. Largely still valid, the treatment covers older formulation of statistico-mechanical investigations, modern formulation of kineto-statistics of the gas model, and more. 1959 edition.

## Proceedings

Mathematical, physical, and engineering sciences

Mathematical Reviews

## Acta Academiae Aboensis

### Mathematica et physica

## Thermodynamics of Small Systems

*Courier Corporation* **Authoritative summary introduces basics, explores environmental variables, examines binding on macromolecules and aggregation, and includes brief summaries of electric and magnetic fields, spherical drops and bubbles, and polydisperse systems. 1963 and 1964 editions.**

## VI Latin American Symposium on Nuclear Physics and Applications

*American Inst. of Physics* **The Sixth Latin American Symposium on Nuclear Applications covered the most active topics in basic nuclear physics which were grouped into four broad categories, namely, nuclear structure, nuclear reactions, subnuclear physics, and nuclear thermodynamics and dynamics. It also placed a significant emphasis on the applications of nuclear science and nuclear instrumentation to a wide range of fields of knowledge.**

## Principles of Phase Structures in Particle Physics

*World Scientific Publishing Company Incorporated* **10(-10) sec after the big bang, when the universe cooled down to the order of 10<sup>15</sup> Kelvin, the electroweak phase transition led to a spontaneous breaking of the symmetry between electromagnetic and weak interactions. 10(-6) sec later, at a temperature of the order of tera degrees, the QCD transition confined the free quarks and gluons to mesons and baryons in the hadronic phase of the present world. This book is about the analytical and numerical methods used to investigate these transitions within the framework of quantum field theory at finite temperature in a continuum formulation and on the lattice. The topics covered include the renormalization group approach in a perturbative and non-perturbative realization, dimensional reduction, asymptotic and convergent expansions in quantities such as strong and weak couplings, high temperatures, and small momenta. One particular case revolves around computer-aided generations of high-order hopping parameter series.**

## Acta Physica Polonica

### B.

### Field Theory

## A Path Integral Approach

*World Scientific Publishing Company Incorporated* **New Edition: Field Theory (3rd Edition)**This unique book describes quantum field theory completely within the context of path integrals. With its utility in a variety of fields in physics, the subject matter is primarily developed within the context of quantum mechanics before going into specialized areas. Adding new material keenly requested by readers, this second edition is an important expansion of the popular first edition. Two extra chapters cover path integral quantization of gauge theories and anomalies, and a new section extends the supersymmetry chapter, where singular potentials in supersymmetric systems are described.

## American Journal of Physics

## Statistical Physics and Thermodynamics

## An Introduction to Key Concepts

*Oxford University Press* **Statistical physics and thermodynamics describe the behaviour of systems on the macroscopic scale. Their methods are applicable to a wide range of phenomena: from heat engines to chemical reactions, from the interior of stars to the melting of ice. Indeed, the laws of thermodynamics are among the most universal ones of all laws of physics. Yet this subject can prove difficult to grasp. Many view thermodynamics as merely a collection of ad hoc recipes, or are confused by unfamiliar novel concepts, such as the entropy, which have little in common with the deterministic theories to which students have got accustomed in other areas of physics. This text provides a concise yet thorough introduction to the key concepts which underlie statistical physics and thermodynamics. It begins with a review of classical probability theory and quantum theory, as well as a careful discussion of the notions of information and entropy, prior to embarking on the development of statistical physics proper. The crucial steps leading from the microscopic to the macroscopic domain are rendered transparent. In particular, the laws of thermodynamics are shown to emerge as natural consequences of the statistical framework. While the emphasis is on clarifying the basic concepts, the text also contains a wealth of applications and classroom-tested exercises, covering all major topics of a standard course on statistical physics and thermodynamics.**

## Similarities and Differences Between Atomic Nuclei and Clusters

## Toward a Unified Development of Cluster Science

*Amer Inst of Physics* **Annotation** The proceedings of the July 1997 conference reflect the interdisciplinary nature of cluster science. Topics of the 63 papers include shell and supershell structure; optical response and related subjects; fission and evaporation; collisions and reactions; phase transition of structure and reaction; cluster impact on solids at low energies (2 parts: cluster activity on surface and material science); radio activity technology for cluster study; and cluster impact on solid surfaces at high energies. Introductory and

summary talks are also included. No index. Annotation c. by Book News, Inc., Portland, Or.

## Physical Review

Statistical physics, plasmas, fluids, and related interdisciplinary topics. E

## An Introduction to Statistical Mechanics and Thermodynamics

*Oxford University Press* 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. The large problem sets (with solutions for teachers) include many computational problems to advance student unders