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Twelfth Training Course in the Physics of Strongly Correlated Systems
An Introduction

CINDY HOWARD

Lecture Notes on Electron Correlation and Magnetism Springer Science & Business Media
Contains articles written by leading experts in the field of condensed matter physics. The book is intended to give a status report of hot topics of solid state physics.
Conductor Insulator Quantum Phase Transitions Springer
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Solid State Physics World Scientific
Superconductivity: From Basic Physics to the Latest DevelopmentsWorld Scientific
Condensed Matter Theories Amer Inst of Physics
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Handbook of Magnetism and Advanced Magnetic Materials, 5 Volume Set Springer Science & Business Media
The present volume contains the text of the invited talks delivered at the Eighth International Conference on Recent Progress in Many-Body Theories held at SchloB Seggau, Province of Styria, Austria, during the period August 22-26, 1994. The pro ceedings of the Fifth Conference (Oulu, Finland 1987), the Sixth Conference (Arad, Israel 1989) and the Seventh Conference (Minneapolis, USA 1991) have been published. by Plenum as the first three volumes of this series. Papers from the First Conference (Trieste, Italy 1978) comprise Nuclear Physics volume A328, Nos. 1 and 2, the Second Conference (Oaxtepec, Mexico 1979) was published by Springer-Verlag as volume 142 of "Lecture Notes in Physics," entitled "Recent Progress in Many Body Theories." Vol ume 198 of the same series contains the papers from the Third Conference (Altenberg, 1983). These volumes intend to cover a broad spectrum of current research topics in physics that benefit from the application of many-body theories for their elucidation. At the same time there is a focus on the development and refinement of many-body methods. One of the major aims of the conference series has been to foster the exchange of ideas among physicists working in such diverse areas as nuclear physics, quantum chemistry, complex systems, lattice Hamiltonians, quantum fluids and condensed matter physics. The present volume contains contributions from all these areas. th The conference was dedicated on the occasion of Ludwig Boltzmann's 150 birthday.
Volume 4 Superconductivity: From Basic Physics to the Latest Developments
From the first application of the oxide magnetite as a compass in China in ancient times, and from the early middle ages in Europe, magnetic materials have become an indispensable part of our daily life. Magnetic materials are used ubiquitously in the modern world, in fields as diverse as, for example, electrical energy transport, high-power electro-motors and generators, telecommunication systems, navigation equipment, aviation and space operations, micromechanical automation, medicine, magnetocaloric refrigeration, computer science, high density recording, non-destructive testing of materials, and in many household applications. Research in many of these areas continues apace. The progress made in recent years in computational sciences and advanced material preparation techniques has dramatically improved our knowledge of fundamental properties and increased our ability to produce materials with highly-tailored magnetic properties, even down to the nanoscale dimension. Containing approximately 120 chapters written and edited by acknowledged world leaders in the field, The Handbook of Magnetism and Advanced Magnetic Materials provides a state-of-the-art, comprehensive overview of our current understanding of the fundamental properties of magnetically ordered materials, and their use in a wide range of sophisticated applications. The Handbook is published in five themed volumes, as follows: Volume 1- Fundamentals and Theory Volume 2- Micromagnetism Volume 3- Novel Techniques for Characterizing and Preparing Samples Volume 4- Novel Materials Volume 5- Spintronics and Magnetoelectronics
Quantum Monte Carlo Approaches for Correlated Systems
American Institute of Physics
A modern, graduate-level introduction to many-body physics in condensed matter, this textbook explains the tools and concepts needed for a research-level understanding of the correlated behavior of quantum fluids. Starting with an operator-based introduction to the quantum field theory of many-body physics, this textbook presents the Feynman diagram approach, Green's functions and finite-temperature many-body physics before developing the path integral approach to interacting systems. Special chapters are devoted to the concepts of Fermi liquid theory, broken symmetry, conduction in disordered systems, superconductivity and the physics of local-moment metals. A strong emphasis on concepts and numerous exercises make this an invaluable course book for graduate students in condensed matter physics. It will also interest students in nuclear, atomic and particle physics.
Algorithms for Lattice Models Cambridge University Press
This advanced textbook provides an introduction to the basic methods of computational physics.
Fourth Training Course in the Physics of Correlated Electron Systems and High-Tc Superconductors World Scientific
Over the past several decades, computational approaches to studying strongly-interacting systems have become increasingly varied and sophisticated. This book provides a comprehensive introduction to state-of-the-art quantum Monte Carlo techniques relevant for applications in correlated systems. Providing a clear overview of variational wave functions, and featuring a detailed presentation of stochastic samplings including Markov chains and Langevin dynamics, which are developed into a discussion of Monte Carlo methods. The variational technique is described, from foundations to a detailed description of its algorithms. Further topics discussed include optimisation techniques, real-

time dynamics and projection methods, including Green's function, reptation and auxiliary-field Monte Carlo, from basic definitions to advanced algorithms for efficient codes, and the book concludes with recent developments on the continuum space. Quantum Monte Carlo Approaches for Correlated Systems provides an extensive reference for students and researchers working in condensed matter theory or those interested in advanced numerical methods for electronic simulation.

Notes from a Thoughtful Curmudgeon Cambridge University Press

Ever since 1911, the Solvay Conferences have shaped modern physics. The 24th edition chaired by Bertrand Halperin did not break the tradition. Held in October 2008, it gathered in Brussels most of the leading figures working on the quantum theory of condensed matter, addressing some of the most profound open problems in the field. The proceedings contain the rapporteur talks giving a broad overview with unique insights by distinguished renowned scientists. These lectures cover the five sessions treating: mesoscopic and disordered systems; exotic phases and quantum phase transitions in model systems; experimentally realized correlated-electron materials; quantum Hall systems, and one-dimensional systems; and, systems of ultra-cold atoms, and advanced computational methods. In the Solvay tradition, the proceedings include also the prepared comments to the rapporteur talks. The discussions among the participants - some of which are quite lively and involving dramatically divergent points of view - have been carefully edited and reproduced in full.

Highlights in Condensed Matter Physics Cambridge University Press

Comprehensive and accessible coverage from the basics to advanced topics in modern quantum condensed matter physics.

Condensed matter, atomic, molecular and chemical physics, fluids, plasmas, biophysics. D Cambridge University Press

This volume contains the lectures delivered at the Fourth Training Course in the Physics of Correlated Electron Systems and High-Tc Superconductors. In contrast to usual workshops, this course was designed to promote active participation of senior and young researchers and to introduce them to some specific problems. Three of the four lectures held are included in this book.

Monte Carlo Simulation in Statistical Physics World Scientific

The papers were peer reviewed by a local panel. The objective of the meeting was to promote the progress of young scientists by means of training through research. The lectures are up-to-date monographs of relevant subjects in the field of condensed matter physics. Contributions include the following lectures: Electron-Phonon Interaction and Strong Correlations in High-Temperature Superconductors: One cannot avoid the unavoidable (The properties of the normal state and pairing mechanism in high-Tc superconductors, Forward scattering peak in the EPI, The FSP theory, The ARPES non-shift puzzle, Interesting predictions of the FSP theory); Strongly Correlated Electron Materials: Dynamical Mean-Field Theory and Electronic Structure (The basic principles of dynamical mean-field theory (DMFT), application of DMFT to the Mott transition, compare to recent spectroscopy, transport experiments; the key role of the quasiparticle coherence scale, transfers of spectral weight between low- and intermediate or high energies is emphasized); Monte Carlo Simulations of Quantum Systems with Global Updates (a model for doped antiferromagnets, first application of the hybrid loop algorithm, namely the t-Jmodel with 1/r2 interaction).

Materials, Experiments, Theory CRC Press

This book is devoted to the rapidly developing field of oxide thin-films and heterostructures. Oxide materials combined with atomic-scale precision in a heterostructure exhibit an abundance of macroscopic physical properties involving the strong coupling between the electronic, spin, and structural degrees of freedom, and the interplay between magnetism, ferroelectricity, and conductivity. Recent advances in thin-film deposition and characterization techniques made possible the experimental realization of such oxide heterostructures, promising novel functionalities and device concepts. The book consists of chapters on some of the key innovations in the field over recent years, including strongly correlated oxide heterostructures, magnetoelectric coupling and multiferroic materials, thermoelectric phenomena, and two-dimensional electron gases at oxide interfaces. The book covers the core principles, describes experimental approaches to fabricate and characterize oxide heterostructures, demonstrates new functional properties of these materials, and provides an overview of novel applications.

Field Theories for Low-Dimensional Condensed Matter Systems Springer Science & Business Media

When many particles come together how do they organize themselves? And what destroys this organization? Combining experiments and theory, this book describes intriguing quantum phases - metals, superconductors and insulators - and transitions between them. It captures the excitement and the controversies on topics at the forefront of research.

Proceedings of the 24th Solvay Conference on Physics Oxford University Press

An understanding of the quantum mechanical nature of magnetism has led to the development of new magnetic materials which are used as permanent magnets, sensors, and information storage. Behind these practical applications lie a range of fundamental ideas, including symmetry breaking, order parameters, excitations, frustration, and reduced dimensionality. This superb new textbook presents a logical account of these ideas, staring from basic concepts in electromagnetsim and quantum mechanics. It outlines the origin of magnetic moments in atoms and how these moments can be affected by their local environment inside a crystal. The different types of interactions which can be present between magnetic moments are described. The final chapters of the book are devoted to the magnetic properties of metals, and to the complex behaviour which can occur when competing magnetic interactions are present and/or the system has a reduced dimensionality. Throughout the text, the theorectical principles are applied to real systems. There is substantial discussion of experimental techniques and current reserach topics. The book is copiously illustrated and contains detailed appendices which cover the fundamental principles.

Quantum Monte Carlo Methods World Scientific

This book originated from a course given at the Univcrsidad Aut6noma of Madrid in the Spring of 1994 and in the Universidad Complutense of Madrid in 1995. The goal of these courses is to give the non-specialist an introduction to some old and new ideas in the field of strongly correlated systems, in particular the problems posed by the high-1~ superconducting materials. As theoretical physicists, our starting viewpoint to address the problem of strongly correlat ed ferlnion systems and related issues of modern condensed matter physics ·is the renormalization group approach applied both to quantU111 field theory and statistical physics. In recent years this has become not

only a powerful tool for retrieving the essential physics of interacting systems but also a link between theoretical physics and modern condensed matter physics. Furthermore, once we have this common background for dealing with apparently different prob lems, we discuss more specific topics and even phenomenological aspects of the field. In doing so we have tried to make the exposition clear and simple, with out entering into technical details but focusing ill the fundamental physics of the phenomena under study. Therefore ,ve expect that our experience ll1ay have some value to other people entering this fascinating field. We have divided these notes into three parts and each part into chapters, which correspond roughly to one or two lectures. Part I, Chaps. 1-2 (A. H. V.

Introduction to Many-Body Physics Academic Press

Presenting the physics of the most challenging problems in condensed matter using the conceptual framework of quantum field theory, this book is of great interest to physicists in condensed matter and high energy and string theorists, as well as mathematicians. Revised and updated, this second edition features new chapters on the renormalization group, the Luttinger liquid, gauge theory, topological fluids, topological insulators and quantum entanglement. The book begins with the basic concepts and tools, developing them gradually to bring readers to the issues currently faced at the frontiers of research, such as topological phases of matter, quantum and classical critical phenomena, quantum Hall effects and superconductors. Other topics covered include one-dimensional strongly correlated systems, quantum ordered and disordered phases, topological structures in condensed matter and in field theory and fractional statistics.

Recent Progress in Many-Body Theories Springer Science & Business Media

This volume contains the lecture notes of the “Spring College on Superconductivity” held from 27 April to 19 June 1992 at ICTP. The distinguished faculty of lecturers has provided a wide coverage of topics on the fascinating subject of superconductivity, ranging from basic physics to the latest developments. The comprehensive reviews included in this volume will prove invaluable for research workers and graduate students in the field. Contents: Theory of Normal Metals (G D Mahan)Strong-Coupling Theory of Superconductivity (D Rainer & J A Sauls)Heavy Fermions and Superconductivity: Theory (G Zwicknagl)On the Electronic Structure and Related Physical Properties of 3d Transition Metal Compounds (G A Sawatzky)Theory of Superconductivity in the High Tc Materials (P W Anderson)Specific Heat Studies of Superconductivity (R Srinivasan)Optical Investigations of High-Temperature Superconducting Cuprates (D Mihailovic)Investigation of Magnetic Properties in High Tc Oxides by Muon Spin Rotation (C Bucci)Charge and Spin Separation in One-Dimensional Systems (C A Balseiro et al.) Readership: Researchers in condensed matter physics. Keywords:Strong-Coupling;Superconductivity;High Tc;Charge;Spin

The Recursion Method American Inst. of Physics

Featuring detailed explanations of the major algorithms used in quantum Monte Carlo simulations, this is the first textbook of its kind to provide a pedagogical overview of the field and its applications. The book provides a comprehensive introduction to the Monte Carlo method, its use, and its foundations, and examines algorithms for the simulation of quantum many-body lattice problems at finite and zero temperature. These algorithms include continuous-time loop and cluster algorithms for quantum spins, determinant methods for simulating fermions, power methods for computing ground and excited states, and the variational Monte Carlo method. Also discussed are continuous-time algorithms for quantum impurity models and their use within dynamical mean-field theory, along with algorithms for analytically continuing imaginary-time quantum Monte Carlo data. The parallelization of Monte Carlo simulations is also addressed. This is an essential resource for graduate students, teachers, and researchers interested in quantum Monte Carlo techniques.