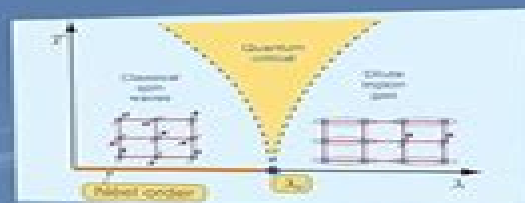
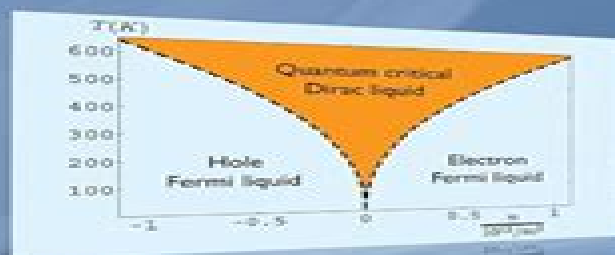


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Quantum Phase Transitions Subir Sachdev, 2001-04-23 Quantum Phase Transitions is the first book to describe in detail the fundamental changes that can occur in the macroscopic nature of matter at zero temperature due to small variations in a given external parameter The subject plays a central role in the study of the electrical and magnetic properties of numerous important solid state materials The author begins by developing the theory of quantum phase transitions in the simplest possible class of non disordered interacting systems the quantum Ising and rotor models Particular attention is paid to their non zero temperature dynamic and transport properties in the vicinity of the quantum critical point Several other quantum phase transitions of increasing complexity are then discussed and clarified Throughout the author interweaves experimental results with presentation of theoretical models and well over 500 references are included The book will be of great interest to graduate students and researchers in condensed matter physics

Understanding Quantum Phase Transitions Lincoln Carr, 2010-11-02 Quantum phase transitions QPTs offer wonderful examples of the radical macroscopic effects inherent in quantum physics phase changes between different forms of matter driven by quantum rather than thermal fluctuations typically at very low temperatures QPTs provide new insight into outstanding problems such as high temperature superconductivity

Equilibrium and Nonequilibrium Aspects of Phase Transitions in Quantum Physics Ricardo Puebla, 2018-09-17 In this book the equilibrium and nonequilibrium properties of continuous phase transitions are studied in various systems with a special emphasis on understanding how well established universal traits at equilibrium may be extended into the dynamic realm going beyond the paradigmatic Kibble Zurek mechanism of defect formation This book reports on the existence of a quantum phase transition in a system comprising just a single spin and a bosonic mode the quantum Rabi model Though critical phenomena are inherent to many body physics the author demonstrates that this small and ostensibly simple system allows us to explore the rich phenomenology of phase transitions both in and out of equilibrium Moreover the universal traits of this quantum phase transition may be realized in a single trapped ion experiment thus avoiding the need to scale up the number of constituents In this system the phase transition takes place in a suitable limit of system parameters rather than in the conventional thermodynamic limit a novel notion that the author and his collaborators have dubbed the finite component system phase transition As such the results gathered in this book will open promising new avenues in our understanding and exploration of quantum critical phenomena

Modern Theories of Many-Particle Systems in Condensed Matter Physics Daniel C. Cabra, Andreas Honecker, Pierre Pujol, 2012-01-05 Condensed matter systems where interactions are

strong are inherently difficult to analyze theoretically The situation is particularly interesting in low dimensional systems where quantum fluctuations play a crucial role Here the development of non perturbative methods and the study of integrable field theory have facilitated the understanding of the behavior of many quasi one and two dimensional strongly correlated systems In view of the same rapid development that has taken place for both experimental and numerical techniques as well as the emergence of novel testing grounds such as cold atoms or graphene the current understanding of strongly correlated condensed matter systems differs quite considerably from standard textbook presentations The present volume of lecture notes aims to fill this gap in the literature by providing a collection of authoritative tutorial reviews covering such topics as quantum phase transitions of antiferromagnets and cuprate based high temperature superconductors electronic liquid crystal phases graphene physics dynamical mean field theory applied to strongly correlated systems transport through quantum dots quantum information perspectives on many body physics frustrated magnetism statistical mechanics of classical and quantum computational complexity and integrable methods in statistical field theory As both graduate level text and authoritative reference on this topic this book will benefit newcomers and more experienced researchers in this field alike

Handbook on the Physics and Chemistry of Rare Earths ,2016-08-01 Handbook on the Physics and Chemistry of Rare Earths is a continuous series of books covering all aspects of rare earth science including chemistry life sciences materials science and physics The book s main emphasis is on rare earth elements Sc Y and the lanthanides La through Lu but whenever relevant information is also included on the closely related actinide elements Individual chapters are comprehensive broad up to date critical reviews written by highly experienced invited experts The series which was started in 1978 by Professor Karl A Gschneidner Jr combines and integrates both the fundamentals and applications of these elements and publishes two volumes a year Presents up to date overviews of new developments in the field of rare earths covering both their physics and chemistry Contains Individual chapters that are comprehensive and broad with critical reviews Provides contributions from highly experienced invited experts

Quantum Scaling in Many-Body Systems Mucio Continentino,2017-04-17 Focusing on experimental results this updated edition approaches the problem of quantum phase transitions from a new and unifying perspective

Quantum Phase Transitions in Cold Atoms and Low Temperature Solids Kaden Richard Alan Hazzard,2011-06-28 The primary focus of this thesis is to theoretically describe nanokelvin experiments in cold atomic gases which offer the potential to revolutionize our understanding of strongly correlated many body systems The thesis attacks major challenges of the field it proposes and analyzes experimental protocols to create new and interesting states of matter and introduces theoretical techniques to describe probes of these states The phenomena considered include the fractional quantum Hall effect spectroscopy of strongly correlated states and quantum criticality among others The thesis also clarifies experiments on disordered quantum solids which display a variety of exotic phenomena and are candidates to exhibit so called supersolidity It collects experimental results and constrains their

interpretation through theoretical considerations This Doctoral Thesis has been accepted by Cornell University Ithaca USA

Advanced Condensed Matter Physics Machine L, 2025-07 Where condensed matter meets the cutting edge This final volume takes you to physics frontier where particles with no charge exist spins never freeze and black holes help understand superconductors Welcome to the wild side of quantum matter What's Inside Quantum critical points Phase transitions at absolute zero SPT phases Symmetry protected topological order Kitaev honeycomb model Exactly solvable spin liquids Majorana fermions Particles that are their own antiparticles AdS/CMT correspondence When black holes explain metals Why This Book Because this is where textbook physics ends and discovery begins These ideas are rewriting what we know about matter itself Author's Note Dear Reader Writing this book felt like charting unknown territory thrilling and humbling Some ideas here may change as we learn more and that's the beauty of science If these pages inspire you to explore further please share your journey in a review The next breakthrough could be yours To the edges of knowledge MachineL **Quantum**

Phase Transitions in the Presence of Disorder and Dissipation Chetan Vyankatesh Kotabage, 2011 A quantum phase transition is a phase transition at absolute zero occurring under variations in an external non thermal parameter such as magnetic field or pressure Quantum phase transitions are one among the important topics currently investigated in condensed matter physics They are observed in various systems e.g. in the ferromagnetic paramagnetic phase transition in LiHoF_4 or in the superconductor metal phase transition in nanowires A particular class of quantum phase transitions which is phase transitions in the presence of disorder and dissipation is investigated here An example of this class is the ferromagnetic paramagnetic phase transition in $\text{Ni}_{1-x}\text{V}_x$ or $\text{CePd}_{1-x}\text{Rh}_x$ caused by variations in chemical composition In these systems disorder is due to random positions of doping element and the dynamics of order parameter fluctuations is dissipative due to conduction electrons These quantum phase transitions are explained using the following approach The Landau-Ginzberg-Wilson functional which is derived from a microscopic Hamiltonian is treated by the strong disorder renormalization group method For ohmic damping phase transitions are strongly influenced by disorder and the critical point is an infinite randomness fixed point which is in the universality class same as that of the random transverse field Ising model The scaling form of observable quantities is activated type rather than conventional power law type For superohmic damping the strong disorder renormalization group method yields one of the recursion relationships different from ohmic damping This difference indicates a more conventional transition for superohmic damping Abstract leaf iii Entanglement in Spin Chains Abolfazl Bayat, Sougato Bose, Henrik

Johannesson, 2022-09-26 This book covers recent developments in the understanding quantification and exploitation of entanglement in spin chain models from both condensed matter and quantum information perspectives Spin chain models are at the foundation of condensed matter physics and quantum information technologies and elucidate many fundamental phenomena such as information scrambling quantum phase transitions and many body localization Moreover many quantum

materials and emerging quantum devices are well described by spin chains Comprising accessible self contained chapters written by leading researchers this book is essential reading for graduate students and researchers in quantum materials and quantum information The coverage is comprehensive from the fundamental entanglement aspects of quantum criticality non equilibrium dynamics classical and quantum simulation of spin chains through to their experimental realizations and beyond into machine learning applications

A Modern Approach to Critical Phenomena Igor Herbut, 2007-01-04 Critical phenomena is one of the most exciting areas of modern physics This 2007 book provides a thorough but economic introduction into the principles and techniques of the theory of critical phenomena and the renormalization group from the perspective of modern condensed matter physics Assuming basic knowledge of quantum and statistical mechanics the book discusses phase transitions in magnets superfluids superconductors and gauge field theories Particular attention is given to topics such as gauge field fluctuations in superconductors the Kosterlitz Thouless transition duality transformations and quantum phase transitions all of which are at the forefront of physics research This book contains numerous problems of varying degrees of difficulty with solutions These problems provide readers with a wealth of material to test their understanding of the subject It is ideal for graduate students and more experienced researchers in the fields of condensed matter physics statistical physics and many body physics

Computer Simulation Studies in Condensed-Matter Physics XI David P. Landau, 1999-05-04 More than a decade ago because of the phenomenal growth in the power of computer simulations The University of Georgia formed the first institutional unit devoted to the use of simulations in research and teaching The Center for Simulational Physics As the simulations community expanded further we sensed a need for a meeting place for both experienced simulators and neophytes to discuss new techniques and recent results in an environment which promoted extended discussion As a consequence the Center for Simulational Physics established an annual workshop on Recent Developments in Computer Simulation Studies in Condensed Matter Physics This year s workshop was the eleventh in this series and the interest shown by the scientific community demonstrates quite clearly the useful purpose which the series has served The latest workshop was held at The University of Georgia February 23 27 1998 and these proceedings provide a status report on a number of important topics This volume is published with the goal of timely dissemination of the material to a wider audience We wish to offer a special thanks to IBM Corporation for their generous support of this year s workshop This volume contains both invited papers and contributed presentations on problems in both classical and quantum condensed matter physics We hope that each reader will benefit from specialized results as well as profit from exposure to new algorithms methods of analysis and conceptual developments Athens GA U S A D P Landau April 1998 H B

Applications of the Gauge/Gravity Duality Jonas Probst, 2018-06-28 Many open questions in Theoretical Physics pertain to strongly interacting quantum systems such as the quark gluon plasma QGP produced in heavy ion collisions or the strange metal phase observed in many high temperature superconductors These systems are notoriously difficult to study using

traditional methods such as perturbation theory but the gauge gravity duality offers a successful alternative approach which maps strongly interacting quantum gauge theories to computationally tractable classical gravity theories This book begins with a pedagogical introduction to how the duality can be used to extract transport properties of quantum systems from their gravity dual It then presents new results on hydrodynamic transport in strongly interacting quantum fluids providing strong evidence that the Haack Yarom identity between second order transport coefficients holds for all fluids with a classical gravity dual and may be a universal feature of all strongly coupled quantum fluids such as the QGP Newly derived Kubo formulae expressing transport coefficients in terms of quantum correlators hold independently of the duality Lastly the book discusses new results on magnetic impurities in strongly correlated metals including the first dual gravity description of an inter impurity coupling crucial for the quantum criticality underlying the strange metal phase

The Best Writing on Mathematics 2019 Mircea Pitici, 2019-11-05 The year's finest mathematical writing from around the world This annual anthology brings together the year's finest mathematics writing from around the world Featuring promising new voices alongside some of the foremost names in the field The Best Writing on Mathematics 2019 makes available to a wide audience many articles not easily found anywhere else and you don't need to be a mathematician to enjoy them These essays delve into the history philosophy teaching and everyday aspects of math offering surprising insights into its nature meaning and practice and taking readers behind the scenes of today's hottest mathematical debates In this volume Moon Duchin explains how geometric statistical methods can be used to combat gerrymandering Jeremy Avigad illustrates the growing use of computation in making and verifying mathematical hypotheses and Kokichi Sugihara describes how to construct geometrical objects with unusual visual properties In other essays Neil Sloane presents some recent additions to the vast database of integer sequences he has catalogued and Alessandro Di Bucchianico and his colleagues highlight how mathematical methods have been successfully applied to big data problems And there's much much more In addition to presenting the year's most memorable math writing this must have anthology includes an introduction by the editor and a bibliography of other notable writings on mathematics This is a must read for anyone interested in where math has taken us and where it is headed

Quantum Phase Transitions in Transverse Field Models Amit Dutta, 2015-01-28 This book establishes the fundamental connections between the physics of quantum phase transitions and the technological promise of quantum information

Classical and Quantum Phase Transitions in Strongly Correlated Electron Systems Thomas Schäfer, 2016 Eng Strongly correlated electron systems exhibit some of the most fascinating phenomena of condensed matter physics Beyond the famous example of the Mott Hubbard metal to insulator transition and the occurrence of classical phase transitions like magnetic and charge ordering as well as superconductivity quantum phase transitions in strongly correlated systems are currently under intense research These transitions are quite intriguing because they occur at zero temperature where quantum fluctuations dominate the physics in contrast to their classical thermal counterparts but they affect broad sectors of

the phase diagram of both real materials and model systems Their theoretical description however faces big challenges both analytical and numerical so that a comprehensive theory could not be established hitherto This dissertation aims at a theoretical understanding of classical and quantum phase transitions by exploiting cutting edge field theoretical many body methods the dynamical mean field theory DMFT which treats local correlations but neglects spatial correlations and the dynamical vertex approximation D A a diagrammatic extension of DMFT which additionally incorporates spatial correlations on every length scale These state of the art methods are applied to one of the most important and fundamental model systems in condensed matter physics the Hubbard model First precursor features of phase transitions are analyzed They can in fact be of very different kind In the case of the Mott Hubbard transition they appear as divergent irreducible vertices in the case of second order phase transitions as charge spin and pairing fluctuations Then the influence of the vicinity of second order phase transitions on one particle spectra is investigated for various dimensionality Interesting features of self energies in specific dimensions are highlighted In the next step the fate of the Mott Hubbard metal insulator transition is determined for two dimensions where the DMFT is known to become an inadequate approximation because it neglects spatial correlations Eventually the magnetic phase diagram of the doped Hubbard model in three dimensions especially the region around its magnetic quantum critical point is analyzed The simultaneous treatment of strong local and non local fluctuations makes D A particularly well suited to study the competing processes which control the physics of a strong coupling quantum critical point The D A critical exponents of the magnetic susceptibility and correlation length for the Hubbard model are determined providing evidence for a significant violation of the prediction of the conventional Hertz Millis Moriya theory

Journal of the Physical Society of Japan, 2016 *Quantum Simulations with Photons and Polaritons* Dimitris G.

Angelakis, 2017-05-03 This book reviews progress towards quantum simulators based on photonic and hybrid light matter systems covering theoretical proposals and recent experimental work Quantum simulators are specially designed quantum computers Their main aim is to simulate and understand complex and inaccessible quantum many body phenomena found or predicted in condensed matter physics materials science and exotic quantum field theories Applications will include the engineering of smart materials robust optical or electronic circuits deciphering quantum chemistry and even the design of drugs Technological developments in the fields of interfacing light and matter especially in many body quantum optics have motivated recent proposals for quantum simulators based on strongly correlated photons and polaritons generated in hybrid light matter systems The latter have complementary strengths to cold atom and ion based simulators and they can probe for example out of equilibrium phenomena in a natural driven dissipative setting This book covers some of the most important works in this area reviewing the proposal for Mott transitions and Luttinger liquid physics with light to simulating interacting relativistic theories topological insulators and gauge field physics The stage of the field now is at a point where on top of the numerous theory proposals experiments are also reported Connecting to the theory proposals presented in the chapters the

main experimental quantum technology platforms developed from groups worldwide to realize photonic and polaritonic simulators in the laboratory are also discussed These include coupled microwave resonator arrays in superconducting circuits semiconductor based polariton systems and integrated quantum photonic chips This is the first book dedicated to photonic approaches to quantum simulation reviewing the fundamentals for the researcher new to the field and providing a complete reference for the graduate student starting or already undergoing PhD studies in this area

Quantum Ising Phases and Transitions in Transverse Ising Models Sei Suzuki, Jun-ichi Inoue, Bikas K. Chakrabarti, 2012-12-14 Quantum phase transitions driven by quantum fluctuations exhibit intriguing features offering the possibility of potentially new applications e g in quantum information sciences Major advances have been made in both theoretical and experimental investigations of the nature and behavior of quantum phases and transitions in cooperatively interacting many body quantum systems For modeling purposes most of the current innovative and successful research in this field has been obtained by either directly or indirectly using the insights provided by quantum or transverse field Ising models because of the separability of the cooperative interaction from the tunable transverse field or tunneling term in the relevant Hamiltonian Also a number of condensed matter systems can be modeled accurately in this approach hence granting the possibility to compare advanced models with actual experimental results This work introduces these quantum Ising models and analyses them both theoretically and numerically in great detail With its tutorial approach the book addresses above all young researchers who wish to enter the field and are in search of a suitable and self contained text yet it will also serve as a valuable reference work for all active researchers in this area

Reviewing **Understanding Quantum Phase Transitions Condensed Matter Physics**: Unlocking the Spellbinding Force of Linguistics

In a fast-paced world fueled by information and interconnectivity, the spellbinding force of linguistics has acquired newfound prominence. Its capacity to evoke emotions, stimulate contemplation, and stimulate metamorphosis is really astonishing. Within the pages of "**Understanding Quantum Phase Transitions Condensed Matter Physics**," an enthralling opus penned by a highly acclaimed wordsmith, readers embark on an immersive expedition to unravel the intricate significance of language and its indelible imprint on our lives. Throughout this assessment, we shall delve into the book's central motifs, appraise its distinctive narrative style, and gauge its overarching influence on the minds of its readers.

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