

World Scientific Lecture Notes in Physics — Vol. 35

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



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# Effective Field Approach To Phase Transitions And Some Applications To Ferroelectrics

**William Kung**



## **Effective Field Approach To Phase Transitions And Some Applications To Ferroelectrics:**

### **Effective Field Approach to Phase Transitions and Some Applications to Ferroelectrics** Julio A

Gonzalo, 1991-05-07 The first half of the book presents the effective field approach which is certainly the simplest approach to investigate cooperative phenomena and the accompanying phase transitions. It provides a common 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 phenomenological theory is stressed. The latter half is devoted to some specific applications of the effective field concept to ferroelectric systems.

**Contents:** Mean Field Approach to Cooperative Phenomena, An Overview, Liquid Vapour Transitions, Ferromagnetic Transitions, Superconductive Transitions, Order Disorder Transitions in Alloys, Ferroelectric Transitions, Superfluid Transitions, Ferroelastic Transitions, Landau Theory and Effective Field Approach, Role of Fluctuations, Equation of State and the Scaling Function, Appendix: Effective Field Approach to Superconductors and Superfluids, Some Application to Ferroelectric Systems, Behaviour at  $T = T_c$  of Pure Ferroelectric Systems with Second Order Phase Transition, Effects of Dipolar Impurities in Small Amounts, Mixed Ferro-Antiferroelectric Systems and other Mixed Ferroelectric Systems, Comments on Ferroelectricity in Zinc Cadmium Telluride, Relaxation Phenomena near  $T_c$ , Polarization Reversal in Ferroelectric Systems, Polarization Switching by Domain Wall Motion, Switching Current Pulse Shape, Elementary Excitations in Ferroelectrics, Dipole Waves, Low Temperature Behaviour of Ferroelectrics, Logarithmic Corrections, Readership: Condensed matter physicists, statistical physicists, and physical chemists.

### **Effective Field Approach to Phase Transitions and Some Applications to Ferroelectrics** Julio Antonio Gonzalo, 2006

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.

**Sample Chapter's:** Chapter 1: An Overview (310 KB). **Contents:** Mean Field Approach to Cooperative Phenomena, Some Applications to Ferroelectrics (1970), Co (1991), Some Applications to Ferroelectrics (1991), Co (1997), Some Applications to Ferroelectrics (1998), Co (2005). **Readership:** Materials scientists, physicists, and chemists in academy and industry; final year undergraduates and graduates in materials science.

*Effective Field Approach To Phase Transitions And Some Applications To Ferroelectrics (2nd Edition)* Julio A Gonzalo, 2006-08-24 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 **Effective Field Approach to Phase Transitions and Some Applications to Ferroelectrics** Julio Antonio Gonzalo, 1991 Based on a graduate course on phase transitions at the Universidad Autonoma de Madrid in 1989 Presents a simple explanation of the effective field approach to investigate phase transitions a well established procedure Applies the method to a few phase transitions mostly solid state with special attention to ferroelectric systems Acidic paper Annotation copyrighted by Book News Inc Portland OR

**Ferroelectrics** Indrani Coondoo, 2010-12-14 Ferroelectric materials exhibit a wide spectrum of functional properties including switchable polarization piezoelectricity high non linear optical activity pyroelectricity and non linear dielectric behaviour These properties are crucial for application in electronic devices such as sensors microactuators infrared detectors microwave phase filters and non volatile memories This unique combination of properties of ferroelectric materials has attracted researchers and engineers for a long time This book reviews a wide range of diverse topics related to the phenomenon of ferroelectricity in the bulk as well as thin film form and provides a forum for scientists engineers and students working in this field The present book containing 24 chapters is a result of contributions of experts from international scientific community working in different aspects of ferroelectricity related to experimental and theoretical work aimed at the understanding of ferroelectricity and their utilization in devices It provides an up to date insightful coverage to the recent advances in the synthesis characterization functional properties and potential device applications in specialized areas **Effective Field Approach to Phase Transitions and Some Applications to Ferroelectrics** Julio

Alfredo Gonzalo, 1990 *Geometry and Phase Transitions in Colloids and Polymers* William Kung, 2009 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 **Magnetic, Ferroelectric, and Multiferroic Metal Oxides** Biljana Stojanovic, 2018-01-02 Magnetic Ferroelectric and Multiferroic Metal Oxides covers the fundamental and theoretical aspects of ferroics and magnetoelectrics their properties and important technological applications serving as the most comprehensive up to date reference on the subject Organized in four parts Dr Biljana Stojanovic leads expert contributors in providing the context to understand the material Part I Introduction the theoretical and practical aspects of ferroelectrics Part II Ferroelectrics From Theory Structure and Preparation to Application magnetic

metal oxides Part III Magnetic Oxides Ferromagnetics Antiferromagnetics and Ferrimagnetics multiferroics Part IV Multiferroic Metal Oxides and future directions in research and application Part V Future of Metal Oxide Ferroics and Multiferroics As ferroelectric materials are used to make capacitors with high dielectric constant transducers and actuators and in sensors reed heads and memories based on giant magnetoresistive effects this book will provide an ideal source for the most updated information Addresses ferroelectrics ferromagnetics and multiferroelectrics providing a one stop reference for researchers Provides fundamental theory and relevant important technological applications Highlights their use in capacitors with high dielectric constant transducers and actuators and in sensors reed heads and memories based on giant magnetoresistive effects

**Field Theory: A Path Integral Approach (Third Edition)** Ashok Das, 2019-02-22 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 All the existing chapters of the previous edition have been expanded for more clarity The chapter on anomalies and the Schwinger model has been completely rewritten for better logical clarity Two new chapters have been added at the request of students and faculty worldwide The first describes Schwinger's proper time method with simple examples both at zero and at finite temperature while the second develops the idea of zeta function regularization with simple examples This latest edition is a comprehensive and much expanded version of the original text

*Foundations Of Quantum Field Theory* Klaus D Rothe, 2020-09-03 Based on a two semester course held at the University of Heidelberg Germany this book provides an adequate resource for the lecturer and the student The contents are primarily aimed at graduate students who wish to learn about the fundamental concepts behind constructing a Relativistic Quantum Theory of particles and fields So it provides a comprehensive foundation for the extension to Quantum Chromodynamics and Weak Interactions that are not included in this book

**Great Solid State Physicists of the 20th Century** Carmen Arag   L  pez, Julio Antonio Gonzalo, 2003 The 20th Century has been called the Century of Physics It could be even more appropriate to call it the Century of Solid State Physics All the technological developments which had changed the world by the end of the century had been based upon previous scientific developments in Solid State Physics The Braggs Debye Bardeen Landau were certainly at the forefront of all those revolutionary changes Contents The Braggs Peter Debye John Bardeen Lev Davidovich Landau The Relevance of Materials Science Readership Final year undergraduates graduate students teachers researchers working in materials physics condensed matter solid state physics

**Introduction To Condensed Matter Physics, Volume 1** Duan Feng, Guojun Jin, 2005-07-04 This is volume 1 of two volume book that presents an excellent comprehensive exposition of the multi faceted subjects of modern condensed matter physics unified within an original and coherent conceptual framework Traditional subjects such as band theory and lattice dynamics are tightly organized in this framework while many new developments emerge spontaneously from it In this volume Basic concepts are emphasized usually they are intuitively introduced then more

precisely formulated and compared with correlated concepts A plethora of new topics such as quasicrystals photonic crystals GMR TMR CMR high T<sub>c</sub> superconductors Bose Einstein condensation etc are presented with sharp physical insights Bond and band approaches are discussed in parallel breaking the barrier between physics and chemistry A highly accessible chapter is included on correlated electronic states rarely found in an introductory text Introductory chapters on tunneling mesoscopic phenomena and quantum confined nanostructures constitute a sound foundation for nanoscience and nanotechnology The text is profusely illustrated with about 500 figures

**Principles Of Phase Structures In Particle Physics** Hildegard Meyer-ortmanns, Thomas Reisz, 2006-12-06 The phase structure of particle physics shows up in matter at extremely high densities and or temperatures as they were reached in the early universe shortly after the big bang or in heavy ion collisions as they are performed nowadays in laboratory experiments In contrast to phase transitions of condensed matter physics the underlying fundamental theories are better known than their macroscopic manifestations in phase transitions These theories are quantum chromodynamics for the strong interaction part and the electroweak part of the Standard Model for the electroweak interaction It is their non Abelian gauge structure that makes it a big challenge to predict the type of phase conversion between phases of different symmetries and different particle contents The book is about a variety of analytical and numerical tools that are needed to study the phase structure of particle physics To these belong convergent and asymptotic expansions in strong and weak couplings dimensional reduction renormalization group studies gap equations Monte Carlo simulations with and without fermions finite size and finite mass scaling analyses and the approach of effective actions as supplement to first principle calculations

Foundations of Quantum Chromodynamics Taiz? Muta, 2010 This volume develops the techniques of perturbative QCD in great pedagogical detail starting with field theory Aside from extensive treatments of the renormalization group technique The operator product expansion formalism and their applications to short distance reactions this book provides a comprehensive introduction to gauge theories Examples and exercises are provided to amplify the discussions on important topics This is an ideal textbook on the subject of quantum chromodynamics and is essential for researchers and graduate students in high energy physics nuclear physics and mathematical physics

**Introduction To Supersymmetry (2nd Edition)** Harald J W Muller-kirsten, Armin

Wiedemann, 2010-01-21 Supersymmetry is a symmetry which combines bosons and fermions in the same multiplet of a larger group which unites the transformations of this symmetry with that of spacetime Thus every bosonic particle must have a fermionic partner and vice versa Since this is not what is observed this symmetry with inherent theoretical advantages must be badly broken It is hoped that the envisaged collider experiments at CERN will permit a first experimental test which is expected to revive the interest in supersymmetry considerably This revised edition of the highly successful text of 20 years ago provides an introduction to supersymmetry and thus begins with a substantial chapter on spacetime symmetries and spinors Following this graded algebras are introduced and thereafter the supersymmetric extension of the spacetime Poincar

algebra and its representations The Wess Zumino model superfields supersymmetric Lagrangians and supersymmetric gauge theories are treated in detail in subsequent chapters Finally the breaking of supersymmetry is addressed meticulously All calculations are presented in detail so that the reader can follow every step

**Classical And Quantum Dynamics Of Constrained Hamiltonian Systems** Heinz J Rothe, Klaus D Rothe, 2010-04-14 This book is an introduction to the field of constrained Hamiltonian systems and their quantization a topic which is of central interest to theoretical physicists who wish to obtain a deeper understanding of the quantization of gauge theories such as describing the fundamental interactions in nature Beginning with the early work of Dirac the book covers the main developments in the field up to more recent topics such as the field antifield formalism of Batalin and Vilkovisky including a short discussion of how gauge anomalies may be incorporated into this formalism All topics are well illustrated with examples emphasizing points of central interest The book should enable graduate students to follow the literature on this subject without much problems and to perform research in this field

The Specific Heat Of Matter At Low Temperatures Ahmet Tari, 2003-08-12 Recent discoveries of new materials and improvements in calorimetric techniques have given new impetus to the subject of specific heat Nevertheless there is a serious lack of literature on the subject This invaluable book which goes some way towards remedying that is concerned mainly with the specific heat of matter at ordinary temperatures It discusses the principles that underlie the theory of specific heat and considers a number of theoretical models in some detail The subject matter ranges from traditional materials to those recently discovered heavy fermion compounds high temperature superconductors spin glasses and so on and includes a large number of figures tables and references The book will be particularly useful for advanced undergraduate and postgraduate students as well as academics and researchers a

*Lattice Gauge Theories: An Introduction (Fourth Edition)* Heinz J Rothe, 2012-03-14 This book provides a broad introduction to gauge field theories formulated on a space time lattice and in particular of QCD It serves as a textbook for advanced graduate students and also provides the reader with the necessary analytical and numerical techniques to carry out research on his own Although the analytic calculations are sometimes quite demanding and go beyond an introduction they are discussed in sufficient detail so that the reader can fill in the missing steps The book also introduces the reader to interesting problems which are currently under intensive investigation Whenever possible the main ideas are exemplified in simple models before extending them to realistic theories Special emphasis is placed on numerical results obtained from pioneering work These are displayed in a great number of figures Beyond the necessary amendments and slight extensions of some sections in the third edition the fourth edition includes an expanded section on Calorons a subject which has been under intensive investigation during the last twelve years

Quark-gluon Plasma, Heavy Ion Collisions And Hadrons Edward V Shuryak, 2024-02-28 This third book on Quark Gluon plasma and heavy ion collisions follows the previous ones published in 1988 and 2005 that described theoretical proposals for a large program and then the QGP discovery at RHIC The present one describes the rather mature field with extensive

program at RHIC and LHC colliders and corresponding theory QGP turns out to be a strongly coupled medium made up of quarks and gluons existing in exploding fireballs It is the hottest form of matter created in a laboratory Other subjects discussed in the book are QCD vacuum structure including topological solitons and nonperturbative phenomena It also includes some recent progress in theory of hadrons bridging hadronic spectroscopy with partonic observables

**Supersymmetry: From The Basics To Exact Results In Gauge Theories** Matteo Bertolini, 2024-10-29 What is Supersymmetry Is it something real If not can it be useful in any way This book structured as a textbook for a one semester graduate course on supersymmetry provides an introduction to this fascinating subject and seeks to answer these questions Theoretically inclined in its contents the book can be divided into three parts The first part introduces the supersymmetry algebra and its representations and provides a detailed description of the superfield formalism The second part focuses on the construction of supersymmetric field theories it includes an overview on non renormalization theorems the analysis of several examples of tree level supersymmetry breaking and a discussion of the basic structure of supersymmetric models for describing physics beyond the Standard Model The third part discusses the quantum behavior of supersymmetric gauge theories in which holomorphy and dualities play a prominent role The reader will become familiar with topics like Seiberg duality dynamical supersymmetry breaking both in stable and metastable vacua Seiberg Witten theory Argyres Douglas fixed points S duality and more Several exercises at the end of each chapter will allow readers to test their understanding discuss some extensions or prove statements from the main text



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














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



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