

SOLITONS AND INSTANTONS

An Introduction to Solitons and Instantons in Quantum Field Theory

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Solitons And Instantons An Introduction To Solitons And Instantons In Quantum Field Theory

R. Rajaraman



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Solitons and Instantons R. Rajaraman,1987 **Solitons and Instantons; An Introduction to Solitons and Instantons in Quantum Field Theory** R. Rajaraman,1982 **Solitons, Instantons, and Twistors** Maciej

Dunajski,2024-07-12 Most nonlinear differential equations arising in natural sciences admit chaotic behaviour and cannot be solved analytically Integrable systems lie on the other extreme They possess regular stable and well behaved solutions known as solitons and instantons These solutions play important roles in pure and applied mathematics as well as in theoretical physics where they describe configurations topologically different from vacuum While integrable equations in lower space time dimensions can be solved using the inverse scattering transform the higher dimensional examples of anti self dual Yang Mills and Einstein equations require twistor theory Both techniques rely on an ability to represent nonlinear equations as compatibility conditions for overdetermined systems of linear differential equations The book provides a self contained and accessible introduction to the subject It starts with an introduction to integrability of ordinary and partial differential equations Subsequent chapters explore symmetry analysis gauge theory vortices gravitational instantons twistor transforms and anti self duality equations The three appendices cover basic differential geometry complex manifold theory and the exterior differential system **Theory of Interacting Quantum Fields** Alexei L. Rebenko,2012-07-04 This monograph is devoted to the systematic presentation of foundations of the quantum field theory Unlike numerous monographs devoted to this topic a wide range of problems covered in this book are accompanied by their sufficiently clear interpretations and applications An important significant feature of this monograph is the desire of the author to present mathematical problems of the quantum field theory with regard to new methods of the constructive and Euclidean field theory that appeared in the last thirty years of the 20th century and are based on the rigorous mathematical apparatus of functional analysis the theory of operators and the theory of generalized functions The monograph is useful for students post graduate students and young scientists who desire to understand not only the formality of construction of the quantum field theory but also its essence and connection with the classical mechanics relativistic classical field theory quantum mechanics group theory and the theory of path integral formalism *Quantum Field Theory III: Gauge Theory* Eberhard Zeidler,2011-08-17 In this third volume of his modern introduction to quantum field theory Eberhard Zeidler examines the mathematical and physical aspects of gauge theory as a principle tool for describing the four fundamental forces which act in the universe gravitative electromagnetic weak interaction and strong interaction Volume III concentrates on the classical aspects of gauge theory describing the four fundamental forces by the curvature of appropriate fiber bundles This must be supplemented by the crucial but elusive quantization procedure The book is arranged in four sections devoted to realizing the universal principle force equals curvature Part I The Euclidean Manifold as a Paradigm Part II Ariadne s Thread in Gauge Theory Part III Einstein s Theory of Special Relativity Part IV Ariadne s Thread in Cohomology For students of mathematics the book is designed to demonstrate

that detailed knowledge of the physical background helps to reveal interesting interrelationships among diverse mathematical topics Physics students will be exposed to a fairly advanced mathematics beyond the level covered in the typical physics curriculum Quantum Field Theory builds a bridge between mathematicians and physicists based on challenging questions about the fundamental forces in the universe macrocosmos and in the world of elementary particles microcosmos

Solitons Boling Guo,Xiao-Feng Pang,Yu-Feng Wang,Nan Liu,2018-03-19 This book provides an up to date overview of mathematical theories and research results on solitons presenting related mathematical methods and applications as well as numerical experiments Different types of soliton equations are covered along with their dynamical behaviors and applications from physics making the book an essential reference for researchers and graduate students in applied mathematics and physics Contents Introduction Inverse scattering transform Asymptotic behavior to initial value problems for some integrable evolution nonlinear equations Interaction of solitons and its asymptotic properties Hirota method Bäcklund transformations and the infinitely many conservation laws Multi dimensional solitons and their stability Numerical computation methods for some nonlinear evolution equations The geometric theory of solitons Global existence and blow up for the nonlinear evolution equations The soliton movements of elementary particles in nonlinear quantum field The theory of soliton movement of superconductive features The soliton movements in condensed state systems contents

Modern Quantum Field Theory Tom Banks,2008-09-18 Presenting a variety of topics that are only briefly touched on in other texts this book provides a thorough introduction to the techniques of field theory Covering Feynman diagrams and path integrals the author emphasizes the path integral approach the Wilsonian approach to renormalization and the physics of non abelian gauge theory It provides a thorough treatment of quark confinement and chiral symmetry breaking topics not usually covered in other texts at this level The Standard Model of particle physics is discussed in detail Connections with condensed matter physics are explored and there is a brief but detailed treatment of non perturbative semi classical methods Ideal for graduate students in high energy physics and condensed matter physics the book contains many problems which help students practise the key techniques of quantum field theory

Path Integrals and Quantum Processes Mark S. Swanson,2014-02-19 Graduate level systematic presentation of path integral approach to calculating transition elements partition functions and source functionals Covers Grassmann variables field and gauge field theory perturbation theory and nonperturbative results 1992 edition

Quantum Field Theory I: Basics in Mathematics and Physics Eberhard Zeidler,2007-04-18 This is the first volume of a modern introduction to quantum field theory which addresses both mathematicians and physicists at levels ranging from advanced undergraduate students to professional scientists The book bridges the acknowledged gap between the different languages used by mathematicians and physicists For students of mathematics the author shows that detailed knowledge of the physical background helps to motivate the mathematical subjects and to discover interesting interrelationships between quite different mathematical topics For students of physics

fairly advanced mathematics is presented which goes beyond the usual curriculum in physics

Xvith International Congress On Mathematical Physics (With Dvd-rom) Pavel Exner,2010-03-31 The International Congress on Mathematical Physics is the flagship conference in this exciting field Convening every three years it gives a survey on the progress achieved in all branches of mathematical physics It also provides a superb platform to discuss challenges and new ideas The present volume collects material from the XVIth ICMP which was held in Prague August 2009 and features most of the plenary lectures and invited lectures in topical sessions as well as information on other parts of the congress program This volume provides a broad coverage of the field of mathematical physics from dominantly mathematical subjects to particle physics condensed matter and application of mathematical physics methods in various areas such as astrophysics and ecology amongst others

Classical Field Theory Horațiu Năstase,2019-03-14 Classical field theory predicts how physical fields interact with matter and is a logical precursor to quantum field theory This introduction focuses purely on modern classical field theory helping graduates and researchers build an understanding of classical field theory methods before embarking on future studies in quantum field theory It describes various classical methods for fields with negligible quantum effects for instance electromagnetism and gravitational fields It focuses on solutions that take advantage of classical field theory methods as opposed to applications or geometric properties Other fields covered includes fermionic fields scalar fields and Chern Simons fields Methods such as symmetries global and local methods Noether theorem and energy momentum tensor are also discussed as well as important solutions of the classical equations in particular soliton solutions

A Pedagogical Introduction to Electroweak Baryogenesis Graham Albert White,2016-12-07 This is an in depth look at baryon number violation in the Standard Model including the necessary background in finite temperature field theory plasma dynamics and how to calculate the out of equilibrium evolution of particle number densities throughout a phase transition It is a self contained pedagogical review of the theoretical background to electroweak baryogenesis as well as a summary of the other prevailing mechanisms for producing the asymmetry between matter and antimatter using the Minimal Supersymmetric Standard Model as a pedagogical tool whenever appropriate

Quantum Mechanics Horatiu Nastase,2022-08-04 A comprehensive modern description of Quantum Mechanics at the graduate level focused on developing the formalism and its applications

String Phenomenology 2003 Veronica Sanz,2004 This book contains a remarkable overview of the current trends in string phenomenology through the contributions of an international team of researchers who present their latest results Dedicated to the memory of the late Professor Ian Kogan this volume will fill a gap in the literature on a comprehensive overview of the subject The proceedings have been selected for coverage in Index to Scientific Technical Proceedings ISTP ISI Proceedings Index to Scientific Technical Proceedings ISTP CDRom version ISI Proceedings CC Proceedings Engineering Physical Sciences

No-Nonsense Quantum Field Theory Jakob Schwichtenberg,2020-03-22 Learning quantum field theory doesn t have to be hard What if there were a book that allowed

you to see the whole picture and not just tiny parts of it Thoughts like this are the reason that No Nonsense Quantum Field Theory now exists What will you learn from this book Get to know all fundamental concepts Grasp what a quantum field is why we use propagators to describe its behavior and how Feynman diagrams help us to make sense of field interactions Learn to describe quantum field theory mathematically Understand the meaning and origin of the most important equations the Klein Gordon equation the Dirac equation the Proca equation the Maxwell equations and the canonical commutation anticommutation relations Master important quantum field theory interactions Read fully annotated step by step calculations and understand the general algorithm we use to particle interactions Get an understanding you can be proud of Learn about advanced topics like renormalization and regularization spontaneous symmetry breaking the renormalization group equations non perturbative phenomena and effective field models No Nonsense Quantum Field Theory is one the most student friendly book on quantum field theory ever written Here s why First of all it s nothing like a formal university lecture Instead it s like a casual conversation with a more experienced student This also means that nothing is assumed to be obvious or easy to see Each chapter each section and each page focuses solely on the goal to help you understand Nothing is introduced without a thorough motivation and it is always clear where each equation comes from The book ruthlessly focuses on the fundamentals and makes sure you ll understand them in detail The primary focus on the readers needs is also visible in dozens of small features that you won t find in any other textbook In total the book contains more than 100 illustrations that help you understand the most important concepts visually In each chapter you ll find fully annotated equations and calculations are done carefully step by step This makes it much easier to understand what s going on Whenever a concept is used that was already introduced previously there is a short sidenote that reminds you where it was first introduced and often recites the main points In addition there are summaries at the beginning of each chapter that make sure you won t get lost

Earthquake Source Asymmetry, Structural Media and Rotation Effects Roman Teisseyre, Minoru Takeo, Eugeniusz Majewski, 2006-07-01 This breakthrough book is the first to examine the rotational effects in earthquakes a revolutionary concept in seismology Existing models do not yet explain the significant rotational and twisting motions that occur during an earthquake and cause the failure of structures The rotation and twist effects are investigated and described and their consequences for designing tall buildings and other important structures are presented This book will change the way the world views earthquakes

Boulevard of Broken Symmetries Adriaan M. J. Schakel, 2008 This textbook covers the main topics in contemporary condensed matter physics in a modern and unified way using quantum field theory in the functional integral approach The book highlights symmetry aspects in acknowledging that much of the collective behaviors of condensed matter systems at low temperatures emerge above a nontrivial ground state which spontaneously breaks the symmetry The emphasis is on effective field theories which provide an efficient and powerful description that is valid at long wavelengths and low frequencies In conjunction with the emphasis on effective theories a modern approach towards

renormalization is taken whereby a wavenumber cut off is introduced to set a scale beyond which the microscopic model under consideration ceases to be valid The unique and innovative character of this presentation free of historical constraints allows for a compact and self contained treatment of the main topics in contemporary condensed matter physics Path Integrals in Physics M Chaichian,A Demichev,2018-10-08 The path integral approach has proved extremely useful for the understanding of the most complex problems in quantum field theory cosmology and condensed matter physics Path Integrals in Physics Volume II Quantum Field Theory Statistical Physics and other Modern Applications covers the fundamentals of path integrals both the Wiener and Feynman types and their many applications in physics The book deals with systems that have an infinite number of degrees of freedom It discusses the general physical background and concepts of the path integral approach used followed by a detailed presentation of the most typical and important applications as well as problems with either their solutions or hints how to solve them Each chapter is self contained and can be considered as an independent textbook It provides a comprehensive detailed and systematic account of the subject suitable for both students and experienced researchers *Introduction to Gauge Field Theories* M. Chaichian,N. F. Nelipa,2012-12-06 In recent years gauge fields have attracted much attention in elementary particle physics The reason is that great progress has been achieved in solving a number of important problems of field theory and elementary particle physics by means of the quantum theory of gauge fields This refers in particular to constructing unified gauge models and theory of strong interactions between the elementary particles This book expounds the fundamentals of the quantum theory of gauge fields and its application for constructing unified gauge models and the theory of strong interactions In writing the book the authors aim was three fold firstly to outline the basic ideas underlying the unified gauge models and the theory of strong interactions secondly to discuss the major unified gauge models the theory of strong interactions and their experimental implications and thirdly to acquaint the reader with a rather special mathematical approach path integral method which has proved to be well suited for constructing the quantum theory of gauge fields Gauge fields are a vigorously developing area In this book we have selected for presentation the more or less traditional and commonly accepted material There also exist a number of different approaches which are presently being developed The most important of them are touched upon in the Conclusion

Autosolitons B.S. Kerner,V.V. Osipov,1994-05-31 This monograph is devoted to an entirely new branch of nonlinear physics solitary intrinsic states or autosolitons which form in a broad class of physical chemical and biological dissipative systems Autosolitons are often observed as highly nonequilibrium regions in slightly nonequilibrium systems in many ways resembling ball lightning which occurs in the atmosphere We develop a new approach to problems of self organization and turbulence treating these phenomena as a result of spontaneous formation and subsequent evolution of autosolitons Scenarios of self organization involve sophisticated interactions between autosolitons whereas turbulence is regarded as a pattern of autosolitons which appear and disappear at random in different parts of the system This monograph is the first

attempt to provide a comprehensive summary of the theory of autosolitons as developed by the authors over the years of research. The monograph is comprised of three more or less autonomous parts. Part I deals with the physical nature and experimental studies of autosolitons and self organization in various physical systems: semiconductor and gas plasma, heated gas mixture, semiconductor structures, composite superconductors, optical and magnetic media systems with uniformly generated combustion, matter distributed gas discharge and electronic systems. We discuss feasibility of autosolitons in the form of highly nonequilibrium regions in slightly nonequilibrium gases and semiconductors, hot and cold regions in semiconductor and gas plasmas, static pulsating and traveling combustion fronts.

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