Quantum Field Theory in Curved Spacetime-Leonard Parker 2009-08-20 Quantum field theory in curved spacetime has been remarkably fruitful. It can be used to explain how the large-scale structure of the universe and the anisotropies of the cosmic background radiation that we observe today first arose. Similarly, it provides a deep connection between general relativity, thermodynamics, and quantum field theory. This book develops quantum field theory in curved spacetime in a pedagogical style, suitable for graduate students. The authors present detailed, physically motivated, derivations of cosmological and black hole processes in which curved spacetime plays a key role. They explain how such processes in the rapidly expanding early universe leave observable consequences today, and how in the context of evaporating black holes, these processes uncover deep connections between gravitation and elementary particles. The authors also lucidly describe many other aspects of free and interacting quantized fields in curved spacetime. Quantum Field Theory in Curved Spacetime-Leonard Parker 2009-08-20 Suitable for graduate students, this book develops quantum field theory in curved spacetime in a pedagogical style. Quantum Field Theory in Curved Spacetime and Black Hole Thermodynamics-Robert M. Wald 1994-11-15 In this book, Robert Wald provides a coherent, pedagogical introduction to the formulation of quantum field theory in curved spacetime. He begins with a treatment of the ordinary one-dimensional quantum harmonic oscillator, progresses through the construction of quantum field theory in flat spacetime to possible constructions of quantum field theory in curved spacetime, and, ultimately, to an algebraic formulation of the theory. In his presentation, Wald disentangles essential features of the theory from inessential ones (such as a particle interpretation) and clarifies relationships between various approaches to the formulation of the theory. He provides a comprehensive, up-to-date account of the Unruh effect, the Hawking effect, and some of its ramifications. In particular, the subject of black hole thermodynamics, which remains an active area of research, is treated in depth. This book will be accessible to students and researchers who have had introductory courses in general relativity and quantum field theory, and will be of interest to scientists in general relativity and related fields. Aspects of Quantum Field Theory in Curved Spacetime-Stephen A. Fulling 1989-08-24 The theory of quantum fields on curved spacetimes has attracted great attention since the discovery, by Stephen Hawking, of black-hole evaporation. It remains an important subject for the understanding of such contemporary topics as inflationary cosmology, quantum gravity and superstring theory. This book provides, for mathematicians, an introduction to this field of physics in a language and from a viewpoint which such a reader should find congenial. Physicists should also gain from reading this book a sound grasp of various aspects of the theory, some of which have not been particularly emphasised in the existing review literature. The topics covered include normal-mode expansions for a general elliptic operator, Fock space, the Casimir effect, the ‘Klein’ paradox, particle definition and particle creation in expanding universes, asymptotic expansion of Green's functions and heat kernels, and renormalisation of the stress tensor. The style is pedagogic rather than formal; some knowledge of general relativity and differential geometry is assumed, but the author does supply background material on functional analysis and quantum field theory as required. The book arose from a course taught to graduate students and could be used for self-study or for advanced courses in relativity and quantum field theory. Quantum Fields in Curved Space-N. D. Birrell 1984-02-23 This book presents a comprehensive review of the subject of gravitational effects in quantum field theory. Although the treatment is general, special emphasis is given to the Hawking black hole evaporation effect, and to particle creation processes in the early universe. The last decade has witnessed a phenomenal growth in this subject. This is the first attempt to collect and unify the vast literature that has contributed to this development. All the major results are presented, and the theory is developed carefully from first principles. Here is everything that students or researchers will need to embark upon calculations involving quantum effects of gravity at the so-called one-loop approximation level. Quantum Field Theory on Curved Spacetimes-Christian Bär 2009-09-18 After some decades of work a satisfactory theory of quantum gravity is still not available; moreover, there are indications that the original field theoretical approach may be better suited than originally expected. There, to first approximation, one is left with the problem of quantum field theory on Lorentzian manifolds. Surprisingly, this seemingly modest approach leads to far reaching conceptual and mathematical problems and to spectacular predictions, the most famous one being the Hawking radiation of black holes. Ingredients of this approach are the formulation of quantum physics in terms of C*-algebras, the geometry of Lorentzian manifolds, in particular their causal structure, and linear hyperbolic differential equations where the well-posedness of the Cauchy problem plays a distinguished role, as well as more recently the insights from suitable concepts such as microlocal analysis. This primer, written by one of the prime organizers given by the editors and contributing authors to an audience of advanced graduate students and young researchers in the field, and assumes working knowledge of differential geometry and functional analysis on the part of the reader. Quantum Fields in Curved Space-N. D. Birrell 1984-02-23 Identifies information sources and shows how to develop a job search strategy. Gives valuable advice on job interviews and on how a new employee can keep his job. Quantum Field Theory in Curved Spacetime and Black Hole Thermodynamics-Robert M. Wald 1994-11-15 In this book, Robert Wald provides a coherent, pedagogical introduction to the formulation of quantum field theory in curved spacetime. He begins with a treatment of the ordinary one-dimensional quantum harmonic oscillator, progresses through the construction of quantum field theory in flat spacetime to possible constructions of quantum field theory in curved spacetime, and, ultimately, to an algebraic formulation of the theory. In his presentation, Wald disentangles essential features of the theory from inessential ones (such as a particle interpretation) and clarifies relationships between various approaches to the formulation of the theory. He also provides a comprehensive, up-to-date account of the Unruh effect, the Hawking effect, and some of its ramifications. In particular, the subject of black hole thermodynamics, which remains an active area of research, is treated in depth. This book will be accessible to students and researchers who have had introductory courses in general relativity and quantum field theory, and will be of interest to scientists in general relativity and related fields. Cosmological Applications of Algebraic Quantum Field Theory in Curved Spacetimes-Thomas-Paul Hack 2015-08-17 This book provides a largely self-contained and broadly accessible exposition on two cosmological applications of algebraic quantum field theory (QFT) in curved spacetime: a fundamental analysis of the cosmological evolution according to the Standard Model of Cosmology, and a systematic study of the perturbations in inflation. The two central sections of the book are preceded by sections providing a pedagogical introduction to the subject. Introductory material on the construction of linear QFTs on general curved spacetimes with and without gauge symmetry in the algebraic approach, physically meaningful quantum states on general curved spacetimes, and the backreaction of quantum fields in curved spacetimes via the semiclassical Einstein equation is also given. The reader should have a basic understanding of General Relativity and QFT on Minkowski spacetime, but no background in QFT on curved spacetimes or the algebraic approach to QFT is required.> Semiclassical and Stochastic Gravity-Bei-Lok B. Hu 2020-01-31 An overview of semi-classical gravity theory and stochastic gravity as theories of quantum gravity in curved space-time. Introduction to Quantum Effects in Gravity-Vitacheslav Mukhanov 2007-06-14 Publisher description Advances in Algebraic Quantum Field Theory-Romeo Brunetti 2015-05-04 This text focuses on the algebraic formulation of quantum field theory, from the introductory aspects to the applications to concrete problems of physical interest. The book is divided in thematic chapters covering both introductory and more advanced topics. These include the algebraic, perturbative approach to interacting quantum field theories, algebraic quantum field theory on curved spacetimes (from its structural aspects to the applications in cosmology and to the role of quantum spacetimes), algebraic conformal field theory, the Kitaev's quantum double model, the decay of gravitational waves and the construction of algebraic quantum field theory. Path Integrals and Anomalies in Curved Space-Firenzo Battistelli 2006-07-20 Path integrals provide a powerful method for describing quantum phenomena. This book introduces the quantum mechanics of particles that move in curved space by employing path integrals and then using them to compute anomalies in quantum field theories. The authors start by deriving path integrals for particles moving in curved space and their symmetries. They then discuss the regularization schemes essential to constructing and computing these path integrals. This topic is used to introduce regularization and renormalization in quantum field theories in a wider context. These methods are then applied to discuss and calculate anomalies in quantum field theory. Such anomalies provide enormous constraints in the search for physical theories of elementary particles, quantum gravity and string theories. An advanced text for researchers and graduate students of quantum field theory and string theory, the first part is also a stand-alone introduction to path integrals in quantum mechanics.
Differential Topology and Quantum Field Theory: Charles Nash 1991 The remarkable developments in differential topology and how these recent advances have been applied as a primary research tool in quantum field theory are presented here in a style reflecting the genuinely two-sided interaction between mathematical physics and applied mathematics. The author, following his previous work (Nash/Sen: Differential Topology for Physicists, Academic Press, 1986), covers elliptic theory, topological quantum field theory, string theory, and knot theory. The explanatory approach serves to illuminate and clarify these theories for graduate students and research workers entering the field for the first time. Treats differential geometry, differential topology, and quantum field theory includes elliptic differential and pseudo-differential operators, Atiyah-Singer index theory, topological quantum field theory, string theory, and knot problems of quantum field theory using differential topology as a tool. Quantum Field Theory Of Point Particles And Strings-Juan Mattingly 2018-09-29 First Published in 2018. Routledge is an imprint of Taylor & Francis, an Informa company.

Effective Action in Quantum Gravity-Y.L. Buchbinder 2017-09-29 In part one of Effective Action in Quantum Gravity, the book describes the principles of quantum field theory and the significance of and theory behind effective action. Part two deals with quantum field theory in curved space-time and the effective action that is obtained in this way. Further it neighbourhood of the classical regimes is often dominated by travelling wave solutions, which plays a major role. The book assumes only a basic understanding of quantum field theory and general relativity and will be of interest to postgraduate students and researchers in theoretical high-energy physics and gravitational theory. Quantum Mechanics in Curved Space-Time-Jürgen Audretsch 2012-12-06 Quantum mechanics and quantum field theory on one hand and Gravity as a theory of curved space-time on the other are the two great conc.-tual schemes of modern theoretical physics. For many decades they have lived peacefully together for one simple reason: it was a coexistence w- out much interaction. There has been the familiar of relativists and the other family of elementary particle physicists and both sides have been convinced that their problems have not very much to do with the problems of the respective other side. This was a situation which could not last forever, because the two theoretical schemes have a particular structural trait in common: their claim for totality and universality. Namely on all one hand all physical theories have to be formulated in a quantum mechanical manner, and on the other hand gravity as curved space-time influences all processes and vice versa. It is the lack of interaction between both relevant domains of application would attract a general inter- est, which demand a combined application of both theoretical schemes. But it is immediately obvious that such an application of both schemes is - possible if the schemes are taken as they are. Something new is needed which reconciles gravity and quantum mechanics. During the last two de- des we are now doing the first steps towards this more general theory and we are confronted with fundamental difficulties.

Perturbative Algebraic Quantum Field Theory-Kasia Rzeczner 2016-03-14 What is quantum field theory? It is a successful and conceptually coherent framework, a road map for the understanding of the physical world at the fundamental level. This book presents the algebraic approach to this subject. The emphasis is on how to construct a consistent quantum field theory. A. Zee also provides added exercises, explanations, and examples, as well as detailed appendices, solutions to selected exercises, and suggestions for further reading. The most accessible and comprehensive introductory textbook available Features a fully revised, updated, and expanded text Covers the latest exciting advances in the field Includes new exercises Offers a one-of-a-kind resource for students and researchers Leading universities that have adopted this book include: Arizona State University Boston University Brandeis University Brown University California Institute of Technology Carnegie Mellon College of William & Mary Cornell University Harvard University Massachusetts Institute of Technology Northwestern University Ohio State University Princeton University Purdue University - Main Campus Rensselaer Polytechnic Institute Rutgers University - New Brunswick Stanford University University of California - Berkeley University of Central Florida University of Chicago University of Texas University of Virginia University of Wisconsin University of Wisconsin - Madison Also useful to physicists interested in the following are included in this book: Cosmological Applications of Algebraic Quantum Field Theory in Curved Spacetimes-Thomas-Paul Hack 2015-07-22 This book provides a largely self-contained and broadly accessible exposition on two cosmological applications of algebraic quantum field theory (QFT) in curved spacetime: a fundamental analysis of the cosmological evolution according to the Standard Model of Cosmology; and a fundamental study of the perturbations in inflation. The two central sections of the book deal with these applications are preceded by sections providing a pedagogical introduction to the subject. Introductory material on the construction of linear QFTs on general curved spacetimes with and without gauge symmetry in the algebraic approach, physically meaningful quantum states on general curved spacetimes, and the backreaction of quantum fields in curved spacetimes via the semiclassical Einstein equation is also given. The reader should have a basic understanding of General Relativity and QFT on Minkowski spacetime, but no background in QFT on curved spacetimes or the algebraic approach to QFT is required. The book is written for graduate students and researchers and is largely self-contained. The book aims to be accessible to researchers and graduate students, who are interested in the mathematical foundations of QFT.
the axiomatic framework, QFT on models of curved spacetimes, QFT on noncommutative Minkowski spacetime.

A Modern Introduction to Quantum Field Theory-Michele Maggiore 2005 The importance and the beauty of modern quantum field theory resides in the power and variety of its methods and ideas, which find application in domains as different as particle physics, cosmology, condensed matter, statistical mechanics and critical phenomena. This book introduces the reader to the modern developments in a manner which assumes no previous knowledge of quantum field theory. Along with standard topics like Feynman diagrams, the book discusses effective lagrangians, renormalization group equations, the path integral formulation, spontaneous symmetry breaking and non-abelian gauge theories. The inclusion of more advanced topics will also make this a most useful book for graduate students and researchers.

Quantum Field Theory in Curved Space-time-A. H. Najmi 1982

Beyond Einstein-David E. Rowe 2018-06-28 Beyond Einstein: Perspectives on Geometry, Gravitation, and Cosmology explores the rich interplay between mathematical and physical ideas by studying the interactions of major actors and the roles of important research communities over the course of the last century.
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