

Relativistic Equation of Motion for Spin 0 Particle

Relativistic energy-momentum relationship

$$E^2 - \mathbf{p}^2 c^2 = m^2 c^4 \Rightarrow p^\mu p_\mu - m^2 c^2 = 0$$

With four vector notation of quantum prescriptions;

$$p_\mu \rightarrow \frac{\hbar}{i} \partial_\mu \quad \text{where} \quad \partial_\mu = \frac{\partial}{\partial x^\mu}; \quad \left(\partial_0 = \frac{1}{c} \frac{\partial}{\partial t}, \quad \partial_1 = \frac{\partial}{\partial x}, \quad \partial_2 = \frac{\partial}{\partial y}, \quad \partial_3 = \frac{\partial}{\partial z} \right)$$

Relativistic equation of motion for field, ψ , the Klein-Gordon Equation

$$-\hbar^2 \partial_\mu \partial^\mu \Psi - m^2 c^2 \Psi = 0$$

2nd order
in time

$$-\frac{1}{c^2} \frac{\partial^2 \Psi}{\partial t^2} + \nabla^2 \Psi = \left(\frac{mc}{\hbar} \right)^2 \Psi$$



Relativistic Particle Physics

Joseph Conlon



Relativistic Particle Physics:

Relativistic Particle Physics H. M. Pilkuhn, 2014-01-15 Relativistic Particle Physics Hartmut M. Pilkuhn, 1979

Lecture Notes on Theoretical Approaches to Relativistic Particle Physics Robert Karplus, 1963 Gauge Theories in Particle Physics: A Practical Introduction Ian J R Aitchison, Anthony J.G. Hey, 2012-12-17 Volume 1 of this revised and updated edition provides an accessible and practical introduction to the first gauge theory included in the Standard Model of particle physics quantum electrodynamics QED The book includes self contained presentations of electromagnetism as a gauge theory as well as relativistic quantum mechanics It provides a unique elementary introduction to quantum field theory establishing the essentials of the formal and conceptual framework upon which the subsequent development of the three gauge theories is based The text also describes tree level calculations of physical processes in QED and introduces ideas of renormalization in the context of one loop radiative corrections for QED New to the Fourth Edition New chapter on Lorentz transformations and discrete symmetries in relativistic quantum mechanics with physical applications Introduction of Majorana fermions at an early stage making the material suitable for a first course in relativistic quantum mechanics Discrete symmetries in quantum field theory Updates on nucleon structure functions and the status of QED The authors discuss the main conceptual points of the theory detail many practical calculations of physical quantities from first principles and compare these quantitative predictions with experimental results helping readers improve both their calculation skills and physical insight *From Special Relativity to Feynman Diagrams* Riccardo D'Auria, Mario Trigiante, 2015-10-06 This book now in its second edition provides an introductory course on theoretical particle physics with the aim of filling the gap that exists between basic courses of classical and quantum mechanics and advanced courses of relativistic quantum mechanics and field theory After a concise but comprehensive introduction to special relativity key aspects of relativistic dynamics are covered and some elementary concepts of general relativity introduced Basics of the theory of groups and Lie algebras are explained with discussion of the group of rotations and the Lorentz and Poincar groups In addition a concise account of representation theory and of tensor calculus is provided Quantization of the electromagnetic field in the radiation range is fully discussed The essentials of the Lagrangian and Hamiltonian formalisms are reviewed proceeding from systems with a finite number of degrees of freedom and extending the discussion to fields The final four chapters are devoted to development of the quantum field theory ultimately introducing the graphical description of interaction processes by means of Feynman diagrams The book will be of value for students seeking to understand the main concepts that form the basis of contemporary theoretical particle physics and also for engineers and lecturers An Appendix on some special relativity effects is added **Relativity, Groups, Particles** Roman U. Sexl, Helmuth K. Urbantke, 2012-12-06 Like many textbooks the present one is the outgrowth of lecture courses mainly given at the University of Vienna Austria on the occasion of the English edition it may be mentioned that our first such lecture course was delivered by my late co author Roman U Sexl

during the fall and winter term 1967-68 in the USA more precisely at the University of Georgia Athens Since then Particle Physics has seen spectacular revolutions but its relativistic symmetry has never been shaken On the other hand new technological developments have enabled applications like the GPS Global Positioning System that in a sense brought Relativity to the domain of everyday use The purpose of the lecture courses and thus of the book is to fill a gap that the authors feel exists between the way Relativity is presented in introductory courses on mechanics and or electrodynamics on the one hand and the way relativistic symmetry is presented in particle physics and field theory courses on the other The reason for the gap is a natural one too many other themes have to be addressed in the introductory courses and too many applications are impatiently waiting for their presentation in the particle and field theory courses

Relativistic Quantum Mechanics Luciano Maiani, Omar Benhar, 2015-11-18 Written by two of the most prominent leaders in particle physics *Relativistic Quantum Mechanics An Introduction to Relativistic Quantum Fields* provides a classroom tested introduction to the formal and conceptual foundations of quantum field theory Designed for advanced undergraduate and graduate level physics students the text only requires p

Three-particle Physics And Dispersion Relation Theory A V

Anisovich, Vladimir Vladislavovich Anisovich, M A Matveev, V A Nikonov, Julia Nyiri, A V Sarantsev, 2013-03-25 The necessity of describing three nucleon and three quark systems have led to a constant interest in the problem of three particles The question of including relativistic effects appeared together with the consideration of the decay amplitude in the framework of the dispersion technique The relativistic dispersion description of amplitudes always takes into account processes connected with the investigated reaction by the unitarity condition or by virtual transitions in the case of three particle processes they are as a rule those where other many particle states and resonances are produced The description of these interconnected reactions and ways of handling them is the main subject of the book

Relativistic Quantum Mechanics and Field Theory Franz Gross, 2008-07-11 An accessible comprehensive reference to modern quantum mechanics and field theory In surveying available books on advanced quantum mechanics and field theory Franz Gross determined that while established books were outdated newer titles tended to focus on recent developments and disregard the basics *Relativistic Quantum Mechanics and Field Theory* fills this striking gap in the field With a strong emphasis on applications to practical problems as well as calculations Dr Gross provides complete up to date coverage of both elementary and advanced topics essential for a well rounded understanding of the field Developing the material at a level accessible even to newcomers to quantum mechanics the book begins with topics that every physicist should know quantization of the electromagnetic field relativistic one body wave equations and the theoretical explanation of atomic decay Subsequent chapters prepare readers for advanced work covering such major topics as gauge theories path integral techniques spontaneous symmetry breaking and an introduction to QCD chiral symmetry and the Standard Model A special chapter is devoted to relativistic bound state wave equations an important topic that is often overlooked in other books Clear and concise throughout *Relativistic Quantum Mechanics and*

Field Theory boasts examples from atomic and nuclear physics as well as particle physics and includes appendices with background material. It is an essential reference for anyone working in quantum mechanics today. Relativistic Quantum Mechanics and Introduction to Quantum Field Theory Anton Z. Capri, 2002. This invaluable textbook is divided into two parts. The first part includes a detailed discussion on the discrete transformations for the Dirac equation as well as on the central force problem for the Dirac equation. In the second part the external field problem is examined, pair production and vacuum polarization leading to charge renormalization are treated in detail. Relativistic Quantum Mechanics and Introduction to Quantum Field Theory has arisen from a graduate course which the author taught for several years at the University of Alberta to students interested in particle physics and field theory. *Lecture Notes on Theoretical Approaches to Relativistic Particle Physics* R. Karplus, 1963. On Nonlocal Theories in Relativistic Particle Physics Robert Marnelius, 1974.

Relativistic Quantum Physics Tommy Ohlsson, 2011-09-22. Quantum physics and special relativity theory were two of the greatest breakthroughs in physics during the twentieth century and contributed to paradigm shifts in physics. This book combines these two discoveries to provide a complete description of the fundamentals of relativistic quantum physics, guiding the reader effortlessly from relativistic quantum mechanics to basic quantum field theory. The book gives a thorough and detailed treatment of the subject, beginning with the classification of particles, the Klein-Gordon equation and the Dirac equation. It then moves on to the canonical quantization procedure of the Klein-Gordon, Dirac and electromagnetic fields. Classical Yang-Mills theory, the LSZ formalism, perturbation theory, elementary processes in QED are introduced, and regularization, renormalization and radiative corrections are explored. With exercises scattered through the text and problems at the end of most chapters, the book is ideal for advanced undergraduate and graduate students in theoretical physics.

Why String Theory? Joseph Conlon, 2016-08-19. Provides the only modern popular science account of string theory accessible to a general audience. Covers a wide range of contemporary mathematics and describes the big picture of known physics. Addresses applications and criticisms of string theory. **Interactions** Anders Bengtsson, 2023-09-05. This book is an introduction to the theory of interacting higher spin gauge fields. It describes in a pedagogical way the methods used and the results obtained within the three major approaches to the subject: the Dirac light front theory, the Fronsdal covariant approach and the Vasiliev AdS theory. Abstract concepts and methods unifying the various approaches are pointed out. The book follows the ideas behind the first volume, explains the mathematical concepts and tools used while also reviewing the history of the subject. *Library of Congress Subject Headings* Library of Congress. Cataloging Policy and Support Office, 2009. Library of Congress Subject Headings Library of Congress, Library of Congress. Subject Cataloging Division, Library of Congress. Office for Subject Cataloging Policy, 2013. **Scientific and Technical Aerospace Reports**, 1994. *Nuclear Science Abstracts*, 1974-07. **Third Paris Cosmology Colloquium - Proceedings Of The Third Paris Cosmology Colloquium Within The Framework Of The International School Of Astrophysics** H J De Vega, Normalized

Sanchez,1996-02-16 The purpose of this meeting was to cover selected topics of high current interest in the interplay between cosmology and fundamental physics It brought together physicists astrophysicists and astronomers and allowed easy and fruitful mutual contacts and communication among them Topics covered this year include phase transitions in cosmology and evolution out of the equilibrium of quantum fields fundamental strings and cosmic strings in cosmology dark matter and large scale structure black holes and quantum gravity

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