

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

Robert Karplus



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

Special Relativity Mohammad Saleem, Muhammad Rafique, 1992 Following an introduction to the basic theory of special relativity this volume explores the influence of special relativity in the fields of mechanics and electromagnetism The authors discuss the vital role of tensor formulation of electromagnetism in synthesizing various physical concepts

Three-particle Physics and Dispersion Relation Theory A. V. Anisovich, 2013 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** 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 **Lecture**

Notes on Theoretical Approaches to Relativistic Particle Physics R. Karplus, 1963 **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

The Enigmatic Realm of **Relativistic Particle Physics**: Unleashing the Language is Inner Magic

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