E. S. Fradkin D. M. Gitman
S. M. Shvartsman

Quantum Electro-dynamics

with Unstable Vacuum

Quantum Electrodynamics With Unstable Vacuum With 12 Figures Springer Series In Nuclear And Particle Physics

Walter Dittrich,Holger Gies

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Quantum Electrodynamics Efim Samoĭlovich Fradkin,D. M. Gitman,Shmariㅤuㅤ Mordkovich Shvartㅤsㅤman,1991 This book contains a systematic analysis of the formalisms of quantum electro dynamics in the presence of an intense external field able to create pairs from the vacuum and thereby violate the stability of the latter The approach developed is not specific to quantum electrodynamics and can equally well be applied to any quantum field theory with an unstable vacuum It should be noted that only macroscopic external fields are considered whereas problems associated with the superstrong Coulomb micro field are not treated As a rule the discussion is confined to those details of the formalism and calculations that are specific to the instability property For instance renormalization is not discussed here since in practical calculations it is carried out according to standard methods The presentation is based mainly on original research undertaken by the authors Chapter 1 contains a general introduction to the problem It also presents some standard information on quantum electrodynamics which will be used later in the text In addition an interpretation of the concept of an external field is given and the problems that arise when one tries to keep the interaction with the external field exactly are discussed In Chapter 2 the perturbation expansion in powers of the radiative interac tion is developed for the matrix elements of transition processes taking the arbitrary external field into account exactly **American Book Publishing Record** ,1991 **Whitaker's Book List** ,1991 *Physics Briefs* ,1990 **INIS Atomindex** ,1980 **Quantum Electrodynamics** E.S. Fradkin,D.M. Gitman,S.M. Shvartsman,1991 This book contains a systematic analysis of the formalisms of quantum electro dynamics in the presence of an intense external field able to create pairs from the vacuum and thereby violate the stability of the latter The approach developed is not specific to quantum electrodynamics and can equally well be applied to any quantum field theory with an unstable vacuum It should be noted that only macroscopic external fields are considered whereas problems associated with the superstrong Coulomb micro field are not treated As a rule the discussion is confined to those details of the formalism and calculations that are specific to the instability property For instance renormalization is not discussed here since in practical calculations it is carried out according to standard methods The presentation is based mainly on original research undertaken by the authors Chapter 1 contains a general introduction to the problem It also presents some standard information on quantum electrodynamics which will be used later in the text In addition an interpretation of the concept of an external field is given and the problems that arise when one tries to keep the interaction with the external field exactly are discussed In Chapter 2 the perturbation expansion in powers of the radiative interac tion is developed for the matrix elements of transition processes taking the arbitrary external field into account exactly **Quantum Electrodynamics of Strong Fields** Greiner W. Hold,2013-06-29 The NATO Advanced Study Institute on Quantum Electrodynamics of Strong Fields was held at Lahnstein on the Rhine from 15 26 June 1981 The school was devoted to the advances theoretical and

exper imental in the physics of strong fields made during the past decade The topic of the first week was almost exclusively quantum electrodynamics with discussions of symmetry breaking in the ground state of the physics of heavy ion collisions and of precision tests of perturbative quantum electrodynamics This was followed in the second week by the presentation of a broad range of other areas where strong fields occur reaching from nuclear physics over quantum chromodynamics to gravitation theory and astrophysics We were fortunate to be able to call on a body of lecturers who not only have made considerable personal contributions to these advances but who are also noted for their lecturing skills Their dedication for their subject was readily transmitted to the stu dents resulting in a very successful school This enthusiasm is also reflected in their contributions to these Proceedings which as I believe will in time become a standard source of reference for future work on the physics of strong fields and will help to spread the benefits of the school to a larger audience than those who were able to attend I regret that the Soviet colleagues Ya B Zeldovich and V S Popov were unable to participate *Quantum Electrodynamics* Gunnar Källén,1972 Kallen s Quantenelektrodynamik provides a concise treatment of the subject Its strong points are the careful attention to ex planatory detail the methodical coverage of all the maj or results and the straightforward lucid style Certainly it will be a val uable reference for one learning the subject or for one who re quires the details of the practical results Of course modern quantum field theory has now grown far beyond its dramatic be ginnings in electrodynamics and we have therefore included some references to introduce the reader to the more recent and more specialized literature We have corrected some minor errors we would appreciate it if readers would inform us of any others which they find We thank Professors Paul Urban and C MtSller for permission to use the biographical material on Kallen We also wish to thank Springer Verlag for undertaking publication of this edition by an unorthodox method but one which will reduce the cost to the reader In particular we are grateful to Dr H Mayer Kaupp and Mr Herb Stillman for their kind cooperation Finally we thank Mr Michael Teague for reading and commenting on the first dozen sections and we thank Mrs Joanne Downs for ed iting and typing the final manuscript May 1972 C K Iddings M Mizushima Department of PhysiCS and Astrophysics University of Colorado Boulder Colorado 80302 IN MEMORIAM PROFESSOR GUNNAR KALLEN On October 13 1968 Professor Gunnar Kallen of the University of Lund Sweden died in an airplane accident near Hanover *Probing the Quantum Vacuum* Walter Dittrich,Holger Gies,2003-07-01 This book is devoted to an investigation of the vacuum of quantum elec trodynamics QED relying on the perturbative effective action approach If the vacuum is probed with external perturbations the response of the system can be analyzed after averaging over the high energy degrees of freedom This results in an effective description of the properties of the vacuum which are comparable to the properties of a classical medium We concentrate primarily on the physics of slowly varying fields or soft photons by integrating out the high energy degrees of freedom i e the elec trons employing Schwinger s proper time method We derive a new represen tation of the one loop photon polarization tensor coupling to all orders to an arbitrary constant electromagnetic field fully maintaining the

dependence on the complete set of invariants On the basis of effective Lagrangians we derive the light cone condition for low frequency photons propagating in strong fields Our formalism can be extended to various external perturbations such as temperature and Casimir situations We give a proof of the unified formula for low energy phenom ena that describes the refractive indices of various perturbed quantum vacua In the high energy domain we observe similarities between a vacuum with a superstrong magnetic field and a magnetized plasma The question of mea surability of the various effects is addressed a violation of causality is not found   *Quantum Electrodynamics* Greiner Walter,Joachim Reinhardt,1994   **Quantum Electrodynamics** Gunnar Källen,2014-03-12 Kallen s Quantenelektrodynamik provides a concise treatment of the subject Its strong points are the careful attention to ex planatory detail the methodical coverage of all the maj or results and the straightforward lucid style Certainly it will be a val uable reference for one learning the subject or for one who re quires the details of the practical results Of course modern quantum field theory has now grown far beyond its dramatic be ginnings in electrodynamics and we have therefore included some references to introduce the reader to the more recent and more specialized literature We have corrected some minor errors we would appreciate it if readers would inform us of any others which they find We thank Professors Paul Urban and C MtSller for permission to use the biographical material on Kallen We also wish to thank Springer Verlag for undertaking publication of this edition by an unorthodox method but one which will reduce the cost to the reader In particular we are grateful to Dr H Mayer Kaupp and Mr Herb Stillman for their kind cooperation Finally we thank Mr Michael Teague for reading and commenting on the first dozen sections and we thank Mrs Joanne Downs for ed iting and typing the final manuscript May 1972 C K Iddings M Mizushima Department of PhysiCS and Astrophysics University of Colorado Boulder Colorado 80302 IN MEMORIAM PROFESSOR GUNNAR KALLEN On October 13 1968 Professor Gunnar Kallen of the University of Lund Sweden died in an airplane accident near Hanover   *New Aspects of Quantum Electrodynamics* Akitomo Tachibana,2017-02-08 This book presents new aspects of quantum electrodynamics QED a quantum theory of photons with electrons from basic physics to physical chemistry with mathematical rigor Topics covered include spin dynamics chemical reactivity the dual Cauchy problem and more Readers interested in modern applications of quantum field theory in nano bio and open systems will enjoy learning how the up to date quantum theory of radiation with matter works in the world of QED In particular chemical ideas restricted now to nonrelativistic quantum theory are shown to be unified and extended to relativistic quantum field theory that is basic to particle physics and cosmology realization of the new generation quantum theory Readers are assumed to have a background equivalent to an undergraduate student s elementary knowledge in electromagnetism quantum mechanics chemistry and mathematics   *Quantum Electrodynamics, 3E* Greiner,2004-01-01   **Quantum Electrodynamics** Walter Greiner,Joachim Reinhardt,1992   Probing the Quantum Vacuum Walter Dittrich,Holger Gies,2014-01-15   **Quantum Electrodynamics of Strong Fields** Professor at the Institute of Theoretical Physics Walter Greiner,B Muller,J Rafelski,1985-10-01

Quantum Electrodynamics and Quantum Optics A. O. Barut,1984 The borderline of quantum electrodynamics and quantum optics offer spectacular results and problems concerning the foundations of radiation theory Perhaps the major new viewpoint that has emerged from recent investigations is that one can now work inside a time dependent quantum process whereas up to now all elementary quantum processes were either stationary or one worked with asymptotic in and out states i e an S matrix approach In the rirst part of this volume the Quantum Electrodynamics the present status of the main approaches to this most accurate of all physical theories are discussed the Hamiltonian approach the Green s function approach with particular emphasis to bound state problems and the newer nonperturbative approach The latest numerical results on radiative corrections Lamb shifts and anomalous magnetic moments are reviewed with new results for high Z atoms Also discussed are different theoretical interpretations of the radiative phenomena as due to quantized field vacuum fluctuations or due to self energy A small group of contributions are devoted to the physics and mathematical description of decaying or unstable states in quantum theory This remarkable phenomenon of quantum theory still needs complete clarification it is a time dependent phenomenon which can be described also by asymptotic S matrix methods but with complex energies   Quantum Electrodynamics Walter Greiner,1989   *Quantum Electrodynamics* Vladimir N. Gribov,2001

Vacuum Structure in Intense Fields H.M. Fried,Berndt Muller,2012-12-06 This Advanced Study Institute ASI brought together two distinct schools of approach to Quantum Electrodynamics QED in the presence of intense external electromagnetic fields in an effort to lay a joint foundation for a needed theoretical explanation of the sharp e e resonances observed in the scattering of very heavy IOns These GSI Darmstadt experiments whose history latest reconfirmations and most recent data were presented in three opening sessions Bokemeyer Koenig show a smooth background of positron e production as a function of e kinetic energy Superimposed upon this background are four very sharp peaks of narrow widths 30 KeV and of clear experimental significance 5 standard deviations Most ofthese peaks correspond to sharp essentially back to back electron positron emission in the ions center of mass Following the approach of supercritical potential theory SPT where the total ionic charge unit Z satisfies Z 137 it has been possible to provide a detailed and apparently correct understanding of the smooth e e background a coherent description of different facets of this approach emphasizing the nature of the charged supercritical vacuum was described by the authors responsible for the invention of SPT Greiner Muller Rafelski In addition predictions for related phenomena were outlined by other lecturers using the SPT approach Bawin Soff SsJrensen

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