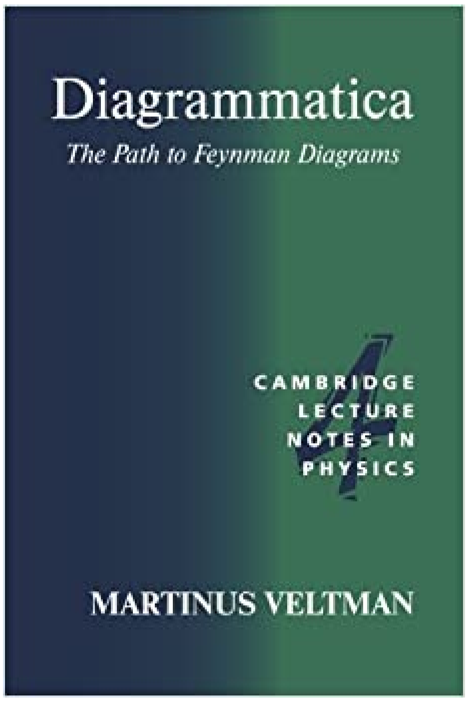
Diagrammatica: The Path To Feynman Diagrams (Cambridge Lecture Notes In Physics)



Synopsis

This book provides an easily accessible introduction to quantum field theory via Feynman rules and calculations in particle physics. The aim is to make clear what the physical foundations of present day field theory are, to clarify the physical content of Feynman rules, and to outline their domain of applicability. The book begins with a brief review of some aspects of Einstein's theory of relativity that are of particular importance for field theory, before going on to consider the relativistic quantum mechanics of free particles, interacting fields, and particles with spin. The techniques learned in the chapters are then demonstrated in examples that might be encountered in real accelerator physics. Further chapters contain discussions on renormalization, massive and massless vector fields and unitarity. A final chapter presents concluding arguments concerning quantum electrodynamics. The book includes valuable appendices that review some essential mathematics, including complex spaces, matrices, the CBH equation, traces and dimensional regularization. An appendix containing a comprehensive summary of the rules and conventions used is followed by an appendix specifying the full Lagrangian of the Standard Model and the corresponding Feynman rules. To make the book useful for a wide audience a final appendix provides a discussion on the metric used, and an easy to use dictionary connecting equations written with different metric. Written as a textbook, many diagrams and examples are included.

Book Information

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Customer Reviews

"...a masterful introduction to quantum field theory and its application to elementary particle physics through Feynman diagrams. The approach is constructive rather than deductive, and the book offers many fine insights into the physics content of results that may be thought of as purely mathematical." Ernest Ma and Jose Wudka, Physics Today"...would be a useful and solid starting point for a novice field theorist..." R. Delbourgo, Mathematical Reviews

Providing an easily accessible introduction to quantum field theory via Feynman rules and calculations in particle physics, the aim of this text is to clarify the physical foundations of present day field theory and the physical content of Feynman rules, and to outline their domain of applicability.

This book takes any engineer with a feel for Maxwell's equations and a little common sense about Schroedinger's equation into the promissed land of quantum field theory.Veltman spends a lot of time helping the reader get his or her head wrapped around the idea of Hilbert space. This cleared my head for what was to follow.It is one of the few books that does not assume you already know the subject. I recommend it for electrical engineers like myself. No idea is hard to understand when the author values communicating notions over notation!Five stars for Martinus Veltman!

very clearly written in an easy to understand approach,this is a fascinating area important to particle physics. The understanding of a complex topic

Martinus Veltman, how best to characterize his work ?Probably, as with Feynman, characterizations always fall somewhat short of the mark.(The mark falls somewhere between Mandl & Shaw and Peskin & Schroeder).Let us read from the Master:" Perturbation Theory means Feynman Diagrams." (First Page of the Introduction)." Apparently, in Quantum Mechanics, the Potential becomes something like the Photon Wave Function." (Page 11)." What is a physical state ?...A physical state is simply a possible physical situation." (Page 33)." A particle with four states is really nothing else but four different particles..." (Page 71)." The important thing is how fields transform ....we will define locality as a mathematical property..." (Page 80-81)." The physically important quantities,however, are not the fields, but the interaction Hamiltonian." (Page 84)." Pion decay and PCAC make up one of the most interesting subjects of particle physics, it has playeda very large role in the discovery of gauge theories..." (Page 124)." The choice as to what kind of field describes an observed particle is really a matter of choice; try what kindof field describes best the observed data." (Page 169)." The limit of zero mass of a massive graviton is not equal to the zero mass case;

and from the experimentalobservations one may actually deduce that the massless graviton is what nature uses." (Page 177)." So, keep this in mind: A theory with massless vector particles, such as quantum electrodynamics,or quantum chromodynamics, must have gauge invariance else the theory is not Lorentz Invariant." (Page 179)." For all practical purposes, the Feynman Rules represent the true content of a theory." (Page 183).The book is intended as somewhat of an introduction. Indeed,plenty of intermediate steps are includedin the calculations and this serves the student in good stead. The interspersed Exercises are usually straightforward.(Exercise#6.4, Page 148 is typical--a routine,short,calculation left to the reader--here, the section on Power Counting).Hints are supplied for a number of Exercises. Appendix A provides mathematical supplement pertaining to Matrices.Appendix C provides a basic introduction to Dimensional Regularization. As for "Feynman's trick" for Integrals: here,(Page 139) surprisingly, the author supplies details for what amounts to a rather elementary exercise for the reader !Earlier on, contour integral techniques are utilized (For example, see Page 64 regarding Bound States).Also, one must--as is usual at this level--be conversant with Fourier Transforms (see Page 66).Finally, I quote Veltman's specific goal:"...to make it clear which principles are behind the rules, and to define clearly the calculational details."And, this is a goal which has been admirably achieved.Upon careful study, one finds this book to be replete with words of wisdom plus technical tools of the trade.Don't forget to follow up with: Quantum Theory of Gravitation, from 1975 Methods In Field Theory:"In these lectures we will approach the theory of Gravitation from the point of view of Quantum Field Theory."

This is a QFT book written by a physicist (Veltman is one of the1999 Physics Nobel prize winners) for physicists. Mathematicalrigour was definitely not one of Veltman's major concerns when hewrote this book. However clarity was indeed a big issue for himand that is most unusual if you take into account that most Nobelprize awarded physicist, are usually much more concerned about"image", "posterity" and "mathematical rigour" than bypedagogical matters.This book is a very good one to start with if you want to learnQFT. It makes no use of the path integral formalism (which is theprefered one by "modern" QFT theorists) . The canonicalformalism (the one used in this book) makes explicit the localnature of QFT; this is an important issue since locallity stemsfrom Lorentz invariance and QFT is nothing but the physicaltheory resulting from quantum mechanics and restrictedrelativity. I fully agree with the statement that the pathintegral method should be sistematically discarded inintroductory QFT books like this one.As its title indicates, Feynman diagrams are the central issue ofthis book. Veltman explains in the introduction: "This is thenthe aim: to make it clear which principles are behind the(Feynman) rules and to define clearly the calculation details".This seems to be the natural choice for such an introductorytext; quoting Veltman again: " ... the theory (meaning QFT), orrather the succesful part (of it), is perturbation theory ...Perturbation theory means Feynman diagrams ".This book provides a clear logical frame that supports thecalculation machinery of perturbative QFT’s and should berecommended to any person willing to introduce himself/herself inQuantum Field Theory as a first choice course book.Taking into account that this is an introductory book, itsshort extension (200 pages) its scope is limited to QED and noserious attempt is made to treat non-abelian theories.One minor (for me it is minor, since my english is also ratherpoor) annoyance: Even I (my mother tonge is spanish) can seethat the writing style is not very good and that some of the usedexpressions are nothing more that literal translations from dutchinto english.

This is a book on quantum field theory using, much more than what is usual, the language of Feynman diagrams, which are pictorial-analytic expressions for terms of the perturbative series for S-matrix elements. Several years ago what could be considered a cruder version of this book circulated widely as a Yellow Report from CERN. It was an admirable text, from which most of us learned how to write the Feynman rules for gauge theories in exotic gauges, and how to renormalize everything by using the dimensional methods. Now comes the book version, polished so that beginners can use it, and with a little more tissue connecting the bones. The Yellow Report was called Diagrammar and became something of a religion. Perusing the book I see no reason why it should not have a comparable success. I particularly admire the graphic derivation of the Ward identities and the (also graphical) treatment of unitarity, very difficult to find antwhere else. The author, Veltman, is a great! authority in Field Theory and a fantastic teacher.

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