Quantum Field Theory Textbooks

There are probably an overabundance of quantum field theory texts, reflecting the difficult nature of teaching the subject, and new ones appear every few years. In general the newer the textbook the better although there are 'classic' books which cover material that newer books skip over. I recommend searching on Amazon, and reading the reviews to find a book appropriate to the student's taste and preparation. Below I will start by listing the quantum field theory textbooks that I own (in rough chronological order of my ownership) along with some comments.

Relativistic Quantum Mechanics and Relativistic Quantum Fields Bjorken & Drell - This classic two volume work published 1964, was still being used for the first two quarters of a year long course when I was at Caltech in 1984. It was written at a time when the success/usefulness of QFT was being questioned (strong interactions) and other approaches (s-matrix, Regge poles etc.) were being championed. Consequently the first volume concentrates on Feynman diagrams, and uses a propagator (Green's function) approach. Thus RQM is an excellent reference on the Dirac and Klein-Gordon equations, and on classic Feynman diagram calculations that are frequently relegated to the exercises in newer books. RQF is a straightforward canonical quantization approach to QFT. The second half of the book may be outdated but covers in detail dispersion relations, and a proof of the renormalization program, as well as a 4th order charge renormalization calculation that is rarely seen in modern books (except for Itzykson and Zuber - reviewed below).

Field Theory: A Modern Primer - 2nd edition Ramond - the first edition was used in my 3rd quarter course at Caltech. The second edition is an excellent supplementary book using path integral techniques and covering modern aspects of gauge theory. The book has excellent coverage of Lorentz/Poincare groups and building action functionals. There is also coverage of topics not usually treated at this level, including finite temperature field theory, gravity as a gauge theory, and anomalies.

Quantum Field Theory - Ryder - This book was considered one of the better and easier first books to learn quantum field theory. Some of the early chapters are excellent especially those covering the Poincare group, symmetries, and the geometry of gauge fields. Uses both the canonical and path integral approaches. The second edition added an interesting chapter on supersymmetry. Major drawback is that the book lacks problems.

Quantum Field Theory of Point Particles and Strings - Hatfield - The first two-thirds of this book is basically a review of quantum field theory (and is relatively easier to read without pen and paper), and the last third is an introduction to string theory. One notable feature of the book is that it covers equally canonical quantization (operator representation), path integral quantization, and the only book that I know of that also covers the Schrodinger Representation and quantization of QFT (yes there actually is a representation using wave functions -actually functionals). So the book is basically an attempt to get the student up to where he can study string theory.

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Quantum Theory of Fields, Volume's 1,2,3 - Weinberg - Written by the master himself, this three volume work (vol. 1 covers foundations and QED, vol 2. modern development including gauge theory and the standard model, vol. 3 supersymmetry). These books are definitely not for an introduction to QFT, but are intended as a second go through, and seek to explain why QFT has to be the way it is due to Lorentz invariance, and cluster decomposition principles. Chapter 2 in vol. 1 is a an excellent introduction to the Poincare groups and symmetries. Weinberg dots every i, crosses every t, and shows every index in an equation, and carefully explains all his arguments - no hand waving.

An Introduction to Quantum Field Theory - Peskin and Schroeder - This book was written as an update to Bjorken and Drell and has many of the same goals and style (calculational). It has become the de facto standard and most used in classrooms. Like Bjorken and Drell one of its goals is to get students calculating Feynman diagrams as fast as possible. Unfortunately this leads to the book jumping around and asking you to take some things (photon propagator) on faith. I remember one sentence in chapter 9, I think, saying they cheated four times and were now going to remedy these defects - by that time I had forgotten what the cheats were. Nevertheless the book has some excellent sections and chapters, although on the whole it is uneven. I especially liked the chapters on radiative corrections and infrared divergencies, the chapters on the systematics of renormalization, and symmetry including the linear and nonlinear sigma models. There are also some excellent guided problems.

Quantum Field Theory in a Nutshell, 2nd edition - Zee - This is an excellent concept book on quantum field theory - it does very few (maybe one) complete detailed calculations. Consequently it really should be used only as a supplemental book. But what a book, war stories abound, explanations are among the clearest in any QFT book, and many advanced topics are covered. Of all the QFT texts, this is the most fun one to read. I recommend all of Zee's books especially his two recent ones on Einstein Gravity in a Nutshell, and Group theory in a Nutshell for Physicists.

Quantum Field Theory - Srednicki - This is the book I recommend. I will simply copy my review from Amazon:

I was at Caltech 1984-86 in Phd. theoretical physics program and they were still using Bjorken & Drell and then Ramond for the final quarter - I fell behind when we hit chapter 8 renormalization never caught up and to my regret dropped out and became a professional high limit poker player. Every few years I would buy another QFT text - I tried them all (Peskin & Schroeder, Ryder, Kaku, Weinberg, Itzykson & Zuber, Hatfield, Zee)- learn a little but still never felt comfortable with the subject. Then I discovered Prof. Srednicki's book on the internet and realized this is the book I have been waiting for. The subject is presented logically and coherently from a theorist point of view.

Renormalization, path integrals etc. are all treated from the beginning with a toy phi-cubed theory. What other field theory book actually shows you the double taylor expansion as in 9.11 page 60 and then clearly explains all the symmetry factors and numerical factors that lead to the final Feynman diagrams.

The best part of the book is the problems - they are neither trivial nor research projects - so far I have worked almost every problem in part 1 (scalar fields)- and they are all instructive and doable. I particularly liked problem 10.5 on field redefinition - when you solve this one you know you understand the material on Feynman diagrams and scattering amplitudes.

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The treatment of scalar fields followed by spinor fields and then gauge fields enables one to learn the subject and gain confidence without overwhelming you with all the technical details and indices at once. The only other book that compares with this one are Weinberg's which I would recommend tackling after Srednicki. I would also recommend Zee's nutshell book for those like myself who read QFT books for fun.

The book is available as an authorized draft on the internet and has an errata and home page for the book

Below, I list some other QFT books (again in rough chronological order) that I have only a cursory familiarity with, and thus highly recommend reading other reviews on the net.

Older books

Quantum Field Theory - Itzkson and Zuber - I once owned this highly recommended book (about 1980) which has been republished as a cheap Dover book. For several years it was used in the Harvard QFT course. As mentioned earlier it is the only book which does the small print incredibly detailed calculations like the second order vacuum polarization.

Quantum Field Theory: A Modern Introduction - Kaku - Of all the QFT books I have owned this was the worst (and I felt good when I resold it) - the book is all talk and very few equations. Its as if the author expects you to work out everything for yourself.

Quantum Field Theory - Brown - This book has been recommended by some for its excellent pedagogy using path integral quantization for QED. Unfortunately thats about all it covers. So while what it does cover is limited, apparently it covers it very well.

Recent Books

Student Friendly Quantum Field Theory - Klauber - Supposedly this is the book if you are least prepared to study quantum field theory. There is a home page on the internet describing the book and which lets you read the beginning chapters, and parts of later chapters. It has a completely different approach using outlines and wholeness/comparison charts. The book only covers QED and canonical quantization. There is also a solution book . Quite frankly after reading the first three chapters, I think the book will only confuse students with its comparisons to relativistic quantum mechanics, and what some believe are outdated ideas (negative energy states, second quantization).

Quantum Field Theory for the Gifted Amateur - Lancaster & Blundell - I love the name of this book. Based on the reviews I read on Amazon, this seems like an excellent book, for someone with a good undergraduate background, needing a book for self study, but not quite ready for Peskin & Schroeder or Srednicki.

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Quantum Field Theory and the Standard Model - Schwartz - This book aims to be the new standard in teaching QFT, and has received excellent reviews. Supposedly it is slightly easier than Srednicki. I like the fact that in the preface the author states “As different students learn in different ways, providing multiple derivations is one way which I have tried to make QFT accessible to a wide audience”.

Finally

Fields - Siegel - This is a free online massive advanced and difficult book. I suggest looking at the books web page to see if this book is for you. For me I hope to study this material after I finish Weinberg’s books.

Conclusion

There are many more quantum field theory books that I have not mentioned. A student should be able to find a book to his liking, unless of course he is totally unprepared for the material. There are of course many popular books (e.g. QED: The Strange Theory of Light and Matter - Feynman) without equations, but that is a whole other list.