

Quantum Field Theory for the Gifted Amateur

Tom Lancaster and Stephen J. Blundell
Oxford U. Press, 2014. \$110.00 (485 pp.).
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In the past couple of decades there has been a quiet revolution taking place in physics. Increasingly, the field is seeing wider use of techniques from quantum field theory (QFT), a change that goes hand in hand with increased cross-pollination of ideas between various subfields of theoretical physics and a reexamination of our understanding of QFT itself. As evident from their primary textbooks, subfields such as particle physics and condensed-matter physics have traditionally remained largely separate from each other in terms of approach, emphasis, and language in their use of QFT. The famous QFT texts from several decades ago (many of which are excellent) tilt heavily toward such topics as relativistic field theories, gauge theories, and computation of scattering amplitudes—a reader could be forgiven for thinking that QFT applied only to high-energy physics. Indeed, it was hard to find texts that included topics and language from a broad range of research disciplines.

Recent times have witnessed a new kind of QFT book containing a significantly wider range of topics. The best of them are rich sources of insight into the conceptual underpinnings of QFT. An excellent example is Anthony Zee's *Quantum Field Theory in a Nutshell* (Princeton University Press, 2003). Such texts are a welcome development that reflects the increasing exchange of ideas and techniques among researchers in high-energy, condensed-matter, and even nuclear physics. Researchers who need to learn the cross-disciplinary language and those further afield who are simply curious will benefit from this new approach.

It is primarily the readers further afield that seem to be the target audience for Tom Lancaster and Stephen J. Blundell's *Quantum Field Theory for the Gifted Amateur*. I admit I was somewhat misled by the title. I was expecting a book aimed at a broad nonexpert audience and antic-

ipated a reading experience along the lines of one of the excellent *Theoretical Minimum* series of books by Leonard Susskind and collaborators. But it is not really a book of that kind. Nevertheless, I was pleasantly surprised by what I found instead.

The book's laudable central philosophy is: "QFT is too important, too beautiful, and too engaging to be restricted to the professionals." However, by "professionals," the authors mean those in areas where QFT is a prerequisite, whereas "amateurs" are professional physicists, or those aspiring to that goal, whose work doesn't require QFT.

Quantum Field Theory for the Gifted Amateur is actually a textbook, and a very good one. In 50 short chapters, it presents a tasting menu of ideas and techniques and includes applications from a wide range of topics of interest to high-energy physicists and condensed-matter physicists alike. In that regard, it follows in the footsteps of Zee, and that approach is most welcome. Also like Zee's, the book has a strong sense of humor and playfulness.

In several other respects, however, Lancaster and Blundell's is very different. It contains fewer advanced topics and is almost completely silent about gravity. Instead, a lot of space is dedicated to working out numerous diverse examples in remarkable detail, and that approach is often used as the primary means of exposition of key ideas. That method is a great way of showing the mechanics of the subject and how an actual computation proceeds, and that's a very important thing to do. The overall result is a refreshing hands-on approach.

Lancaster and Blundell's example-driven approach makes their text a tremendous resource to have to hand or perhaps to use as a textbook for a first course on QFT to a mixed audience. The downside of their approach is that sometimes key conceptual aspects of the subject's underpinnings are not emphasized enough (at least for my taste) or risk getting lost in the details. That could have been partially rectified if the authors had consistently used the short summary of key lessons at the end of each chapter to drive home certain core ideas with a strong clear statement. In many cases, such as for the legendarily misunder-

stood topic of renormalization, that opportunity is missed.

That drawback is far from a deal-breaker, however, since this book—and arguably any book on a subject so rich—is best used in conjunction with a complementary text. *Quantum Field Theory for the Gifted Amateur* would be an excellent companion to one of the existing great texts that provide deeper conceptual scope and more glimpses of the frontiers of the subject.

As already mentioned, a good deal of humor in the book will keep the reader amused between bouts of normal ordering or contour integration. That humor can be found in the prose style itself, the contents of the numerous marginal notes, the whimsical quotes at the beginning of each chapter, and the many delightful hand drawings used as illustrations alongside more traditional figures.

Although I remain puzzled by the somewhat misleading if catchy title, I consider *Quantum Field Theory for the Gifted Amateur* a welcome addition to the growing list of books that use topics from across physics to illuminate the richness and beauty of QFT, one of physics's most powerful theoretical tools.

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