

Folland, Gerald B.

Quantum field theory: A tourist guide for mathematicians. (English) [Zbl 1155.81003](#)
Mathematical Surveys and Monographs 149. Providence, RI: American Mathematical Society (AMS)
(ISBN 978-0-8218-4705-3/hbk). xi, 325 p. (2008).

It is not easy to write a book on quantum field theory for mathematicians. The book under review is not an attempt to develop quantum field theory in a mathematically rigorous fashion. Indeed, sixty years after the growth of quantum electrodynamics and forty years after the discovery of the other gauge theories on which the current understanding of the fundamental interactions of physics is based, putting these theories on a sound mathematical foundation remains an outstanding open problem. The author tries to give mathematically precise definitions and arguments when they are available and proceeds on a more informal level when they are not. The reader is required to be familiar with Fourier analysis, distributions (generalized functions), and linear operators on Hilbert spaces as well as a little Lie theory on the mathematical side. He or she is assumed to be familiar with the Hamiltonian and Lagrangian versions of classical mechanics, special relativity, the Maxwell theory of electromagnetism, and basic quantum mechanics on the physical side. Chapters 2 and 3 are reviews and references for these physical prerequisites. Chapter 5 introduces free fields, which are already mathematically nontrivial although physically interesting. The plunge into the deep waters of interacting field theory takes place in Chapter 6, which along with Chapter 7 on renormalization contains most of the really hard work in the book. Chapter 8 sketches the attractive alternative approach to quantum fields through Feynman's sum-over-histories view of quantum mechanics, and Chapter 9 presents the rudiments of gauge field theory, skirting most of the quantum issues but managing to derive some very interesting physics nonetheless. The reader can find another book about quantum fields written by a mathematician in [*R. Ticciati*, Quantum field theory for mathematicians. Cambridge: Cambridge University Press (1999; [Zbl 0932.81001](#))].

Reviewer: [Hirokazu Nishimura \(Tsukuba\)](#)

MSC:

[81-01](#) Textbooks (quantum theory)
[81Txx](#) Quantum field theory and related classical field theories

Cited in **1** Review
Cited in **15** Documents

Keywords:

[quantum field theory](#); [free quantum fields](#); [Wightman axioms](#); [perturbation theory](#); [Feynman diagrams](#); [renormalization](#); [functional integrals](#); [gauge field theories](#)