University of Oxford

Department of Physics

C6 – Theoretical Physics – Introduction to Quantum Field Theory

Recommended Literature

Please send comments and questions to andrei.starinets@physics.ox.ac.uk

Textbooks often used in modern QFT courses:

M.Peskin and D.Schroder, An Introduction to Quantum Field Theory, Perseus Books, 1995
[This is a standard textbook used in QFT courses worldwide; contains elements of effective theory (a modern QFT paradigm); somewhat phenomenology-oriented]

M.Maggiore, A Modern Introduction to Quantum Field Theory, Oxford U. Press, 2005
[Good comprehensive modern text]

J.Bjorken and S.Drell, Relativistic Quantum Fields, McGraw Hill, 1978
[Classic textbook, very pedagogical. A little bit old-fashioned]

D.Bailin & A.Love, Introduction to Gauge Field Theory, Taylor & Francis, 1993
[A good, no-nonsense text]

L.Ryder, Quantum Field Theory, Cambridge U. Press, 1985
[A simpler version, perhaps, but contains all essential ingredients; good practical introduction to path integrals in QFT; written for humans; his GR textbook is also useful]

A.Zee, Quantum Field Theory in a Nutshell, Princeton U. Press, 2003
[Belongs to the Immortal Classics category. This is not a comprehensive textbook but rather a collection of important stories explaining in detail the fundamental ingredients of QFT. See also Zee's similar book on GR. He also wrote an interesting popular book about particle physics called "Fearful Symmetry"]

S.Coleman, Quantum Field Theory, World Scientific, 2019
[Another Immortal Classics: a collection of notes by the famous physicist and one of the best lecturers on the subject in human history]

S.Coleman, Aspects of Symmetry, Selected Erice Lectures, Cambridge University Press, 1985
[All about spontaneous symmetry breaking and other useful QFT issues (some are advanced) from the Master; Immortal Classics]

M.Le Bellac, Quantum and Statistical Field Theory, Clarendon Press, 1992
[Excellent textbook – quite unique in presenting QFT and Quantum Statistical Mechanics within the same framework]

F.Mandtl and G.Shaw, Quantum Field Theory, John Wiley & Sons, 1984
[Simple and pedagogical introduction to the standard canonical quantization and QED]

Other QFT textbooks – modern and not so modern

2000-current

S.Weinberg, The Quantum theory of Fields, volumes I-III, Cambridge U. Press, 1995-2000
[A comprehensive treatment of QFT; some people like it]

M.Srednicki, Quantum Field Theory, Cambridge U. Press, 2007

M.Schwartz, Quantum Field Theory and the Standard Model, Cambridge U. Press, 2014

T.Banks, Modern Quantum Field Theory, Cambridge U. Press, 2008

H.Nastase, Classical Field Theory, Cambridge U. Press, 2019

H.Nastase, Introduction to Quantum Field Theory, Cambridge U. Press, 2020

F.Gelis, Quantum Field Theory, Cambridge U. Press, 2019

V.P.Nair, Quantum Field Theory, Springer, 2004

T.Lancaster & S.Blundell, Quantum Field Theory for the Gifted Amateur, Oxford U. Press, 2014

L.Alvarez-Gaume and M.Vazquez-Mozo, An Invitation to Quantum Field Theory, Springer-Verlag, 2012

L.Baulieu, J.Iliopoulos, R.Seneor, From Classical to Quantum Fields, Oxford U. Press, 2017

T.P.Cheng and L.F.Li, Gauge theory of elementary particle physics, Clarendon Press, 1984

C.Burgess and G.Moore, The Standard Model: A Primer, Cambridge U. Press, 2007

A.Duncan, The conceptual framework of quantum field theory, Oxford U. Press, 2012

L.S.Schulman, Techniques and Applications of Path Integral, Dover, 2005

1980-2000

P.Ramond, Field theory: a modern primer, Addison-Wesley, 1990

L.S.Brown, Quantum Field Theory, Cambridge U. Press, 1992

W.Greiner and J.Reinhardt, Field Quantization, Springer-Verlag, 1996

V. B. Berestetskii, E.M. Lifshitz, L. P. Pitaevskii, Quantum Electrodynamics: Volume 4 (Course of Theoretical Physics), Pergamon Press, 1982

1950-1980

C.Itzykson and J.-B.Zuber, Quantum Field Theory, McGraw-Hill, 1980

E.Henley and W.Thirring, Elementary Quantum Field Theory, McGraw-Hill, 1962

S.Schweber, An Introduction to Relativistic Quantum Field Theory, Harper & Row, 1962

N.N.Bogolyubov and D.V.Shirkov, Introduction to the theory of quantized fields (translation from the Russian), John Wiley & Sons, 1959

A. I. Akhiezer, V. B. Berestetsky, Quantum Electrodynamics (translation from the Russian), U.S. Atomic Energy Commission, 1953

Symmetries, Noether theorems, and the theory of constrained dynamics

K.Sundermeyer, Symmetries in Fundamental Physics, Springer , 2014

K. Sundermyer, Constrained Dynamics, Springer-Verlag, 1982

M.Henneaux and C.Teitelboim, Quantization of Gauge Systems, Princeton U. Press, 1992

Non-perturbative QFT

R.Rajaraman, Solitons and Instantons, North-Holland, 1982
[One of the best QFT books ever written – focuses on non-perturbative aspects. Immortal Classics.]

E.Weinberg, Classical Solutions in Quantum Field Theory, Cambridge U. Press, 2012

M.Marino, Instantons and Large N: An introduction to non-perturbative methods in Quantum Field Theory, Cambridge U. Press, 2015

Useful popular books about QFT

S.Schweber, QED and the men who made it, Princeton U. Press, 1994

A.Smilga, Digestible Quantum Field Theory, Springer, 2016

A.Pais, Inward Bound, Oxford U. Press, 1986

Mathematically rigorous – QFT axiomatics and so on

R.Ticciati, Quantum field theory for mathematicians, Cambridge U. Press, 1990

E.Zeidler, Quantum Field Theory: A bridge between mathematicians and physicists, vols. 1-3, Springer-Verlag, 2006-2011

N.N.Bogolyubov, A.A.Logunov, I.T.Todorov, Introduction to Axiomatic Quantum Field Theory (translation from the Russian), W.A. Benjamin, 1975
[In my opinion, the best ever book on rigorous QFT]

N.N.Bogolyubov, A.A.Logunov, I.T.Todorov, A.I.Oksak, General Principles of Quantum Field Theory (translation from the Russian), Kluwer Academic Publishers, 1990

R.Streater and A.Whiteman, PCT, Spin and Statistics, and All That, Princeton U. Press, 1989

J.Glimm and A.Jaffe, Quantum Physics: A functional integral point of view, Springer, 1981

B.Simon, P(0)2 Euclidean (Quantum) Field Theory, Princeton U. Press, 2015 *[Good luck…]*

Mathematical Methods

R.Courant and D.Hilbert, Methods of Mathematical Physics, volumes I, II, Wiley-Blackwell, 1966

P.Morse and H.Feshbach, Methods of Theoretical Physics, volumes I, II, McGraw Hill, 1953

A. P. Prudnikov, Y.A. Brychkov, O.I. Marichev, Integrals and Series, volume I: Elementary Functions (translation from the Russian), Gordon and Breach, 1986
[To date, this is the most complete collection of integrals, series and products in the world]

A. P. Prudnikov, Y.A. Brychkov, O.I. Marichev, Integrals and Series, volume II: Special Functions (translation from the Russian), Gordon and Breach, 1986

A. P. Prudnikov, Y.A. Brychkov, O.I. Marichev, Integrals and Series, volume III: More Special Functions (translation from the Russian), Gordon and Breach, 1991

A. P. Prudnikov, Y.A. Brychkov, O.I. Marichev, Integrals and Series, volume IV: Direct Laplace Transforms (translation from the Russian), Gordon and Breach, 1992

A. P. Prudnikov, Y.A. Brychkov, O.I. Marichev, Integrals and Series, volume V: Inverse Laplace Transforms (translation from the Russian), Gordon and Breach, 1992

E.Kamke, Differentialgleichungen: Loesungsmethoden Und Loesungen (in German), Chelsea Publishing Company, 1982
[The best ever collection of solutions to ODE; Immortal Classics; no English translation exists]

C.Lanczos, The variational principles of mechanics, Dover, 1986

Online courses

Some QFT courses are now available online. For example, MIT lectures depositary is a good resource:

https://ocw.mit.edu/courses/

In particular, Ian Stewart's lectures on effective field theory are very useful:

https://ocw.mit.edu/courses/physics/8-851-effective-field-theory-spring-2013/video-lectures/lecture-1-introduction-to-effective-field-theory-eft/