

PHYS 480 – Undergraduate Quantum Field Theory

Syllabus, Spring 2026

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Prerequisites: Lagrangian mechanics; special relativity; 3rd year quantum mechanics.

Content: This is a one-semester introduction to quantum field theory at the undergraduate level. The main goal is to give an honest treatment of the simplest interacting quantum field theories. The plan for the semester is roughly as follows:

Week	Topic
1: 05/01 - 09/01	Why QFT? Review 1
2: 12/01 - 16/01	Review 2
3: 19/01 - 23/01	Non-relativistic scalar fields
4: 26/01 - 30/01	Relativistic scalars
5: 02/02 - 06/02	Path integrals 1
6: 09/02 - 13/02	Path integrals 2
7: 16/02 - 20/02	Reading break
8: 23/02 - 27/02	Feynman Diagrams
9: 02/03 - 06/03	Tree-level processes
10: 09/03 - 13/03	Loops 1
11: 16/03 - 20/03	Loops 2
12: 23/03 - 27/03	Some applications at one loop
13: 30/04 - 03/04	Life beyond scalars

Textbook and supplementary material: No textbook exists that introduces QFT at this level, and so the material for this course will be cobbled together from a variety of sources.

1. I will be writing detailed lecture notes over the course of the term, and these will be available and continuously updated on Brightspace.
2. David Tong has excellent lecture notes for his QFT 1 at Cambridge, available at <https://www.damtp.cam.ac.uk/user/tong/qft.html>.
3. I will borrow at times from Srednicki's textbook, as well as Lowell Brown's.

Course format:

Lectures: Tuesdays/Fridays, 1600-1720
Problem Sets: 5+1 assignments over the Term, due every other week via Brightspace or my mailbox.
Final project: You will work together with a small group of students to present and write up a one-hour lecture on a special topic during the final examination period.

Grades:

1. Final: 30% final project. (Details forthcoming.)
2. Problem sets: 70%.

Learning outcomes: Understand why relativity and basic properties of quantum mechanics necessitates quantum fields, and how QFT respects the laws of quantum mechanics. Be proficient in computing simple physical processes using canonical quantization (the Hamiltonian formulation), from the path integral, and using Feynman diagrams. Develop competence in the calculation of simple one-loop effects and understand their physical implications.

Academic integrity: Students are required to abide by all academic regulations set as set out in the University calendar, including standards of academic integrity. Violations of academic integrity (e.g. cheating and plagiarism) are considered serious and may result in significant penalties.