PHYS 7314: Quantum Field Theory I

General information

Time and location:	Tuesdays and Thursdays, 11:00am-12:20pm, 157 Fondren Science
Instructor:	Pavel Nadolsky
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Office hours:	By appointment, request an appointment at doodle.com/pavelnadolsky (Links to an external site.)L external site.
Course webpage	Posted on SMU Canvas (courses.smu.edu (Links to an external site.)Links to an external site.). (Links external site.)Links to an external site. To view, enter your 8-digit SMU ID and password.

Textbook, learning objectives, grading, policies

Text	*Quantum Field Theory*, by Mark Srednicki, 1st Edition
Recommended reading and materials	1. *An Introduction to Quantum Field Theory*, by G. Sterman 2. *Introduction to Quantum Field Theory*, by M. Peskin and D. Schroeder 3. *The Quantum Theory of Fields*, volumes 1, 2,3 by Steven Weinberg 4. *Fields*, by Warren Siegel (free, hep-th/9912205) 5. *Classical Electromagnetism in a nutshell*, by Anupam Garg (selected sections) 6. Simon DeDeo's online course on an Introduction to Renormalization
Grading	Your grade will be based on weekly homework problems (70%) and a final project (30%) • Late Homework: 15% off per day for the first four days, or until graded (whichever is first). Thereafter I'll accept (but won't grade) them at any time for 25% credit.
Homework assignments	In the Assignments folder on the website.

Reading sequence

Plan to read 3-4 chapters per week . Detailed assignments are on the website

1. Attempts at relativistic quantum mechanics
2. Lorentz invariance
3. Canonical quantization of scalar fields
4. The spin-statistics theorem
5. The LSZ reduction formula
6. Path integrals in quantum mechanics
7. The path integral for the harmonic oscillator
8. The path integral for free field theory
9. The path integral for interacting field theory
10. Scattering amplitudes and the Feynman rules
11. Cross sections and decay rates
12. Dimensional analysis with ?=c=1
13. The Lehmann-Källén form
14. Loop corrections to the propagator
15. The one-loop correction in Lehmann-Källén form
16. Loop corrections to the vertex
17. Other 1PI vertices
18. Higher-order corrections and renormalizability
19. Perturbation theory to all orders
20. Two-particle elastic scattering at one loop
21. The quantum action
22. Continuous symmetries and conserved currents
23. Discrete symmetries: P, T, C, and Z
24. Nonabelian symmetries (skip until later)
27. Other renormalization schemes
28. The renormalization group
29. Effective field theory (skip until later)
30. Spontaneous symmetry breaking (skip until later)
32. Spontaneous breaking of continuous symmetries (skip until later)
33. Representations of the Lorentz Group
34. Left- and right-handed spinor fields
35. Manipulating spinor indices
36. Lagrangians for spinor fields
37. Canonical quantization of spinor fields I
38. Spinor technology
39. Canonical quantization of spinor fields II
40. Parity, time reversal, and charge conjugation
41. LSZ reduction for spin-one-half particles
42. The free fermion propagator
43. The path integral for fermion fields
44. Formal development of fermionic path integrals (skip until later)
45. The Feynman rules for Dirac fields
46. Spin sums
47. Gamma matrix technology
48. Spin-averaged cross sections