

Quantum Field Theory II

Topics for Final Projects

1. Grand Unified Theories
Gauge Theories of Elementary Particle Physics, Cheng and Li, Ch. 14;
Unification and Supersymmetry, R. Mohapatra, Ch. 5, 6, 7.
2. Renormalization Group Equations and Critical Exponents
Introduction to Modern QFT, M. Peskin, Ch. 13;
Condensed Matter Field Theory, Altland and Simons, Ch. 8.
3. The Kosterlitz-Thouless Phase Transition
Condensed Matter Field Theory, Altland and Simons, Ch. 8.6;
Field Theories of Condensed Matter Systems, E. Fradkin, Ch. 4.6;
Scientific Background on the Nobel Prize of Physics 2016,
<https://www.nobelprize.org/prizes/physics/2016/summary/>
4. Meissner Effect and the Anderson-Higgs Mechanism in Superconductivity,
Condensed Matter Field Theory, Altland and Simons, Ch. 6;
The Quantum Theory of Fields II, S. Weinberg, Ch. 21.6.
5. Effective Field Theory of the Strong Interactions at Low Energies,
The Quantum Theory of Fields II, S. Weinberg, Ch. 19;
Dynamics of the Standard Model, Donoghue, Golowich and Holstein, Ch. 4 and 7;
Effective Lagrangians for the Standard Model, A. Dobado, A. Gomez-Nicola, A. Maroto and J. Pelaez, Ch. 6.
6. Axions and the Strong CP Problem
The Quantum Theory of Fields II, S. Weinberg, Ch. 23.6;
Dynamics of the Standard Model, Donoghue, Golowich and Holstein, Ch. 3.
7. Majorana Fermions in Condensed Matter
Majorana Fermions Condensed Matter Physics, A. Legget, Review article, 2016;
Majorana and Condensed Matter Physics, F. Wilczek, arxiv:1404.0637.
8. The Quantum Hall Effect(s) and Topology
Condensed Matter Field Theory, Altland and Simons, Ch. 9;
Field Theory of Condensed Matter Physics, E. Fradkin, Ch. 12, 13, 14.
9. Effective Potential at Finite Temperature and Early Universe Phase Transitions
The Early Universe, E. Kolb and M. Turner, Ch. 7;
Finite Temperature Field Theory and Phase Transitions, M. Quiros, hep-ph/9901312;
Effective Potential at Finite Temperature in the Standard Model, M. Carrington, Physical Review D 45, 2933 (1992).

10. Supersymmetric Field Theories

The Quantum Theory of Fields III, S. Weinberg, First few chapters;

Advanced Topics in Quantum Field Theory, M. Shifman, Ch. 10, sections 44-49;

Unification and Supersymmetry, R. Mohapatra, Ch. 9, 10;

Modern Supersymmetry J. Terning, First few chapters.