Quantum Field Theory

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Time & Place:

Lectures

Mo 10-12 HS B
Do 10-12 HS A

Fr 10-12 1.3.21 (SR T1)

Problem sessions

Fr 12-14 1.4.31 (SR E3)

Lectures & problem sessions will be freely interchanged, typically with advance notice, or additional lectures held on Friday at 10.

Exam: Th 12.7.2018 10-12 HS A

Make-up exam: last week of semester break
OR first week of winter term 2018/19

Homework problems:

* made available on website on Thursday
* solutions should be turned in on the following Thursday at the beginning of class
* must have 50 % of points

QFT

→ elementary particles

→ statistical physics

→ many-body systems

* functional integral methods

* operator methods

Literature

1) A. Altland, B. Simons, Condensed Matter Field Theory (Cambridge)

2) P. Chaikin, T. Lubensky, Principles of Condensed Matter Physics (Cambridge)

3) L.S. Brown, Quantum Field Theory (Cambridge)

4) A. Zee, Quantum Field Theory in a Nutshell (Princeton)

5) N. Nagaosa, Quantum Field Theory in Condensed Matter Physics (Springer)

6) H. Bruus, K. Flensberg, Many-Body Quantum Theory in Condensed Matter Physics (Oxford)

7) J. Negele, H. Orland, Quantum Many Particle Systems (Addison-Wesley)

8) A. Fetter, D. Walecka, Quantum Theory of Many-Particle Systems (Mc Graw-Hill)

9) A. Abrikosov, L. Gorkov, L. Dzyaloshinski, Methods of Quantum Field Theory in Statistical Physics (Dover)

10) X.-G. Wen, Quantum Field Theory of Many-Body Systems

11) E. Fradkin, Field Theories of Condensed Matter Systems

... and many more

You may also find it useful to consult books for some of the math that is used throughout these lectures. Good references are

* M. Stone & P. Goldbart, Mathematics for Physics, Cambridge Univ Press (2009)

* G.B. Arfken, Mathematical Methods for Physicists

* F. Smithies, Integral equations

Quantum field theory

Chapter 1 : Phases of matter and phase transitions

Chapter 2 : Transverse field Ising model

Chapter 3 : Free bosonic fields : harmonic chain

Chapter 4 : Path integrals

Chapter 4 : Linear response and correlation functions

Chapter 5 : Boson functional integrals

Chapter 6 : Interacting Bose systems

Chapter 7 : Boson superfluidity

Chapter 8 : Bosons at finite temperature and vortex excitations

Chapter 9 : Fermion functional integral

Chapter 10 : Hubbard-Stratonovich transformation and RPA

Chapter 11 : Superconductivity

Chapter 12 : Peierls transition and fermion mass generation

Chapter 13 : Perturbation theory and Feynman diagrams

Chapter 14 : Feynman diagrams for Green's functions

REMARK : I may substitute some chapters for basic gauge theory.