PHYSICS 622 — Springl 2014

Instructor: Paul Stevenson HB 240 ext. 5248.
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Lectures: Tues, Thurs 2:30 – 3:45 p.m.

Textbook

There is no required textbook for the course. However, I recommend Peskin and Schroeder, *Introduction to Quantum Field Theory* (Addison-Wesley) or Srednicki *Quantum Field Theory* (Cambridge University Press).

Syllabus

1. Quantum Field Theory for spinless fields. Canonical quantization; perturbation theory; Wick's theorem; Feynman diagrams.
2. Fields with spin; internal and spacetime symmetries; spin-$\frac{1}{2}$ particles; Dirac equation; spin-1 particles; gauge invariance; Quantum Electrodynamics (QED).
3. Non-Abelian Gauge Theories. Lie Algebras; SU(n) groups. Quantum Chromodynamics (QCD); ghosts; Feynman rules.
4. Renormalization; ultraviolet divergences in the effective potential and in scattering amplitudes; dimensional regularization; loop diagrams; renormalization-scheme dependence in perturbation theory.
5. Functional integral methods.

The course presupposes a good background in both graduate-level quantum mechanics and classical mechanics (Lagrangian and Hamiltonian formalisms) and a basic knowlwdge of particle physics. The course aims to give a good introduction to relativistic quantum field theory, the theoretical framework for the fundamental theories of particle physics. In particular, it explains how the "Feynman rules" are derived and how renormalization works.

There will be homework sets about once a week and a final take-home exam, with the exam under the Honor Code rules. Grading will be based on the homework sets (78%) and final exam (22%).

Students are welcome to come to my office at any time if they have questions.

Copies of my lecture notes will be available in a binder in room HBH 230 and on Owlspace.

Any student with a documented disability needing academic adjustments or accommodations is requested to speak with me during the first week of class. Additionally, students will need to contact Disability Support Services in the Allen Center.