PHY 8850 – Quantum Field Theory – Syllabus

Semester: Fall 2009

Lecturer:

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Lecture Time/Room:

Lecture **Monday, Wednesday, Friday 1:55-2:50 pm**, 185 Physics Building

Suggested Texts:

M. E. Peskin, D. V. Schroeder, **An Introduction to Quantum Field Theory**, (Addison-Wesley Publishing Company) [main text];
L. H. Ryder, **Quantum Field Theory**, (Cambridge University Press)
D. Bailin and A. Love, **Introduction to Gauge Field Theory**, (IOP Publishing, Graduate Student Series in Physics).

Office Hours: By appointment.

Grading:

Your course grade will be determined by your performance in homework assignments and a Final Project on the basis of the following distribution.

Homework Projects (typically every10 days)	80%
Final Project	20%

The overall course grade will be determined on the basis of the following curve:

Grade	**Cumulated Score**	**Grade**	**Cumulated Score**
A	91-100	C	60-64
A-	85-90	C-	55-59
B+	80-84	D+	50-54
B	75-79	D	45-49
B-	70-74	D-	40-44
C+	65-69	E	0-39

The completed homework assignments are due at 5 pm on the date specified, typically 10 days after the assignment is given. Late submissions are accepted, but maximum possible score for the late assignment will be linearly decreased according to the formula $N = N_{\max}\left(1 - 0.2n\right)$, where n is the number of days (weekend days and holidays are included).

Course description and objectives:

This course provides an introduction to modern methods of quantum field theory, including Feynman diagram methods, applications to scattering processes and bound states, QED and QCD, regularization, and renormalization. It is suitable for both students of theory and experiment in the fields of nuclear, particle, and solid state physics.

Topics to be covered:

1. **Introduction.** Classification of particles. Need for the field-theoretic description.
2. **Scalar fields.** Symmetries and conservation laws. Scalar fields. Canonical quantization of scalar fields. Propagators. Symmetries.
3. **Vector fields.** Massless and massive vector fields. Canonical quantization of vector fields. Gupta-Bleuler formalism.
4. **Fermion fields.** Classical Dirac fields. Canonical quantization of fermion fields. Canonical quantization of fermion fields. Propagators.
5. **Interacting fields and Feynman diagrams.** Scalar QED. Perturbation theory. Wick's theorem and Feynman diagrams.
6. **Cross-sections and S-matrix.** General formalism. Feynman rules for S-matrix elements. Yukawa theory. Top quark decay.

Depending on how much time we have left, we will discuss other related topics, such as spontaneous symmetry breaking, path integrals, QFT renormalization, operator product expansions, Standard Model physics, and other applications of QFT to real-world processes. Anything left out of PHY 8850 will be discussed in PHY 8860 next semester.

Website: http://www.physics.wayne.edu/~apetrov/PHY8850/