PHY 8860 – Quantum Field Theory II – Syllabus

Semester: Fall 2012

Lecturer:

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Lecture Time/Room:

Lecture **Monday, Wednesday, Friday 10.40-11.35 pm**, 177 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)
J.F. Dononghue, E. Golowich, B. Holstein, **Dynamics of the Standard Model**, (Cambridge Monographs on Particle Physics, Nuclear Physics & Cosmology);

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 (two or three problems/10 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.

Course description and objectives:

This course provides an introduction to modern methods of quantum field theories, including renormalization, regularization, path integrals, Feynman diagrams, etc. It is suitable for students of both theory and experiment in the fields of nuclear, particle, and condensed matter physics.

Topics to be covered:

1. **Renormalization I.** Renormalization of φ^4 theory.
2. **Gauge theories.** Abelian and nonabelian theories. Symmetries in QFT.
3. **Standard Model.** Fields and interactions. Goldstone theorem. Higgs mechanism.
4. **Quantum Chromodynamics (QCD).** Deep inelastic scattering. Parton distribution functions. Other sample processes.
5. **Renormalization II.** Renormalization of QED and QCD at one loop. Renormalization group, decoupling theorem.
6. **Example effective field theories.** Euler-Heisenberg Lagrangian. Sigma model. Heavy Quark Effective Theory and other EFTs of QCD.
7. **Further developments.**

Depending on how much time we have left, we will discuss other related topics.

Website: http://www.physics.wayne.edu/~apetrov/PHY8860/