**Physics 217 Introduction to Quantum Field Theory I — Fall 2009**


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| Instructor: | Stefano Profumo |
| Office: | ISB, Room 325 |
| Phone Number: | 831-459-3039 |
| Office Hours: | Wednesdays 4:00-5:00 PM (or by app.) |
| E-mail: | `profumo@scipp.ucsc.edu` |
| Course Web Page: | `http://scipp.ucsc.edu/~profumo/teaching/phys217_09/phys217.html` |


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| Lectures: | Mondays and Wednesdays, 2:00-3:45 PM |
| Lecture Room: | ISB, Room 231 |

## Course Description

This course is the first quarter of a 2-quarter graduate-level introduction to relativistic quantum field theory (QFT). The focus is on introducing QFT and on learning the theoretical background and computational tools to carry out elementary QFT calculations, with a few examples from tree-level quantum electrodynamics processes. The course will be mostly based on the first 5 chapters of the Peskin and Schroeder book.

## Course Outline

1. Quantum Mechanics, Special Relativity and their marital issues
2. Elements of Classical Field Theory
3. The Klein-Gordon Field
4. The Dirac Field
5. Discrete Symmetries of the Dirac Theory
6. Perturbation Theory
7. Feynman Diagrams
8. Elementary Processes in QED
9. Schwinger-Dyson Equations and Functional Integrals

### Required Textbook

- *An Introduction to Quantum Field Theory* by Peskin and Schroeder (1 day reserve)

### Reference Textbooks

- *Modern Quantum Field Theory* by Banks (1 day reserve)
- *Quantum Field Theory* by Srednicki (1 day reserve)
- *Quantum Field Theory* by Mandl and Shaw (1 day reserve)
- *The Quantum Theory of Fields: Foundations* by Weinberg (3 days reserve)
- *Quantum Electrodynamics* by Berestetskii, Lifshitz and Pitaevskii (3 days reserve)
- *Quantum Field Theory* by Itzykson and Zuber (3 days reserve)
- *Relativistic Quantum Mechanics* by Bjorken and Drell (3 days reserve)

### Homeworks and Grading Policy

Grading will be based on 4/5 homework exercises. Each homework will consist of typically 2 exercises on the material discussed in class, or on complements to that material. The homeworks will be posted on the course web page during the quarter. One week after the homework is handed out, during the first half hour at the beginning of class two "*volunteers*" will either spontaneously step forward or (in the absence of volunteers) will be drafted by the Instructor to solve the assigned problems, or to sketch the solution, on the blackboard. Volunteers will rotate throughout the class participants. Grading will be given according to the quality of both these oral presentations and the interaction/suggestions given to the volunteer when one is not at the blackboard (i.e. participation will be an important component).

The idea behind this homework and grading policy is to familiarize you with presenting orally your work, and in particular your research: doing this effectively is a fundamental skill and component to any research activity, both at the informal level of group meetings and at the more formal level of conference talks or job interviews. Interaction with those presenting their research is also a fundamental aspect of successful research. Further, this will give everybody an opportunity to discuss and re-think the assigned homework material, and to try to conceptualize and digest it in order to present it to others.