Phys. 773, Quantum Field Theory II (Xerxes Tata)

This class is the second semester of a two semester course on Relativistic Quantum Field Theory, the standard language for describing high energy phenomena. By now you should – given the form of the interactions – be able to compute leading order scattering cross sections and decay rates of elementary particles, and compare the results with empirical values. In part II of this course we will go beyond lowest order perturbation theory (which introduces a host of new issues), and also develop non-Abelian gauge theories that are the bedrock of the Standard Model of particle physics.

Text: Introduction to Quantum Field Theory (Michael Peskin and Daniel Schroeder). Please treat this as the nominal text for the class. The topics are sufficiently advanced that it is worthwhile to look at several texts to gain a broader perspective. Here is a book-list to help out.

- Relativistic QM and Relativistic Quantum Fields (Bjorken and Drell)
- Quantum Field Theory (Mandl and Shaw)
- Relativistic Quantum Theory (Berestetskii, Lifschitz and Pitaevskii)
- Quantum Electrodynamics (Akhiezer and Berestetskii)
- Quantum Field Theory (Nash)
- Quantum Field Theory (Lurié)
- Relativistic Quantum Field Theory (Schweber)
- Quantum Field Theory (Itzykson and Zuber)
- Advaanced Quantum Mechanics (Sakurai)
- Quanatum Electrodynamics (Jauch and Rohrlich)
- Quantum Theory of Fields (Weinberg)
- QFT in a Nutshell (Zee)
- QFT (Srednicki)
- QFT and the Standard Model (Schwartz)

Prerequisites: Phys. 772.

Homework will be assigned regularly and graded. Please do these assignments in a timely manner even if you plan not to register for the class (This is the ticket price). **You will not gain gain anything unless you keep up with these assignments.**

Grade: Based on HW assignments.

Topics to be covered:

- Higher order corrections (mostly in QED);
- Renormalization and regularization;
- Anomalous magnetic moment of the muon;
- Infrared divergences

Constructing the Standard Model

- Lie algebras and Lie groups
- Non-Abelian gauge theories (Yang-Mills-Shaw-Utiyama constructions)
- Quantum Chromodynamics
- Spontaneously broken gauge theories
- The Electroweak Interaction

Other topics (e.g. functional methods) depending on interest, instructor capability and availability of time.

By the end of the course you should have a reasonable idea of how QFT is used in contemporary particle physics and related areas, and also about the structure (and some phenomenology) of what is referred to as the Standard Model.