Experimental Particle Physics (171.625) Spring 2013

1. Schedule:

Mon/Wed/(some Fri) 3:00-4:15 pm, Bloomberg 361
Instructor: Prof. Andrei Gritsan, email gritsan@jhu.edu
Office: Bloomberg 433
http://www.pha.jhu.edu/~gritsan/2013.171.625/

2. Reference material:

Main textbook: "Introduction to High Energy Physics," 4th edition
Author: Perkins, Donald H.
Published: Cambridge ; New York : Cambridge University Press, 2000.

Recommended: "Introduction to Elementary Particles," 2nd edition
Author: David Griffiths
Published: Wiley, 2008

Optional: "The Experimental Foundations of Particle Physics," 2nd edition
Authors: Robert N. Cahn and Gerson Goldhaber
Published: Cambridge University Press, 2009

Supporting: "Review of Particle Properties"
by Particle Data Group, on-line http://pdg.lbl.gov/ and handouts

3. Grade policy:

33.3% homework assignments
33.3% in-class presentation
33.3% attendance or exam (student's choice)

4. Homework assignments

HW1 (introductory material, selected topics in Chapters 1, 2)
HW2 (experimental methods, selected topics in Chapter 11)
HW3 (experimental methods and symmetries, Chapters 11, 3)
HW4 (symmetries, hadrons, selected topics in Chapters 3, 4, 7)
HW5 (QCD and EW interactions, selected topics in Chapters 5, 6, 7)
HW6 (EW interactions, selected topics in Chapters 7, 8, 9)

5. In-class presentation will cover a topic of your choice. This topic may be picked from the book by R. N. Cahn and G. Goldhabe, where you can pick one of the published research papers in experimental particle physics (high energy physics). The list of papers will also be provided by the instructor. Presentations will take place in the last month of classes. Each presentation will be about 20 minutes with more than one student presenting in each class. Computer projector will be used for your presentation. In addition, a one-page outline of the presentation is due the last day of classes before the Spring break.

6. Attendance or exam will test your understanding of material covered in class and in presentations by other students.

Your attendance and homework assignment should guarantee that you know the material. Nonetheless, if you fail to attend class or there is a reason to believe that homework was not a result of your own work, an exam will be assigned at the end of the course.

7. General information:

The course is suitable for advanced physics undergraduates and beginning graduate students interested in experimental high energy physics. Some basic knowledge of non-relativistic Quantum Mechanics, Theory of Relativity, and relevant mathematical techniques is required. However, the material will be presented in a phenomenological and empirical way with the emphasis on experimental aspects of the field. Other more advanced courses on particle physics are recommended for deeper studies of theoretical formalism.

The required textbook "Introduction to High Energy Physics" by Donald Perkins will serve as the main guide throughout the course. Do not expect mathematical rigor from this book. However, this is a great introductory material which will serve as the main guide throughout the course. It combines all recent developments in particle physics with the balance between experiment and theory.

The recommended textbook "Introduction to Elementary Particles" by David Griffiths is a great mathematically rigorous introduction at appropriate level. However, most experimental aspects of the field are not covered. The instructor will use some chapters of this book to complement the main textbook. The additional optional textbook "The Experimental Foundations of Particle Physics" by Robert N. Cahn and Gerson Goldhaber gives historical overview of experimental particle physics with an overview of original articles. This book can be used to prepare for the presentation. We will also use the summary of elementary particle properties as the most up-to-date and detailed reference material.

First we will go through the introduction to elementary particles and their interaction (corresponding to Chapters 1, 2 of the textbook). Then we will discuss the experimental aspects of the field (Chapter 11), which should tell us why we would believe in elementary particles and everything that we learn about them. By this time you should have a general overview of the experimental methods in particle physics and be able to select a topic for in-class presentation. We will continue with selected topics on the symmetries (Chapter 3), hadrons and QCD (Chapters 4, 5, 6), and electroweak interactions (Chapters 7, 8, 9). Homework assignment should follow closely our progress in class.