Introduction to Experimental Particle Physics (171.731/171.408) Spring 2008

1. Schedule:

Mon/Wed/(two Fri) 3:00-4:15 pm, Bloomberg 361
Instructor: Prof. Andrei Gritsan, email gritsan(at)jhu.edu
Office: Bloomberg 433
http://www.pha.jhu.edu/~gritsan/2008.171.731/
http://www.pha.jhu.edu/~gritsan/2008.171.408/

2. Reference material:

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

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

Supporting: "Introduction to Elementary Particles"
Author: David Griffiths
Published: Wiley, 1987

3. Grade policy:

25% homework assignments
25% in-class presentation
20% midterm
30% final exam

4. Homework assignments are six biweekly sets of problems which cover the topics discussed during the two weeks in class:

HW1 due Mon Feb.11 (introductory material, selected topics in Chapters 1, 2)
HW2 due **Wed** Feb.20 (experimental methods, selected topics in Chapter 11)
HW3 due Mon Mar.10 (experimental methods and symmetries, Chapters 11, 3)
HW4 due Mon Mar.31 (symmetries, hadrons, selected topics in Chapters 3, 4, 7)
HW5 due Mon Apr.14 (QCD and EW interactions, selected topics in Chapters 5, 6, 7)
HW6 due Mon Apr.28 (EW interactions, selected topics in Chapters 7, 8, 9)

5. In-class presentation will cover a topic of your choice and there are two options for a topic. The first option is one of the published research papers in experimental particle physics (high energy physics). The second option would be a mini-research project where some computing skills and data analysis would be necessary.

The list of papers and potential topics for mini-research projects will be provided by the instructor. Students can also suggest papers or topics of their choice, but would need approval of the instructor. Presentations will take place on Mondays in the last month of classes. Each presentation will be 20 minutes with more than one student presenting in each class. Overhead slide projector or computer projector could 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 and before the midterm. The relevant dates are the following:

Fri Feb.22 – deadline to select a topic
Wed Mar.10 – one-page outline of the presentation
Mon Apr.7, Apr.14, Apr.21 (tentative) – choice days for the paper presentations

6. Two exams will test your understanding of material covered in class, homework assignments, and presentations by other students:

Wed Mar.12 – MIDTERM EXAM, Bloomberg 361, 3:00-4:15pm
(cover first seven weeks of classes and HW1-3)

Wed May 14 – FINAL EXAM, Bloomberg 361, 9:00am-12:00(noon)
(cover all material, including topics presented by other students)

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 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.

We will also use the summary of elementary particle properties as the most up-to-date and detailed reference material. The optional 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 and there have been certain developments in the field in the past 20 years. The instructor will use some chapters of this book to complement the main textbook.

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.

The instructor will keep on-line summary of the course up-to-date, including links to the papers and mini-research topics for in-class presentations:
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