

# EXPERIMENTAL METHODS OF PARTICLE PHYSICS

**PHYS 7361 (SPRING 2013) SYLLABUS**

<http://www.physics.smu.edu/~kehoe/7361/S13.html>

**Instructor:** Professor Bob Kehoe      **Office:** Fondren Science 113  
**e-mail:** [kehoe@physics.smu.edu](mailto:kehoe@physics.smu.edu)      **Phone:** (214) 768-1793  
**Fax:** (214) 768-4095

**Texts:** *"Particle Detectors"*, C. Grupen and B. Shwartz (2003),  
*"Introduction to Experimental Particle Physics"*, R. Fernow (1990).

**Class Coordinates:** Tues/Thurs. 11am – 12:20pm in Fondren Science Rm 26;

**Course Objectives:** To provide an introduction to the science of particle physics detectors and their use. Students will familiarize themselves with the physics of particle interactions with matter, and several major detector technology categories. They will also study the electronics and triggering used to acquire data signals. Elements of modern reconstruction and statistical analysis will be discussed. Calculation will be one emphasis of the course.

**Method of Instruction:** The class will consist of lectures. Homework is the foundation of your effort to acquire skill in using the material in the course. It will consist primarily of problems from the textbooks. It will be due on each Tuesday following the week the material is covered and will be worth 25% of the course grade.

**Tests & Quizzes:** There will be one mid-term exam, and one final exam. The mid-term will make up 25% of the class grade. The final is cumulative over the whole course and counts for 30% of the grade. Quizzes will be each Monday, and covering material from the previous week. Quizzes account for 20% of the course grade.

**Grading and Attendance Policy:** In all cases, it is *crucial* to show your work clearly to get credit for solutions to physics problems. Regrading requests must be well-justified in writing. Anticipated absences resulting from religious observance or officially sanctioned extracurricular activity must be brought to the instructor's attention at least 2 weeks in advance. Make-up exams will need to be arranged with the instructor.

**Other References:** The Department graduate library and/or University library have several other texts which serve as useful complements to the texts in this course:

D. Green, *The Physics of Particle Detectors*, Cambridge U. Press, 2000.

R. Cahn and G. Goldhaber, *Experimental Foundations of Particle Physics*, Cambridge U. Press, 2009.

*Experimental Techniques in High-Energy Nuclear and Particle Physics*, ed. by T. Ferbel, World Scientific Publ. Co., 1999.

R. Fruhwirth, et al., *Data Analysis Techniques for High-Energy Physics*, Cambridge U. Press, 2000.

W. Leo, *Techniques for Nuclear and Particle Physics Experiments*, Springer-Verlag, 1994.

C. Leroy and P. Rancoita, *Principles of Radiation Interaction in Matter and Detection*, World Scientific Publ. Co., 2009.

K. Kleinknecht, *Detectors for Particle Radiation*, Cambridge U. Press, 1998.

A. Frodesen, O. Skyeggestad and H. Tofte, *Probability and Statistics in Particle Physics*, Columbia U. Press, 1979.

R. Barlow, *Statistics: A Guide to the Use of Statistical Methods in the Physical Sciences*, John Wiley and Sons, 1989.

G. Cowan, *Statistical Data Analysis*, Oxford U. Press, 1998.

L. Lyons, *Statistics for Nuclear and Particle Physicists*, Cambridge U. Press, 1989.

## PHYSICS 7361 SCHEDULE, SPRING 2013

GS = Grupen and Shwartz; F = Fernow; () = optional reading

Date	Reading, Tests, Quizzes	Homework Problems:
Jan 22 T	Introduction F Ch. 1.1 to 1.6	F Ch. 1: 2, 3, 5, 6, 7
Jan 29 T	Ionization and Multiple Scattering GS Ch. 1.1.1 to 1.1.4 F Ch. 2.1 to 2.4.1, 2.7	GS Ch. 1: 1, 2, 4 F Ch. 2: 1, 2, 4
Feb 12 T	Other Electromagnetic Interactions GS Ch. 1.1.5, 1.1.10, 5.4 to 5.7 F Ch. 2.4.2	GS Ch. 5: 3, 4 F Ch. 2: 7
Feb 19 T	Photon Interactions w/Matter GS Ch. 1.2 F Ch. 2.5	GS Ch. 1: 5 F Ch. 2: 8, 9
Feb 26 T	Nuclear Interactions GS Ch. 1.3 F Ch. 3.1 to 3.2	F Ch. 3: 2, 3, 4
Mar 5 T	Tracking Detectors GS Ch. 7 (F Ch. 9.1, 4 and 10.1, 2, 4)	GS Ch. 7: 1, 4, 5 F Ch. 9: 7; Ch. 10: 1, 3
Mar 7 Th	Mid-term exam	
Mar 9-17	*Spring Break, no class	
Mar 26 T	Calorimetry GS Ch. 8 (F Ch. 11)	GS Ch. 8: 1, 2, 3 F Ch. 11: 1, 2, 3
Apr 9 T	Detectors for Particle Identification GS Ch. 9 and 10 (F Ch. 8)	GS Ch. 9: 1, 2, 4, 6; Ch. 10: 2, 4, 6 F Ch. 8: 3, 7
Apr 16 T	Electronics and Triggering GS Ch. 14 F Ch. 13	GS Ch. 14: 2 F Ch. 13: 4, 5, 6
Apr 23 T	Reconstruction and Analysis GS Ch. 15.1 to 15.6	GS Ch. 15: 1-4
May 2 T	Review	
May 11 S	Final Exam, 8am - 11am	