PHYSICS 8810

PARTICLE PHYSICS

FALL 2016

Advanced elementary particle physics including weak, electromagnetic, and strong interactions. Rudiments of experimental devices and techniques at level appropriate to both experimentally- and theoretically-oriented students. Prerequisites: PHY7060, PHY7110, PHY7410 (PHY8850 is strongly recommended). This is a 3 credit course.

Instructor:	Prof. Robert Harr	**Office:**	262 Physics
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Office Hours: 10:30 - 11:30 Monday and Wednesday, or by appointment.

Web Page: http://hep.physics.wayne.edu/~harr/courses/8810/f16/

Textbook: *Collider Physics* updated edition, by Vernon D. Barger and Roger J.N. Phillips, Westview Press, (1991); ISBN 0-201-14945-1. This text is recommended.

The course will follow the text, and appropriate sections for reading will be given at the start of lecture. A bibliography of other useful texts is on the web.

Lectures: TuTh 9:35am -- 11:00am, Physics Research Building, room 177.

You are encouraged to ask questions; if something isn't clear to you, it likely isn't clear to others in the class as well.

Homework: The practice of Physics requires problem solving skills. In this course you will learn and practice problem solving skills with weekly homework assignments. You may discuss and collaborate with classmates on the problems, but the final solution must be your own. Copying of solutions will result in failure for all parties involved. Your solutions will be collected, graded, and contribute to your final grade. Homework must include **explanatory text** and be **neatly written** or it will be given zero credit. The best 5 of 6 homework scores will be used in calculating your grade.

Research Report: Everyone will write a report on a topic that can be investigated using the Pythia Monte Carlo code. The topic will be chosen in consultation with the instructor. All reports are due by the final day of classes, Monday, December 12, 2016. Late reports will NOT be accepted.

Exams: At present, it is planned for the report to take the place of exams.

Grading:

Homework	67%	bi-weekly
Final Exam	0%	TBA

Research Report	33%
TOTAL	100%

The grade scale is as follows:

A+	95 -- 100%
A	90 -- 95%
A-	85 -- 90%
B+	80 -- 85%
B	75 -- 80%
B-	70 -- 75%
C+	65 -- 70%
C	60 -- 65%
F	< 60%

Policies: Late work is not accepted. The lowest homework score will be dropped. You are allowed and encouraged to discuss problems together, but what you turn in must be your own work -- do not copy problem solutions and turn them in as your own work. As a general rule, your classmates should not see the solutions you will turn in, and you should not see their solutions. Follow this link to view the English department's statement on plagiarism and a copy of Wayne State's academic integrity policy.

This is a zero-tolerance policy.

Course Content

Date	Topic	Text
7 Jan	Introduction	1.1 - 1.2
9 Jan	Review of rel. QM	1.3
11 Jan	Quantum numbers, C, P, angular mom.	
14 Jan	To be rescheduled	
16 Jan	To be rescheduled	
18 Jan	The standard model, Noether's theorem	2.1 - 2.2, Hw.1 due
21 Jan	MLK Holiday	
23 Jan	QED	2.2, 7.1
25 Jan	Yang-Mill's	2.3 - 2.4
28 Jan	SU(2), QCD, SU(3)	2.5 - 2.10
30 Jan	Higgs mechanism, Gauge sector parameters, masses and mixing	

1 Feb	Feynman rules	
4 Feb	Calculating decay widths and cross sections	Hw.2 due
6 Feb	Lepton decays, muon lifetime	3.1 - 3.3
8 Feb		3.4 - 3.9
11 Feb	Hadrons and quark decays	
13 Feb	Elastic $e^+ e^-$ collisions	4.1 - 4.3
15 Feb	Inelastic $e^+ e^-$ collisions	4.4 - 4.6
18 Feb	νe^- interactions	4.7, Hw.3 due
20 Feb	Partons and e, μ DIS	5.1 - 5.2
22 Feb	ν DIS	5.3 - 5.5
25 Feb	Parton distribution functions (PDF's)	5.6
27 Feb	Hadron-hadron collisions	5.7 - 5.9
1 Mar	Fragmentation	6
4 Mar		Hw.4 due
6 Mar		
8 Mar	To be rescheduled	
11 Mar	Spring Break	
13 Mar	Spring Break	
15 Mar	Spring Break	
18 Mar		
20 Mar		Hw.5 due
22 Mar		
25 Mar		
27 Mar		
29 Mar		
1 Apr		
3 Apr		
5 Apr		
8 Apr		Hw.6 due
10 Apr		

12 Apr		
15 Apr		
17 Apr		
19 Apr		
22 Apr		Reports due

Robert Harr

January 29, 2013