PHYSICS 556. Introductory Particle Physics.

Instructor:	Tim Gorringe.
Office:	CP273.
Phone:	257-8740.
Textbook:	Introduction to High Energy Physics, Donald Perkins, 4^{th} Ed.
Web page	www.pa.uky.edu/∼gorringe/phy556/s10
Class hours:	TR 11:00 - 12:15. CP367
Office hours:	T 2:00 - 3:00, CP273.
Office hours:	R 3:00 - 4:00, CP273.

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1 Course Objectives.

PHY556 is an introductory course in particle physics. We'll cover the properties of the elementary particles (quarks, leptons), the nature of the fundamental forces (strong, weak, electromagnetic), the role of symmetry, as well as some experiments that were pivotal in the development of the field. We'll also explore how the strong force is revealed in the properties of neutrons, protons and other hadrons and how the weak force is revealed in the charateristics of nuclear beta-decay and other weak processes.. Finally, we'll discuss the unification of the electromagnetic force with the weak force, and examine the nature of neutrinos.

2 Course Prerequisites.

Unlike many classes in physics this course isn't mathematically rigorous. In PHY556 our emphasis is concepts, ideas and the experimental underpinnings of the subject material. The prerequisite for PHY556 is undergraduate quantum mechanics (PHY520).

3 Course Grading.

Your final grade will be based on homework, the mid-term exam and the final exam. In addition, a 1% bonus is given to those who complete the on-line instructor and course

evaluation at the end of the semester. The contributions of the different components to your final grade, and the dates of the mid-term and the final, are given below.

assignment	date	contribution
homework		25%
mid-term exam	11:00-12:15 *am* R Mar 4	25%
final exam	10:30-12:30 *am* T May 4	50%
evaluation bonus	14 Apr. - 28 Apr.	1%

4 Homework assignments.

Homework assignments will be posted online and announced in class. Each Thursday the homework assignments from the preceding Thursday and Tuesday classes will be collected at the beginning of the class period. You are encouraged to get together with other students to discuss the homework assignments, but your homework solutions must be written–up independently. Late homework isn't accepted. Homework solutions will be made available in the Science library.

5 Course evaluations.

Course evaluations are an important component of our instructional program. Our on-line course evaluation was developed to allow each student ample time to complete the evaluation of the course and the instructor. The evaluation window for Spring 2007 will open on Monday, Apr. 12 and close on Wednesday, Apr. 28. To access the system go the physics department web page at www.pa.uky.edu and click the course evaluations link.

6 Important dates.

Classes begin on Wednesday, January 13 and end on Friday, April 30. During the semester there are several academic holidays: Martin Luther King Birthday - Monday, January 18, and Spring Break - Monday through Friday, March 15-20. The last day to drop a course is Friday, April 2.

7 Course schedule.

PHY556 meets TR from 11:00 to 12:15 am in room CP367. The following table lists the topics we will cover during the semester. Column four gives the relevant section in the text book.

Lec.	Date	Topic	Ch.Sec
1	R Jan, 14	foundations of quantum mechanics and special relativity and overview of elementary particles and fundamental forces	1.1-1.2
2	T Jan, 19	fermions & bosons, particles & antiparticles	1.3-1.6
3	R Jan, 21	handedness and flavor of quarks and leptons	1.7-1.9
4	T Jan, 26	quantum theory versus classical theory of fundamental forces	2.1-2.4
5	R Jan, 28	quantum electrodynamics / quantum field theory Feynman diagrams, gauge invariance and renormalization	2.4-2.6
6	T Feb, 2	examples of strong, weak and gravitational interactions	2.7-2.9
7	R Feb, 4	estimates of cross sections and decay rates	2.10-2.11
8	T Feb, 9	introductory remarks on basic symmetries - the example of parity	3.1-3.5
9	R Feb, 11	conservation of electric charge, lepton number, baryon number	3.7-3.8
10	T Feb, 16	CP/T violation and CPT invariance	3.9-3.11
11	R Feb, 18	general remarks on approximate symmetries - the example of isospin	3.12-3.14
12	T Feb, 23	the quarkonium states and their quark sub-structure	4.1-4.2
13	R Feb, 25	the baryon decuplet and its quark sub-structure	4.3-4.4
14	T Feb, 2	other baryon and meson multiplets and their quark sub-structure	4.5-4.7
	R Mar, 4	**mid-term exam 11:0-12:15**	**Ch. 1-4**
15	T Mar, 9	baryon masses, magnetic moments, and the top quark	4.8-4.13
16	R Mar, 11	$e^+e^-\rightarrow$hadrons and fractionally charged, point-like, spin-1/2 partons	5.1-5.2
	T Mar, 16	Spring Break	
	R Mar, 18	Spring Break	
17	T Mar, 23	lepton-hadron scattering and form factors, structure functions and neutron/proton structure	5.3-5.10
18	R Mar, 25	strong interactions at short distances and large distances	6.1-6.4
19	T Mar, 30	strong interactions and running coupling constants	6.5
20	R Apr, 1	basic feature of nuclear beta-decay	7.1-7.8
21	T Apr, 6	basic features of pion/muon decay	7.9-7.10
22	R Apr, 8	neutral weak currents	7.11-7.13
23	T Apr, 13	weak decays and mass mixing of quarks	7.14
24	R Apr, 15	weak interactions involving kaons	7.15-7.16
25	T Apr, 20	the Glashow-Weinberg-Salam model of electroweak unification	8.1-8.6
26	R Apr, 22	experimental evidence for electroweak unification	8.7-8.10
27	T Apr, 27	spontaneous symmetry breaking and the Higg's mechanism	8.11-8.13
28	R Apr, 29	neutrino mass and neutrino oscillations	9.6-9.8
	R May, 4	**Final exam 13:00-12:30**	**Ch. 1-9**