

# Physics 926

## Introduction to Nuclear and Particle Physics

### Spring 2008

#### Course Description

We will explore particle physics from a modern perspective, with an eye towards the new physics that we expect to learn soon at the Large Hadron Collider. We will start with an overview of our current understanding of how the universe is built of quarks and leptons that interact through the exchange of gauge bosons, and then work through the basics of group theory, how to do first-order calculations of cross sections and decay rates, and the application of these ideas to the electromagnetic, weak and electroweak interactions.

#### Meeting Time

12:30-1:45 PM, 202 Brace

#### Instructor

Ken Bloom, 108 Ferguson, 472-6093, [kenbloom@unl.edu](mailto:kenbloom@unl.edu)  
Office Hours: Monday 2:00-4:30 PM or by appointment (or by chance)

#### Prerequisites

Physics 917 or permission of instructor

#### Texts

There are two “recommended” texts for the course:

*Introduction to Particle Physics (4<sup>th</sup> Edition)*, Perkins

*Quarks and Leptons: An Introductory Course in Modern Particle Physics*,

Halzen and Martin.

The course will be pitched somewhere in between the two; you will want to have at least one of these books.

There are also two “optional” texts available at the bookstore:

*Introduction to Particle Physics*, Griffiths (easier)

*Particle Physics: A Comprehensive Introduction*, Seiden (harder)

You may want to explore other books, such as those by Gottfried and Weisskopf, Aitchison and Hey, and Quigg.

In addition, it will be useful to have access to the Review of Particle Properties; see <http://pdg.lbl.gov> for an online version, and information on how to request (for free) a paper copy. Some homework problems will rely on information available here.

## Homework

Assignments will be handed out in lecture each Tuesday, and will be due in lecture the following Tuesday. Homework not turned in on time will receive a grade of zero. You are encouraged to discuss the homework problems with other students, especially after you have made an initial attempt to solve them on your own. However, the solutions you turn in to be graded must be your own work.

## Makeup Lecture Time

The instructor may need to miss class sessions from time to time. We will determine a mutually agreeable time slot for makeup classes. Once it is determined, please try to keep this time available.

## Exams

There will be one midterm exam, which will probably be about a week before spring break. We will set the date at least two weeks in advance of the exam. The final exam will be held in the assigned time slot of 10:00-12:00 on Friday, May 9.

## Grading (approximate)

30% -- homework  
30% -- midterm exam  
40% -- final exam

## Course Outline

Big-picture overview  
Review of special relativity and other tools  
Experimental aspects of particle physics  
Invariance principles and conservation laws  
Group theory and the construction of hadrons  
Quantum electrodynamics as an example of perturbative calculations  
Weak interactions  
Mixing and CP violation  
Neutrinos  
Electroweak interactions  
Gauge symmetries and symmetry breaking  
The Standard Model and beyond

## Web Pages

Course materials and links to other materials of interest will be available through the Blackboard system.

## Academic Integrity

Refer to the Student Code of Conduct and Academic Integrity, which can be found at the Student Judicial Affairs Web site and in the back of the Undergraduate Bulletin. The first violation of the code will result in at least a failing grade for the assignment and notification of university officials. Further action may be taken. Subsequent violations will result in failure for the course, along with notification of university officials. To avoid situations of cheating, plagiarism or academic dishonesty, start your work early and contact the instructor in advance if something is unclear.

## Students with Disabilities

Students with disabilities are encouraged to contact the instructor for a confidential discussion of their individual needs for academic accommodation. It is the policy of the University of Nebraska-Lincoln to provide flexible and individualized accommodation to students with documented disabilities that may affect their ability to fully participate in course activities or to meet course requirements. To receive accommodation services, students must be registered with the Services for Students with Disabilities (SSD) office, 132 Canfield Administration, 472-3787 voice or TTY.