

**Course Information**

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**Physics 556: Nuclei and Elementary Particles**

**Physics 714: Introduction to High Energy Physics**

**Fall 2007**

**Overview**

The course will introduce you to the basic concepts of nuclear and elementary particle physics. The emphasis will be on providing a broad overview of the development of modern subatomic physics. It is intended to:

- Provide senior undergraduates with an introduction to nuclear and particle physics. The hope is to spark their interest so they can decide whether they would like to pursue similar research in graduate school
- Provide graduate students who have chosen to work in other fields of physics a working knowledge of the techniques and concepts of nuclear and particle physics
- Provide graduate students who are considering research in nuclear or high energy physics their first exposure to the motivations of current research problems in the field.

Some facility with basic quantum mechanics is assumed. The lectures will be pitched to cater to both undergraduate and graduate students. Both projected slides and blackboard will be used. Most of the lecture notes will be scanned and .pdf versions of the notes and slides will be posted on the web.

**Instructor:** Krishna S. Kumar  
**Office:** LGRT 421  
**Telephone:** office 545-1310  
**e-mail:** [kkumar@physics.umass.edu](mailto:kkumar@physics.umass.edu)  
**Office hours:** Any working day by walk-in or appointment- arrange by e-mail or telephone.

**Textbook:**

***Introduction to Elementary Particles***, (ISBN 0-471-60386-4) by David J. Griffiths. I will put the two copies in the library on reserve.

There are several books that will be using to supplement this material. They will be on the reserve list as well (if available):

- **Particles and Nuclei** by Povh, Rith, Scholz and Zetsche
- **Modern Elementary Particle Physics** by Gordon Kane
- **Subatomic Physics** by Frauenfelder and Henley
- **The Experimental Foundations of Particle Physics** by Cahn and Goldhaber
- **Introduction to High Energy Physics** by D. H. Perkins

Whenever supplementary material is used, there will be lecture notes or web links and clear documentation in handouts.

**Syllabus:**

Chapters 1 thru 4, 6 thru 8 and 10 thru 11 of the main textbook will be covered. The topics are:

- Fundamental constituents of matter
- Relativistic Kinematics and Scattering
- Symmetries and Conservation Laws
- Relativistic Spin One-Half Formalism
- Quantum Electrodynamics
- Charged and Neutral Weak Interactions
- Gauge Invariance and Electroweak Theory
- Particle Production at Colliders
- CP Violation
- Neutrino Mass
- Nuclear Beta decay
- Nuclear Shell Structure

**Typical Schedule:**

Starting on Tuesday, there will be a handout every 2 weeks. This handout will describe the material to be covered, suggested reading and a homework assignment. The assignment will be due in 2-3 weeks.

The lecture style will be to use the blackboard on pedagogical aspects of the course. This will be supplemented by slides which will emphasize experimental results as well as phenomenological aspects of the course. Please don't hesitate to stop me when I am going too fast. Hopefully, I will be able to infuse some of the passion and enthusiasm that I feel for subatomic physics during these lectures.

*I would like to run several supplementary lectures on Monday or Friday in late September/early October since we will skip 3 classes in late October*

**Assignments:**

Assignments will be the primary source for grading assessment. It is okay to discuss the assignment with others (including me), but it is strongly recommended that you complete the assignment independently. Promptness in submitting the assignments is critical, since it ensures that you are keeping up with the course.

**Assessment:**

The grade for the course is based on the assignments, an end-semester report/presentation on one of a selected group of landmark experiments in nuclear and particle physics, and a brief oral exam. ***There will be no written exams.***

**Website:**

To be developed