

SYLLABUS PHYS 4312 (Nuclear/Particle Physics) — Spring 2013

Schedule:	TT 2:00 - 3:20 pm, Math 012
Instructor:	Dr. Richard WIGMANS
Office, tel:	Sci 114, 742-3779
E-mail:	wigmans@ttu.edu
Office hours:	TT 11:00-12:30 and by appointment
Prerequisite:	PHYS 2402 or equivalent
Text:	Ashok Das & Thomas Ferbel <i>Introduction to Nuclear and Particle Physics</i> (paperback edition, ISBN 981-238-744-7)
Evaluation:	Homework & quizzes 30%
	Individual paper + presentation 30%
	Tests 40%

- **Course content:**

This course is intended to be a comprehensive introduction to the study of the subatomic structure of matter and of the forces that govern its behavior at the most elementary level. In the past century, enormous progress has been made in this field, not least because of the tremendous technological developments that made increasingly sophisticated experiments possible at ever increasing energies.

After a brief historical overview of the developments in subatomic physics and of the relativistic kinematics that is needed to understand many essential details, we will roughly follow the approach of Das and Ferbel, who divide the material in three parts: Nuclear physics, Instrumentation and Particle Physics. We will also discuss the increasingly important synergy between the study of the innermost structure of matter and of the largest object we know: The Universe. This synergy has led to a rapidly developing new field: *Astroparticle physics*.

In contrast with many other courses, the emphasis will generally be on the physics insight rather than on a mathematically solid approach of the phenomena. The practical problems (and the often very ingenious ways in which these are being solved) in the daily life of a particle physicist will take a central place in the lectures.

- **Learning objectives and assessment:**

One objective of this course is to introduce you to the cutting edge of fundamental physics research, which has shaped our understanding of the nature of matter and the way it behaves at the most elementary level. Another objective is to make you familiar with modern literature search methods, and with the writing and public presentation of a scientific paper. These are very important skills for anyone who would like to pursue a scientific career.

The assessment of how well you have internalized and are able to apply the concepts of modern physics research will be done through evaluation of your homework and by means of tests. The public presentation of your research topic will be peer reviewed by your fellow students, as well as by one or several professors. The instructor will discuss these evaluations with you.

- **Credit:**

This course will count for 3 credits and can be taken as an elective by Physics majors, as well as by graduate students.

- **Grading:**

The grading will be on a straight 10-point scale. The average needed for an A is above 90, a B is above 80, a C is above 70 and a D is above 60.

Other Notes:

- There will be bi-weekly homework assignments. This homework is either due in the week after it is assigned, or will be the topic of a short quiz in the week after it is assigned. Details will be provided later.
- There will be 3 midterm tests, which cover the three main topic areas (nuclear physics, instrumentation, particle physics). These tests are take-home exams. Dates will be determined in consultation with the students. There is **no** comprehensive final exam.

- An important part of this course is the **individual project**. Each student will choose a specific topic, do a literature study on this topic, write a paper on this topic and present this paper in class. It is recommended that the topics are chosen as early as possible. Each topic has to be agreed upon by the instructor, who also has a list of possible topics to choose from. The paper should have a length of at maximum 20 pages and should be written in a scientific format. The length of the presentation is about 20 minutes. The presentations will take place in the last two weeks of the semester. The paper is due on the last day of class.
 - Any student who, because of a disabling condition, may require some special arrangements in order to meet course requirements should contact the instructor as soon as possible so that necessary accommodations can be made.
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