Physics 416, Advanced Topics in Physics

Spring 2010

Dr. Yost

Office:	216 Grimsley Hall	**Textbook:**	Kenneth Krane Introductory Nuclear Physics Wiley, 1987 ISBN: 978-0471805533
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Classes:	208 Grimsley Hall, MWF 8:00 – 9:00	**Office Hours:**	MWF 9-10 AM, 4-5 PM or by appointment
Web Page:	www.vic.com/syost/phys416		

This course is an introduction to nuclear physics. We will begin with a brief overview of nuclear properties and some historical perspective, then review (or introduce) the quantum mechanics needed to understand nuclear physics at the level of this course. We can then describe nuclear structure models, radioactive decay, and nuclear reactions. The prerequisites for this course are PHYS 222 and 272, and MATH 107 or 132.

Topics

Topics covered will be somewhat flexible, but should include the most of the following:

- Historical introduction and terminology
- Introduction to / review of quantum mechanics:
  wave functions, the Schrödinger equation, angular momentum, *etc*.
- Nuclear properties: radius, mass, binding energy, angular momentum, *etc*.
- Nuclear models: the shell model, *etc*.
- Radioactive decay: α, β, γ.
- Nuclear reactions: cross sections, fission, fusion
- Applications: technology, astrophysics (including student presentations)

Since this is an advanced topics course, the schedule will be flexible, and may be partially determined by student interest.

Grades

Grades will be based on four aspects of the course, with approximately equal weight:

- Midterm Exam
- Final Exam
- Presentation on a specific application of nuclear physics
- Homework and participation

Exams

The midterm exam will cover material in about the first 5 weeks of the course. The final exam will focus primarily on the later parts of the course. Notes will be permitted during the exams, which will focus on homework-style problems (not necessarily from the homework, but requiring similar analysis). The mid-term exam will be a take-home exam, and the final will be done in-class. All exam work must be completed individually using only permitted resources.

Presentation

Each student will select a topic relevant to some technological or astrophysical application of nuclear physics, in consultation with me, and present it in a written paper as well as in an oral presentation to the class near the end of the semester. The paper should be approximately 10 pages in length, and will be presented in a 20 minute talk before the class, to be followed by a question period. I will schedule meetings with each student before mid-terms to discuss your choice of topic. The topics should be at an appropriate level for this course, and specific enough to permit a reasonably in-depth discussion in a 10-page paper.

Homework and Participation

Homework will be assigned to clarify the reading. The purpose of the homework, in most cases, is to clarify the reading, and to be sure you have understood it. Collective work may be very useful, though you must turn in your own solutions. You should come to class prepared to discuss the assigned readings, and to ask questions about any parts that require further clarification. Don't just *read* the book – *work* through its details and try to fill in gaps.