Physics 440: Nuclear and Particle Physics
Spring 2025, On-line

Instructor:	Phil Rubin
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Office Hours:	By appointment
Website:	`http://prubin.physics.gmu.edu/courses/440-540/`

Please note:

- All e-mail communication from the instructor concerning this course will be to GMU accounts only.
- If you are a student with a disability and you need academic accommodations, please see me **and** contact the Office of Disability Resources at 703.993.2474. All academic accommodations must be arranged through that office.

Course Goal:

1. To gain a basic familiarity with sub-atomic physics and its methods.

Suggested Reference:

- Course notes: `http://prubin.physics.gmu.edu/courses/440-540/notes.pdf`

Additional References:

- *Quarks & Leptons: An Introductory Course in Modern Particle Physics*, F. Halzen and A. Martin
- *Introduction to High Energy Physics*, D. Perkins
- *Introduction to Elementary Particles*, D. Griffiths
- *Nuclear and Particle Physics: An Introduction*, B. R. Martin [Recommended to me, but I'm unfamiliar with it]
- *Particle Physics*, B. R. Martin [Recommended to me, but I'm unfamiliar with it]

Reading Resources:

- Undergraduate: `http://prubin.physics.gmu.edu/courses/440-540/undergrad/`
- Graduate: `http://prubin.physics.gmu.edu/courses/440-540/grad/`
- Nobel Prize Lectures: `http://prubin.physics.gmu.edu/courses/440-540/nobel/`

Expectations:

The fundamental expectation is that each student answers all assigned problems correctly. Each student is expected to participate in an individual, scheduled, weekly, one-hour, one-on-one tutorial to go over assigned these problems. They will be the basis of the oral final examination.

The exercises are worth 80% of the final grade. For 40% of the grade, each student is expected to attempt and submit draft solution to each exercise by Sunday 17:00 (5 pm) of the week it is assigned. The instructor will review these and identify and offer suggestions for any that are not correctly done. These will be the focus of the Monday tutorial. The other 40% of the exercise grade requires that correct solutions to all problems ate submitted by midnight (00:00) Friday of the week assigned.

The fraction of problems attempted (right or wrong) and submitted on time (Sunday, 17:00) determines the fraction of the first 40% earned. The fraction of correct answers submitted by the weekly deadline (Friday, midnight) determines the fraction of the remaining 40%.

It is recommended that the notes linked to above be studied before attempting the problems. The instructor is available by e-mail or (usually) Zoom to answer questions. Working with others to get started or overcome difficulties is encouraged, but the solutions presented must be the work of the presenting student. Shared or copied solutions will earn no credit for all involved.

An oral final exam based on the assigned problems will account for the remaining 20% of the final grade.

Grading:

- Exercises, 80%; final exam 20%

A+ = 100-93.33%	A = 93.32-86.67	A- = 86.66-80
B+ = 79.99-73.33	B = 73.32-66.67	B- = 66.66-60
C+ = 59.99-53.33	C = 53.32-46.67	C- = 46.66-40
	D = 39.99-20	
	F < 20	

Tentative Schedule:

Week	Topic
1	Dimensions and units
2	Collisions and scattering
3	Interactions between electromagnetic radiation and matter
4	Interactions between charged particle radiation and matter
5	Particle accelerators and detectors
6	Nuclei
7	Nuclear stability and instability
8	**Spring break**
9	Nuclear transformations and radioactivity
10	Nuclear models
11	Nuclear reactions
12	Nuclear fission and fusion
13	Four-momentum
14	Particle physics (I)
15	Particle physics (II)

Final Examination: One-hour, individual, cumulative oral exam based on the semester's exercises. Date and time to be scheduled after Spring break (week 8).

Attendance and Tardiness: Preparation for and on-time attendance at tutorial sessions required. Credit will be deducted for tardiness.

Disruptive Behavior: It is expected that you will engage constructively at tutorial sessions, prepared to offer and explain solutions to the exercises assigned.

Honor Code Violations: The work you present must be your own. Plagiarism and cheating will be punished with failing grades and trial by the honor committee. It's important to appreciate that science is impossible when dishonesty, in any manifestation, exists.

The GMU Honor Code: `https://oai.gmu.edu/mason-honor-code/`