

PHYS 1378: INTRODUCTION TO NUCLEAR AND PARTICLE PHYSICS

SPRING 2026

Course Info:

- Instructor: **Pranava Teja Surukuchi**; 417 Allen Hall; surukuchi@pitt.edu;
- Office hours; **TBD**
- Meeting times: **MWF 9:00–9:50 AM**
- Location: **TBD**

Course Description:

This is a self-contained introductory course that provides an experimental and theoretical introduction to nuclear and particle physics. The interactions of particles with matter will be reviewed along with experimental techniques used for particle production, detection, and measurement. Theoretical framework underlying particle and nuclear physics—including kinematics, special relativity, quantum mechanics, symmetries, and conservation laws—will be reviewed. These concepts and techniques are applied to examine a range of properties of elementary particles and nuclei and the phenomena associated with them. Applications of nuclear and particle physics and open questions requiring physics beyond the Standard Model will also be briefly discussed.

Texts:

Brian R. Martin, Graham Shaw: *Nuclear and Particle Physics: An Introduction*, 3rd ed ISBN: 978-1-119-34461-2.

The lectures will also be drawn from several other books and papers. Some other good references include

- **Ernest M Henley, A. Garcia**; *Subatomic Physics*, 3rd ed ISBN 978-981-277-222-0
- **Glenn F. Knoll**; *Radiation Detection and Measurement*, 4th ed ISBN: 978-0-470-13148-0
A great resource for experimental aspects of nuclear and particle physics
- **David J. Griffiths, Darrell F. Schroeter**; *Introduction to Quantum Mechanics*, 3rd ed ISBN: 9781107189638

Prerequisites:

Although the course is self-contained, a background in quantum mechanics (Physics 1370) is recommended. A good grasp of vector calculus and linear algebra would also be beneficial. No prior knowledge of nuclear and particle physics is expected.

Course Objectives:

Upon completion of the course, students are expected to gain a basic understanding of the experimental and theoretical aspects of particle and nuclear physics and apply them to the understand various nuclear and particle physics phenomena.

Homework:

A significant portion of learning in the course occurs through solving homework problems. Homework sets are assigned 1–2 weeks on Fridays and will be due the following week on Friday. Late homeworks will be graded, with a 50% penalty, if turned in within a week after the due date. I encourage you to discuss with me ahead of time any extenuating circumstances that would prevent you from submitting your homework by the due date. We will use [Canvas](#) as the primary source for sharing homework problem sets and solutions. You are encouraged to form study groups with the other members of the class. You can discuss the homework problems with the study group, but you are required to submit your own solutions.

Exams, project, and Grading:

There will be one mid-term and one final exam. The exam dates are TBD, but will be announced several weeks in advance. The final course grade will be determined depending on:

- Homework: 35%
- Mid-term exam: 25%
- Final comprehensive exam: 40%

Policies and Statements

Academic Integrity

Students in this course will be expected to comply with the [University of Pittsburgh's Policy on Academic Integrity](#). Any student suspected of violating this obligation for any reason during the semester will be required to participate in the procedural process, initiated at the instructor level, as outlined in the University Guidelines on Academic Integrity. This may include, but is not limited to, the confiscation of the examination of any individual suspected of violating University Policy. Furthermore, no student may bring any unauthorized materials to an exam, including dictionaries and programmable calculators.

To learn more about Academic Integrity, visit the [Academic Integrity Guide](#) for an overview of the topic. For hands-on practice, complete the [Academic Integrity Modules](#).

Use of AI

The use of AI tools (such as ChatGPT, Gemini, etc) is only allowed in limited contexts. Homeworks are designed to reinforce learning by prompting you to reflect on the concepts and ideas discussed in the class. Relying on AI tools to solve homework problems undermines the efficacy of this process. As a result, you are not permitted to use AI tools to solve homework assignments. However, you are allowed to use AI tools to search for resources, brainstorm ideas, or correct and refine grammar. You are required to acknowledge the use of these tools where applicable. Examples of such statements can be found [here](#). A particularly beneficial way of utilizing AI tools to reinforce learning is by having them generate questions for you to answer, encouraging deeper understanding.

Disability Services

If you have a disability for which you are or may be requesting an accommodation, you are encouraged to contact both your instructor and [Disability Resources and Services \(DRS\)](#), 140 William Pitt Union, [\(412\) 648-7890](#), drsrecep@pitt.edu, [\(412\) 228-5347](#) for P3 ASL users, as early as possible in the term. DRS will verify your disability and determine reasonable accommodations for this course.

Accessibility

The Canvas LMS platform was built using the most modern HTML and CSS technologies, and is committed to W3C's Web Accessibility Initiative and [Section 508](#) guidelines. Specific details regarding individual [feature compliance](#) are documented and updated regularly.

Copyright Notice

These materials may be protected by copyright. United States copyright law, 17 USC section 101, et seq., in addition to University policy and procedures, prohibit unauthorized duplication or retransmission of course materials.

See Library of Congress [Copyright Office](#) and the [University Copyright Policy](#).

Equity, Diversity, and Inclusion

The University of Pittsburgh does not tolerate any form of discrimination, harassment, or retaliation based on disability, race, color, religion, national origin, ancestry, genetic information, marital status, familial status, sex, age, sexual orientation, veteran status or gender identity or other factors as stated in the University's Title IX policy. The University is committed to taking prompt action to end a hostile environment that interferes with the University's mission. For more information about policies, procedures, and practices, visit the [Civil Rights & Title IX Compliance web page](#).

I ask that everyone in the class strive to help ensure that other members of this class can learn in a supportive and respectful environment. If there are instances of the aforementioned issues, please contact the Title IX Coordinator, by calling [\(412\) 648-7860](#), or e-mailing titleixcoordinator@pitt.edu. Reports can also be [filed online](#). You may also choose to report this to a faculty/staff member; they are required to communicate this to the University's Office of Diversity and Inclusion. If you wish to maintain complete confidentiality, you may also contact the University Counseling Center [\(412\) 648-7930](#).

Religious Observances

The observance of religious holidays (activities observed by a religious group of which a student is a member) and cultural practices are an important reflection of diversity. As your instructor, I am committed to providing equivalent educational opportunities to students of all belief systems. At the beginning of the semester, you should review the course requirements to identify foreseeable conflicts with assignments, exams, or other required attendance. If at all possible, please contact me (your course coordinator/s) within the first two weeks of the first class meeting to allow time for us to discuss and make fair and reasonable adjustments to the schedule and/or tasks.

Sexual Misconduct, Required Reporting, and Title IX

If you are experiencing sexual assault, sexual harassment, domestic violence, and stalking, please report it to me and I will connect you to University resources to support you.

University faculty and staff members are required to report all instances of sexual misconduct, including harassment and sexual violence to the Office of Civil Rights and Title IX. When a report is made, individuals can expect to be contacted by the Title IX Office with information about support resources and options related to safety, accommodations, process, and policy. I encourage you to use the services and resources that may be most helpful to you.

As your professor, I am required to report any incidents of sexual misconduct that are directly reported to me. You can also report directly to Office of Civil Rights and Title IX: (412) 648-7860 (M-F; 8:30am-5:00pm) or via the Pitt Concern Connection at: [Make A Report](#)

An important exception to the reporting requirement exists for academic work. Disclosures about sexual misconduct that are shared as a relevant part of an academic project, classroom discussion, or course assignment, are not required to be disclosed to the University's Title IX office.

If you wish to make a confidential report, Pitt encourages you to reach out to these resources:

- The University Counseling Center: (412) 648-7930 (8:30 A.M. TO 5 P.M. M-F) and (412) 648-7856 (AFTER BUSINESS HOURS)
- Pittsburgh Action Against Rape (community resource): 1(866) 363-7273 (24/7)

If you have an immediate safety concern, please contact the University of Pittsburgh Police, (412) 624-2121

Any form of sexual harassment or violence will not be excused or tolerated at the University of Pittsburgh.

For additional information, please visit the [full syllabus statement](#) on the Office of Diversity, Equity, and Inclusion webpage.

Your Well-being Matters

College/Graduate school can be an exciting and challenging time for students. Taking time to maintain your well-being and seek appropriate support can help you achieve your goals and lead a fulfilling life. It can be helpful to remember that we all benefit from assistance and guidance at times, and there are many resources available to support your well-being while you are at Pitt. You are encouraged to visit [Thrive@Pitt](#) to learn more about well-being and the many campus resources available to help you thrive.

If you or anyone you know experiences overwhelming academic stress, persistent difficult feelings and/or challenging life events, you are strongly encouraged to seek support. In addition to reaching out to friends and loved ones, consider connecting with a faculty member you trust for assistance connecting to helpful resources.

The [University Counseling Center](#) is also here for you. You can call (412) 648-7930 at any time to connect with a clinician. If you or someone you know is feeling suicidal, please call the University Counseling Center at any time at (412) 648-7930. You can also contact Resolve Crisis Network at (888) 796-8226. If the situation is life threatening, call Pitt Police at (412) 624-2121 or dial 911.