

**Physics 1378: Introduction to Nuclear and Particle Physics**  
**Spring 2022**  
**Syllabus**

**Lecture Room** 106 Allen Hall

**Lecture** MWF, 2:00-2:50 PM

**Instructor** Brian Batell

**E-mail** [batell@pitt.edu](mailto:batell@pitt.edu)

**Course Website** We will use the Pitt Canvas site for this course:

<https://canvas.pitt.edu>

Log in with your University ID and password and navigate to the PHYS 1378 page. Here you will find announcements, lecture notes, homework assignments and solutions, grades, the syllabus, and other important materials. Please check this site regularly for course announcements.

**Text** *Nuclear and Particle Physics: An Introduction*, 3rd Edition, Brian R. Martin, Graham Shaw, ISBN: 978-1-119-34461-2. The publisher page is linked [here](#).

**Supplementary Texts** I will draw on other references for source material and will collect them here as the course develops. You may also find these useful as supplementary texts.

*Undergraduate Level Particle Physics Textbooks:*

Modern Particle Physics, 1st Edition, by Mark Thomson

Introduction to Elementary Particles, 2nd Edition, by David J. Griffiths.

*Undergraduate Level Quantum Mechanics Textbooks:*

Introduction to Quantum Mechanics, 3rd Edition, by David J. Griffiths, Darrell F. Schroeter

*Graduate Level Quantum Mechanics Textbooks:*

Principles of Quantum Mechanics, by Ramamurti Shankar

*Graduate Level Quantum Field Theory Textbooks:*

An Introduction to Quantum Field Theory, by Michael E. Peskin, Daniel V. Schroeder

**Office Hours** I will hold regular office hours each week on Wednesdays and Fridays from 3:00 PM - 4:00 PM.

I strongly encourage you to take advantage of office hours. If my regular office hours do not work with your schedule for any reason, please email me to set up an appointment to meet outside of these times.

**Course Description** A self-contained undergraduate level course covering the theoretical concepts and the experimental methods of nuclear and particle physics. An introduction to quantum mechanics and special relativity, the theoretical frameworks underlying the study of elementary particles, will be provided. Particle and nuclear reactions will be understood and calculated using symmetry principles and kinematics. The methods of particle acceleration and detection will be examined. These basic concepts and techniques will be applied to understand a broad range of phenomena across nuclear and particle physics, including properties of nuclei, radioactivity, nuclear models, properties of elementary particles, the electromagnetic, weak, and strong interactions, the Standard Model and the Higgs boson, applications of nuclear and particle physics, and open questions requiring physics beyond the Standard Model.

**Learning Objectives** Develop an understanding of the theoretical principles and experimental techniques underlying the study of nuclear and particle physics. Apply these basic concepts and methodologies to describe and understand a variety of nuclear and particle physics phenomena.

**Homework** Homework will be assigned every 1-2 weeks and will be due the following week. Homework will be graded and solutions to the homework will be made available after all students have turned in the assignment. Late assignments will be accepted if turned in no later than one week after the original due date and will be awarded 50% of the total credit. If there are outstanding circumstances that prevent you from completing the assignment on time, please see me to discuss the matter. I strongly encourage you to discuss the homework problems with your classmates. However, each student must write their own solutions to the homework problems.

**Exams** There will be one take-home midterm exam and one take-home final comprehensive exam during the semester.

**Grading** The final grade will be awarded according to the weighted credit for homework (30%), midterm exam (30%), and final exam (40%).

**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. To learn more about Academic Integrity, visit the [Academic Integrity Guide](#) for an overview of the topic. For hands-on practice, complete the [Understanding and Avoiding Plagiarism tutorial](#).

**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](mailto: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.

**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](mailto: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).

**Gender Inclusive Language Statement** Language is gender-inclusive and non-sexist when we use words that arm and respect how people describe, express, and experience their gender. Just as sexist language excludes women's experiences, non-gender-inclusive language excludes the experiences of individuals whose identities may not fit the gender binary, and/or who may not identify with the sex they were assigned at birth. Identities including trans, intersex, and genderqueer reflect personal descriptions, expressions, and experiences. Gender-inclusive/non-sexist language acknowledges people of any gender (for example, first year student versus freshman, chair versus chairman, humankind versus mankind, etc.). It also arms non-binary gender identifications, and recognizes the difference between biological sex and gender expression. Students, faculty, and staff may share their preferred pronouns and names, and these gender identities and gender expressions should be honored.

From the [Gender, Sexuality, and Women's Studies Program](#).

**Health and Safety Statement** During this pandemic, it is extremely important that you abide by the [public health regulations](#), the University of Pittsburgh's [health standards and guidelines](#), and [Pitt's Health Rules](#). These rules have been developed to protect the health and safety of all of us. Universal [face covering](#) is required in all classrooms and in every building on campus, without exceptions, regardless of vaccination status. This means you must wear a face covering that properly covers your nose and mouth when you are in the classroom. If you do not comply, you will be asked to leave class. It is your responsibility have the required face covering when

entering a university building or classroom. For the most up-to-date information and guidance, please visit [coronavirus.pitt.edu](https://coronavirus.pitt.edu) and check your Pitt email for updates before each class.

**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** The University is committed to combating sexual misconduct. As a result, you should know that University faculty and staff members are required to report any instances of sexual misconduct, including harassment and sexual violence, to the University's Title IX office. What this means is that as your professor, I am required to report any incidents of sexual misconduct that are directly reported to me, or of which I am somehow made aware. After a report is made, you will be contacted by the Title IX Office for opportunities for support and options for proceeding.

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.

**If you have any concerns about the course, please do not hesitate to contact the instructor.**