

PHYS 5702 RELATIVISTIC QUANTUM MECHANICS

TERM WINTER 2025

Course Instructor: Prof. Yue Zhang	Class Location: Check Carleton Central
Email: yuezhang13@cunet.carleton.ca (Please include “PHYS5702” in subject line.)	Class Time: WF 11:35 am – 12:55 pm
Department/Unit: Physics	First Day of Class: January 8, 2025
Preclusions: PHYS 5701 and permission of the Department	Last Day of Class: April 4, 2025
	Office Hours: Make appointment by email.
	Office Location: Room 3324 HP

Important dates and deadlines can be found here: [link](#), including class suspension for fall, winter breaks, and statutory holidays.

Topics Covered and Learning Outcomes

Official description: Relativistic wave equations. Expansion of S matrix in Feynman perturbation series. Feynman rules. An introduction to quantum electro-dynamics with some second quantization. Gauge theories. May include introduction to Standard Model.

Topics to be Covered:

- Reviews: classical mechanics, quantum mechanics, classical fields, special relativity.
- Quantization of scalar, fermion and vector fields.
- S-matrix, Feynman rules, and perturbation theory.
- Decay rate and scattering cross section.
- QED processes.

Assessments

Grade Breakdown:

Assignments (x4) 60%,	FinalExam 40%
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Homework assignments will be posted on Brightspace. The deadline for handing in your work is usually two weeks after they have been given out. You are encouraged to discuss together on the homework assignments; however, the work you hand in must be your own.

There will be a take-home final exam at the end of the semester. Students will be given 48 hours to complete the exam. It will be open book and open notes, but you may not consult with any other people or use the internet.

Late and Missed Work Policies

Late Work

Late assignments will not be accepted, unless permission is received from the professor for documented reasons.

Missed Work

If you missed an exam, you must notify the professor within three working days after the date of the exam. Deferred exams will be permitted for documented reasons (illness, injury or other extraordinary circumstances beyond the student's control).

Learning Materials and other Course/Lab Resources

Ancillary fees associated with this course, e.g., textbooks, course packs, lab manuals, field work, online resources or links required for the course along with their associated cost (if applicable). Estimated costs can be acquired based on current bookstore offerings, Amazon, etc.

- For most of this course I will follow this textbook: An Introduction to Quantum Field Theory, by M. E. Peskin and D. V. Schroder, Westview Press, (1995).

While it is not mandatory to purchase the book, I strongly recommend doing so if financially feasible. It not only will be useful for studying this course, but also for research in the future.

The textbook will be available in the Bookstore, and online (e.g. Amazon). About CA\$120 (paperback) for a new book. The library may have copies of the book.

- I will post my lecture notes in BrightSpace, <https://brightspace.carleton.ca>.

Students are not required to purchase textbooks or other learning materials for this course.

Academic Accommodations and Regulations

Carleton is committed to providing academic accessibility for all individuals. You may need special arrangements to meet your academic obligations during the term. The accommodation request processes are outlined on the Academic Accommodations website (<https://students.carleton.ca/course-outline/>).

Statement on Chat GPT/Generative AI usage (See the Sample Syllabus Statements for AI use in Courses document for examples)

Statement on Academic Integrity

Misconduct in scholarly activity will not be tolerated and will result in consequences as outlined in Carleton University's Academic Integrity Policy (see here). A list of standard sanctions in the Faculty of Science can be found here. Additional details about this process can be found on the Faculty of Science Academic Integrity website. Students are expected to familiarize themselves with and abide by Carleton University's Academic Integrity Policy.

Student Rights and Responsibilities

Students are expected to act responsibly and engage respectfully with other students and members of the Carleton and the broader community. See the 7 Rights and Responsibilities Policy for details regarding the expectations of non-academic behaviour of students. Those who participate with another student in the commission of an infraction of this Policy will also be held liable for their actions.