

**CARLETON UNIVERSITY
DEPARTMENT OF PHYSICS**

**PHYS 5601 F
FALL 2025**

EXPERIMENTAL TECHNIQUES OF NUCLEAR AND ELEMENTARY PARTICLE PHYSICS

Instructor: Razvan Gornea

Office Hours: *available on request via email*

Office: *Meeting in HP 2462 or remotely using Zoom*

Email: razvan.gornea@carleton.ca

Teaching assistant: Ishan Vyas

Contact: *available via email*

Email: IshanVyas@cmail.carleton.ca

Course meets: Mondays and Wednesdays, from 10h05 to 11h25

Pre-requisites & Precluded Courses:

PHYS 4307 and PHYS 4707 (or permission from the Physics Department)

Course Description and Objectives:

This course introduces various experimental methods that were developed for and are used in particle and nuclear physics. Major sections are:

1. Introduction, fundamentals and brief history
2. Radioactive sources and particle generators
3. Interaction of ionizing radiation with matter
4. Detection of electrically charged particles
5. Detection of electrically neutral particles
6. Electronics and data acquisition systems
7. Experiment design
8. Applications: calorimeters
9. Applications: trackers
10. Applications: low-background detectors

Reading and Textbook:

Introduction to Experimental Particle Physics [Revised Edition]

R. Fernow

Cambridge University Press – 2023

Cost is about 68 CAD on www.amazon.ca

Course Requirements & Methods of Evaluation:

Grades distribution:

- assignments count for 40%
- seminar on a research project or detection technique counts for 30%
- written take-home final examination counts for 30%

There will be 4 assignments given during the term. You are encouraged to discuss the problems with your colleagues, but ***the submitted work must be your own***. The mid-term seminar will consist of a 20-minute presentation followed by 10 minutes of questions. The take-home final exam duration will be four days.

Inclusivity statement

I am committed to fostering an inclusive learning environment well suited to all regardless of race, gender identity, expression, sexual orientation, age and ability. All students, the instructor and visitors should be treated with respect during all interactions. It is my intent that our classes will support a diversity of experience, thought and perspective. I am constantly striving to create an inclusive learning environment, and I always appreciate your feedback and support. I welcome electronic or in-person communication to let me know your preferred name and pronouns.

University policies

Grade Definition:

In accordance with the Carleton University Undergraduate Calendar Regulations, the letter grades assigned in this course will have the following percentage equivalents:

A+ = 90-100	B+ = 77-79	C+ = 67-69	D+ = 57-59
A = 85-89	B = 73-76	C = 63-66	D = 53-56
A- = 80-84	B- = 70-72	C- = 60-62	D- = 50-52
F = <50			

WDN = Withdrawn from the course

ABS = Student absent from final exam

DEF = Deferred (See above)

FND = (Failed, no Deferred) = student could not pass even with 100% on final exam

Academic Regulations, Accommodations, Plagiarism, Etc.:

University rules regarding registration, withdrawal, appealing marks, and most anything else you might need to know can be found on the university's website, here:

<http://calendar.carleton.ca/undergrad/regulations/academicregulationsoftheuniversity/>

Academic Accommodations for Students with Disabilities:

The Paul Menton Centre for Students with Disabilities (PMC) provides services to students with Learning Disabilities (LD), psychiatric/mental health disabilities, Attention Deficit Hyperactivity Disorder (ADHD), Autism Spectrum Disorders (ASD), chronic medical conditions, and impairments in mobility, hearing, and vision. If you have a disability requiring academic accommodations in this course, please contact PMC at **613-520-6608 or pmc@carleton.ca** for a formal evaluation.

If you are already registered with the PMC, contact your PMC coordinator to send your ***Letter of Accommodation*** at the beginning of the term, and no later than two weeks before the first in-class scheduled test or exam requiring accommodation (if applicable).

carleton.ca/pmc

For Religious Obligations:

Students requesting academic accommodations on the basis of religious obligation should make a formal, written request to their instructors for alternate dates and/or means of satisfying academic requirements. Such requests should be made during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist, but no later than two weeks before the compulsory event.

Accommodation is to be worked out directly and on an individual basis between the student and the instructor(s) involved. Instructors will make accommodations in a way that avoids academic disadvantage to the student.

Students or instructors who have questions or want to confirm accommodation eligibility of a religious event or practice may refer to the Equity Services website for a list of holy days and Carleton's Academic Accommodation policies or may contact an Equity Services Advisor in the Equity Services Department for assistance.

carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf

For Pregnancy:

Pregnant students requiring academic accommodations are encouraged to contact an Equity Advisor in Equity Services to complete a letter of accommodation. The student must then make an appointment to discuss her needs with the instructor at least two weeks prior to the first academic event in which it is anticipated the accommodation will be required.

carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf

Plagiarism:

Plagiarism is the passing off of someone else's work as your own and is a serious academic offence. For the details of what constitutes plagiarism, the potential penalties and the procedures refer to the section on Instructional Offences in the Undergraduate Calendar.

What are the Penalties for Plagiarism?

A student found to have plagiarized an assignment may be subject to one of several penalties including: expulsion; suspension from all studies at Carleton; suspension from full-time studies; and/or a reprimand; a refusal of permission to continue or to register in a specific degree program; academic probation; award of an FNS, Fail, or an ABS.

What are the Procedures?

All allegations of plagiarism are reported to the Dean of Faculty of Science. Documentation is prepared by instructors and/or departmental chairs.

The Dean writes to the student and the University Ombudsperson about the alleged plagiarism.

The Dean reviews the allegation. If it is not resolved at this level then it is referred to a tribunal appointed by the Senate.

Students are expected to familiarize themselves with and follow the Carleton University Student Academic Integrity Policy (see <https://carleton.ca/registrar/academic-integrity/>). The Policy is strictly enforced and is binding on all students. Plagiarism and cheating – presenting another's ideas, arguments, words or images as your own, using unauthorized material, misrepresentation, fabricating or misrepresenting research data, unauthorized co-operation or collaboration or completing work for another student – weaken the quality of the graduate degree. Academic dishonesty in any form will not be tolerated. Students who infringe the Policy may be subject to one of several penalties including: expulsion; suspension from all studies at Carleton; suspension from full-time studies; a refusal of permission to continue or to register in a specific degree program; academic probation; or a grade of Failure in the course.

Assistance for Students:

Academic and Career Development Services: <http://carleton.ca/sacds/>

Writing Services: <http://www.carleton.ca/csas/writing-services/>

Peer Assisted Study Sessions (PASS): <https://carleton.ca/csas/group-support/pass/>

Math Tutorial Centre: <https://carleton.ca/math/math-tutorial-centre/>

Science Student Success Centre: <https://sssc.carleton.ca/>

Important Information:

- Student or professor materials created for this course (including presentations and posted notes, labs, case studies, assignments and exams) remain the intellectual property of the author(s). They are intended for personal use and may not be reproduced or redistributed without prior written consent of the author(s).
- Students must always retain a hard copy of all work that is submitted.
- Standing in a course is determined by the course instructor subject to the approval of the Faculty Dean. This means that grades submitted by the instructor may be subject to revision. No grades are final until they have been approved by the Dean.
- Carleton University is committed to protecting the privacy of those who study or work here (currently and formerly). To that end, Carleton's Privacy Office seeks to encourage the implementation of the privacy provisions of Ontario's *Freedom of Information and Protection of Privacy Act* (FIPPA) within the university.
- In accordance with FIPPA, please ensure all communication with staff/faculty is done via your Carleton email account. To get your Carleton Email you will need to activate your MyCarletonOne account through Carleton Central. Once you have activated your MyCarletonOne account, log into the MyCarleton Portal.

Important Dates:

<https://carleton.ca/registrar/registration/dates-and-deadlines/>