

**CARLETON UNIVERSITY
DEPARTMENT OF PHYSICS**

**PHYS 5601 F
FALL 2026**

EXPERIMENTAL TECHNIQUES OF NUCLEAR AND ELEMENTARY PARTICLE PHYSICS

Carleton University acknowledges that its campus is located on the traditional, unceded territories of the Algonquin Anishinaabeg people. We recognize our responsibility to the natural environment and to reconciliation with Indigenous peoples.

Instructor: Razvan Gornea

Office Hours: available on request via email

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

Email: razvan.gornea@carleton.ca

Course meets: Mondays and Wednesdays, from 16h05 to 17h25

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 71 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***. Use of AI is not allowed except for spelling and grammar corrections. Please use exclusively “standard web search” when preparing for a presentation. The mid-term seminar will consist of a 20-minute talk followed by 10 minutes of questions. The take-home final exam duration will be two 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.

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

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, including information about the *Academic Consideration Policy for Students in Medical and Other Extenuating Circumstances*, are outlined on the Academic Accommodations website (students.carleton.ca/course-outline).

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:

Please note the following important dates. Consult the [Calendar website](#) for a full list of important dates and the most updated information.

Date	Notes
September 2	Deadline for course outlines to be made available to students for Early Fall, Full Fall and Fall/Winter courses
September 18-20	Deferred Exam Period: Full Summer and late Summer term deferred final examinations.
October 26	Deadline for course outlines to be made available to students for Late Fall courses.
October 26-30	Fall Break: No classes will take place. Students cannot be required to attend class or submit coursework from Sunday, October 25 to Sunday, November 1. The following exceptions may apply: • If it is necessary to hold a test after Friday, October 23 due to exceptional circumstances, it can only be scheduled on Saturday, October 24. <i>This timing must be announced on the course outline that is distributed at the beginning of the term.</i>
October 31- November 1 and November 7-8	Final examinations in early fall undergraduate courses will be held.
November 11	Remembrance Day is on Wednesday, November 11. As much as possible, course instructors are asked to allow for a moment of silence for personal reflection at 11 a.m. in accordance with Senate policy .
November 20-22	Early fall undergraduate deferred final examinations will be held.

November 27	Last day for summative tests or examinations, or formative tests or examinations totaling more than 15% of the final grade, in late fall term undergraduate courses, before the official final examination period.
December 12-23	Final examinations in Full Fall and Late Fall courses and mid-term examinations in Fall/Winter courses will be held. Examinations are normally held all seven days of the week.
December 23	All final take-home examinations are due on this day, with the exception of those conforming to the examination regulations in the Academic Regulations of the University section of the Undergraduate Calendar/General Regulations of the Graduate Calendar.
December 30	Deadline for course outlines to be made available to students for Early Winter and Full Winter courses.
January 22-24; January 29-31	Full fall and late fall term deferred final examinations will be held.
February 15-19	Winter Break: No classes will take place. Students cannot be required to attend class or submit coursework from Sunday, February 14 to Sunday, February 21. The following exceptions may apply: • If it is necessary to hold a test after Friday, February 12, it can only be scheduled on Saturday, February 13. This timing must be announced on the course outline that is distributed at the beginning of the term.
February 18	Deadline for course outlines to be made available to students registered for Late Winter courses.
February 27-28, March 6-7	Final exams for Early Winter undergraduate courses will be held.
March 19-21	Early Winter term undergraduate deferred final examinations will be held.
March 25	Last day for summative tests or examinations, or formative tests or examinations totaling more than 15% of the final grade, in full winter term or fall/winter undergraduate courses, before the official April final examination period.
April 11-23	Final examinations in Full Winter, Late Winter, and Fall/Winter courses will be held. Examinations are normally held all seven days of the week.
April 23	All final take-home examinations are due on this day, with the exception of those conforming to the examination regulations in the Academic Regulations of the University section of the Undergraduate Calendar/General Regulations of the Graduate Calendar.

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