

# Course Outline

PHYS 6601: Particle Physics Phenomenology (Fall 2020)  
Department of Physics, Carleton University

## General information:

**Instructor:** Yue Zhang, Assistant Professor of Physics

**Office:** 3324 Herzberg Laboratories

**Email:** Yue.Zhang13@carleton.ca (**Include “PHYS6601” in the subject line**)

**Course date/time:** 8:35 – 9:55 AM, Mondays and Wednesdays

**First Day of Class:** September 9, 2020

**Last Day of Class:** December 9, 2020

**Course location:** Online

**Office Hour:** Make appointment by email.

## Course Information:

**Course Description:** This course covers much of the required knowledge for research in particle physics from both the experimental and theoretical points of view. Topics may include: standard model, parton model, quark model, hadron spectroscopy, and tests of QCD.

**Prerequisites:** PHYS 5602 and PHYS 5702, or permission of the Department.

**Course Web Page:** Homework assignments will be posted in CULearn, to log in, go to <http://www.carleton.ca/culearn>. Please check it on a regular basis. Additional email communications will take place as needed.

**Textbook:** *The Standard Model: A Primer*, by C. P. Burgess and Guy D. Moore, Cambridge University Press, (2006).

**Other useful textbooks:** *An Introduction to Quantum Field Theory*, by M. E. Peskin and D. V. Schroder, Westview Press, (1995);

*Gauge Theories of the Strong, Weak, and Electromagnetic Interactions: Second Edition*, by C. Quigg, Princeton University Press, (2013).

## Course Content:

- ▷ Quantum field theory overview
- ▷ The Standard Model Lagrangian: masses, interactions, symmetries

- ▷ Weak interaction: gauge bosons, Higgs boson, lepton decays and collisions, low energy effective theories
- ▷ Strong interaction: deep-inelastic scattering, parton model for LHC analysis, hadrons as low energy description
- ▷ Flavor physics and CP violation, brief introduction to neutrino physics

## **Grading Scheme:**

### Homework assignments (4 × 20%):

There will be four assignments given out. Assignments will be posted on CULearn. The deadline for handing in assignments is two weeks after they have been given out. You are encouraged to work together on the homework assignments; however, the work you hand in must be your own. Late assignment will not be accepted without an acceptable reason.

### Final Seminar (20%):

Each student will be expected to give a 20-minute seminar on a topic in particle physics. Please discuss your choice of topic with the Professor before Reading Week. You should take this opportunity to learn about a particle physics topic that is not directly related to your thesis research. The talks will be scheduled during the December exam period in consultation with the class.

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.

## **Notable dates:**

September 9, 2020: First Day of Class.

October 12, 2020: Statutory holiday. University closed.

October 26-30, 2020: Fall break. Classes are suspended.

December 9, 2020: Last Day of Class.

December 11, 2020: Fall term ends.

December 12 – 23, 2020: Final examinations in fall term courses and mid-term examinations in fall/winter courses may be held.

## **Course Copyright:**

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your own educational use. You may not allow others to reproduce or distribute lecture notes and course materials publicly for commercial purposes without my express written consent.

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## **Academic Accommodation Policies:**

You may need special arrangements to meet your academic obligations during the term. For a list of academic accommodation statements, please visit: <https://students.carleton.ca/course-outline/#pregnancy-obligation>.

**Pregnancy obligation:** Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist.

**Religious obligation:** Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist.

**Academic accommodations for students with disabilities:** If you have a documented disability requiring academic accommodations in this course, please contact the Paul Menton Centre for Students with Disabilities (PMC) at 613-520-6608 or [pmc@carleton.ca](mailto:pmc@carleton.ca) for a formal evaluation or contact your PMC coordinator to send your instructor your Letter of Accommodation at the beginning of the term. You must also contact the PMC no later than two weeks before the first in-class scheduled test or exam requiring accommodation (if applicable). After requesting accommodation from PMC, meet with your instructor as soon as possible to ensure accommodation arrangements are made.

**Survivors of sexual violence:** As a community, Carleton University is committed to maintaining a positive learning, working and living environment where sexual violence will not be tolerated, and where survivors are supported through academic accommodations as per Carleton's Sexual Violence Policy. For more information about the services available at the university and to obtain information about sexual violence and/or support, visit: [carleton.ca/sexual-violence-support](https://carleton.ca/sexual-violence-support).

**Accommodation for student activities:** Carleton University recognizes the substantial benefits, both to the individual student and for the university, that result from a student participating

in activities beyond the classroom experience. Reasonable accommodation must be provided to students who compete or perform at the national or international level. Please contact your instructor with any requests for academic accommodation during the first two weeks of class, or as soon as possible after the need for accommodation is known to exist.

## **Academic Policies:**

Academic policies are posted on the Department of Physics webpage:

<https://physics.carleton.ca/current-undergraduate-students/academic-policies>.

Please also read and be familiar with the following Carleton University policies: Privacy and freedom of information: <http://www6.carleton.ca/privacy/>.

**Academic integrity:** The University Senate defines plagiarism as “presenting, whether intentionally or not, the ideas, expression of ideas or work of others as one’s own. This can include:

- reproducing or paraphrasing portions of someone else’s published or unpublished material, regardless of the source, and presenting these as one’s own without proper citation or reference to the original source;
- submitting a take-home examination, essay, laboratory report or other assignment written, in whole or in part, by someone else;
- using ideas or direct, verbatim quotations, or paraphrased material, concepts, or ideas without appropriate acknowledgment in any academic assignment;
- using another’s data or research findings;
- failing to acknowledge sources through the use of proper citations when using another’s works and/or failing to use quotation marks;
- handing in “substantially the same piece of work for academic credit more than once without prior written permission of the course instructor in which the submission occurs.”

Plagiarism is a serious offence that cannot be resolved directly by the course’s instructor. The Associate Dean of the Faculty conducts a rigorous investigation, including an interview with the student, when an instructor suspects a piece of work has been plagiarized. Penalties are not trivial. They can include a final grade of “F” for the course.”

Please read item 19 of <http://calendar.carleton.ca/grad/gradregulations/>, in particular the sections on plagiarism and the unauthorized resubmission of work.

## **Useful Resources:**

Carleton’s Student Academic and Career Development Services (SACDS), including Career Services, Academic Advising, Co-Operative Education, and the Centre for Student Academic Support.