# PHYS 424: Particle Physics
January - April 2020

**Instructor**: Prof. Michel Lefebvre
**Office**: Elliott 205A
**Phone**: +1 250 721-7706
**Email**: lefebvre@uvic.ca
**Web:** https://www.uvic.ca/science/physics/vispa/people/faculty/lefebvre.php

**Lectures**: In Clearihue A207
Tuesdays 15:30 - 16:50
Fridays 13:30 - 14:50
First lecture: Tuesday 7 January 2020.

**Course web**: http://coursespaces.uvic.ca

**Text**: Introduction to Elementary Particles, 2nd edition, David Griffiths.
One copy in the Library Reserve call number "pri 16779".

**Office Hours**
In Elliott 205A: Thursdays 13:00-15:00 starting 16 January.
You can also email lefebvre@uvic.ca to make an appointment.

**Keys to success**
- Attend lectures.
- Read the text.
- Do assignments.
- Work on your project.

**Course material**
Course material will be distributed via the University's http://coursespaces.uvic.ca web site, and will include assignments, assignment solutions, and all slides shown in class.

**Topics covered**
This course will be an overview of particle physics, leading to topics of current research interest, such as CP violation, the Higgs boson and neutrino oscillations. The course will start with an overview of elementary particle dynamics, followed by a review of special relativity. We will then discuss symmetries, including a review of angular momentum in quantum mechanics. We will then address the calculation of decay rates and scattering cross sections through the use of the Feynman diagrams. This will then be applied to quantum electrodynamics, quantum chromodynamics, and the weak interaction. If time permits, we will discuss gauge theories and the structure of the Standard Model of particle physics, including the role of the Higgs boson and close with a discussion of neutrino oscillations and physics beyond the Standard Model.

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**Required course**
Prerequisite: PHYS 423 or permission from the Department.
If you do not satisfy this requirement, please contact the instructor.

**Marking and Grades**
To obtain credit in the course you must attempt and submit material for all evaluated components, and have at least 50% on your final mark which is obtained with the following marking scheme:

| | | |
|---|---|---|
| Assignments | 30% | approximately 6 or 7 assignments |
| Project | 30% | slides and presentation components |
| Final exam | 40% | 3 hour exam, April Exam Period |

If the application of this scheme would result in grades that are judged by the instructor to be inconsistent with the University's grading descriptions, then the instructor will assign percentages consistent with them. The grade N is a failing grade that indicates that you did not complete the required course work.

**Calculator for exam**
You may only use a non-programmable, non-graphing calculator for exams. Examples of acceptable calculators are the Sharp EL-510R or EL-510RNB; they can be bought in the UVic Bookstore for about $10.

**Accommodation**
Arrangement for reasonable accommodations for customarily accommodated issues will be considered, however this is contingent on your active participation: If you miss a course requirement, you are expected to contact the instructor as soon as reasonably possible, and you are expected to give the instructor advance warning of issues that you could have reasonably foreseen.

**Conduct**
Attendance in class not required, but strongly recommended.
It is strictly prohibited to use cell phones or laptops to perform texting or social networking during class.
Cheating, plagiarism, and other form of academic fraud are taken very seriously by the University and by the instructor. Please familiarize yourself with the University Policy on Academic Integrity.

**Final Exam**
You can bring your textbook, assignments and personal notes to the final exam. Make sure you have your textbook for the exam.

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**Other potentially useful references**

- Mark Thomson, Modern Particle Physics, Cambridge University Press, 2013.
  - This is an excellent modern text suitable for senior undergraduate and M.Sc. level.
- IJR Aitchison and AJG Hey, Gauge Theories in Particle Physics, Institute of Physics Publishing, 3rd edition
  - This is a two-volume advanced text suitable for M.Sc. and Ph.D. level
- Ta-Pei Cheng and Ling-Fong Li, Gauge theory of elementary particle physics, Oxford science publication.
  - This is a classic advanced text on gauge theories, and it includes a useful introduction to group theory for Lie groups.
- Howard Georgi, Lie Algebras in Particle Physics, Westview press.

**Tentative Schedule (updated 2020/01/10)**

| Date | Lecture Title | Text reference |
|---|---|---|
| Jan 7 | Introduction | Chapter 1 |
| Jan 10, 14 | Elementary Particle Dynamics | Chapter 2 |
| Jan 17, 21, 24 | Relativistic Kinematics | Chapter 3 |
| Jan 28, 31 | Symmetries | Chapter 4 |
| Feb 4, 7, 11 | Symmetries | Chapter 4 |
| Feb 14 | The Feynman Calculus | Chapter 6 |
| Feb 17-21 | READING BREAK | |
| Feb 25, 28 | The Feynman Calculus | Chapter 6 |
| Mar 3, 6, 10 | Quantum Electrodynamics | Chapter 7 |
| Mar 13, 17 | Quantum Chromodynamics | Chapter 8 |
| Mar 20 | Project presentations | |
| Mar 24, 27 | Weak Interactions | Chapter 9 |
| Mar 31, Apr 3 | Gauge Theories | Chapter 10 |