



PHYS 2903

# PHYSICS TOWARDS THE FUTURE

*An on-line course based on the  
Open Physics Education Module*



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**Office Hours:** Friday 2pm – 3pm (to be confirmed) via Zoom , or by appointment.

## OVERVIEW

This course is intended for students with little or no background in Science. It introduces physics through a set of modules that closely connected to our everyday life and future.

This course is only available on-line via BrightSpace. The course is delivered asynchronously, i.e., it does NOT have fixed lecture times. The students should take the online lessons following the course timeline (see Page 3). **The lectures are interactive and include questions, a student need to achieve 75% or higher in a lecture before they can see the next lecture.** All lectures must be completed to gain access to the module quizzes.

**Faculty of Science B.Sc. students may only take this course as a free elective, while students in Computer Science (BCS) may only take as a breadth elective.**

## COURSE LEVEL LEARNING OUTCOMES

By the end of the course, students should be able to:

1. Explain physics related phenomenon using basic physics principles and terminology
2. Perform basic calculation/estimations to solve simple physics related problems
3. Make correct judgement/decisions on physics related issues in their daily life based on basic physics principles
4. Explain our position in the solar system, our galaxy and the universe
5. Briefly describe a couple recent advances in physics research

# CONTENT

The following thematic modules will be covered in this course. Each module will help you answer a series of questions listed below.

## 1. Sound and Music

In many ways, music might be viewed as one of the most human of inventions. What is the nature of sound and what are the relationships between pitch, loudness, musical scales and the fundamental properties of sounds? How are sounds generated, from different types of instruments, that create a musical performance?

## 2. Light and Colour

What is light exactly? What is radiation and electromagnetic wave? How do eyes and lenses work? How do we see colours? How do we communicate with EM waves?

## 3. Cell Phone

It has become commonplace, almost anywhere one travels in the world, to see people using cell phones for conversations, texting, accessing the internet, listening to music, and taking photos. What are the physics principles behind the manufacture and operation of cell phones?

## 4. Medical Physics

Medical physics is about using physical approaches to diagnose and treat diseases. What is x-ray? How does it “see” through our body? What is MRI? Why doctors always order MRI instead of x-ray if you have a joint pain? How ultrasound scan works?

## 5. The Solar System and Beyond

The nature of the universe beyond our planet has always fascinated humans. How do we use rockets to place satellites in orbit and send missions out into the solar system? What is the structure of our solar system...of our galaxy...of the universe?

## 6. Recent Advances

Some of the most interesting questions in science are being tackled by physicists around the world. What are dark matter and dark energy? What are gravitational waves? Why is discovery of the Higgs particle important and what does it tell us? What are neutrinos and how do we observe them?

# MODULE COMPLETION DATES AND PHYSICS TOPICS COVERED

The pace of this course is about finishing one module in every two weeks. **Each module contains a series of interactive lecture videos. You must answer questions in one lecture and achieve at least 75% before the next lecture video become visible.** The following is the timeline.

Thematic Modules	Suggested completion dates of lecture videos	Physics topics Covered
1. Sound and Music	Jan. 14	amplitude, velocity, wavelength, and frequency of sound waves, resonance, interference, harmonics, standing waves
2. Light and Colour	Jan 28	Radiation as wave, electromagnetic wave, optical lenses and its application, human eyes, wavelength and color, color perceptions, radio waves and communication.
3. Cell Phone	Feb. 11	Semiconductors, diode and transistor, basic of logic gates and CPU, fabrication of integrated circuits, acceleration and accelerometer, rotation and gyroscope, light polarization and LCD screen.
4. Medical Physics	Feb. 26	x-ray properties and production, x-ray diffraction and imaging, ionizing radiation dose, radiation therapy, nuclear magnetic resonance, magnetic resonance imaging principle and safety, ultrasound imaging.
5. Solar System and Beyond	Mar. 11	gravity, momentum, energy, circular motion, orbits, time dilation
6. Recent Advances	Mar. 25	neutrinos, Higgs particle, gravitational waves, dark energy and dark matter, photonics

## EVALUATION

### 1. (40%) Module quizzes

**Only after you have completed all the interactive lecture videos in a module, and scored 75% or higher in each lecture video, the module quiz for that module will become available (visible).** The module quiz is a one-hour online quiz of 15 questions. Each quiz account for 6.67% of the final mark.

Thematic Module	Module quiz due date
1. Sound and Music	Jan. 18, 11:59 pm
2. Light and Colour	Feb. 1, 11:59 pm
3. Cell Phone	Feb. 15, 11:59 pm
4. Medical Physics	Mar. 1, 11:59 pm
5. Solar System and Beyond	Mar. 15, 11:59 pm
6. Recent Advances	Mar. 29, 11:59 pm

If you missed the quiz deadline, make-up quizzes will be available with 20% penalty.

### 2. (40%) Two Lab reports

During this course, you are supposed to perform two labs of your choice using materials or devices that are available in your home.

The due dates are listed in this table:

	<b>Labs</b>	<b>Due dates</b>
Lab #1 (20%) Please pick ONLY one of the two labs	1. Rubber band guitar	<b>Feb 22</b> , 11:59pm (at the end of reading week)
	2. Light and imaging by lens	
Lab #2 (20%)	Virtual lab: Solar Systems	<b>April 8</b> , 11:59pm

For the lab report, a write up template will be provided. The lab reports should be written using word processing software, for example, M.S. Word or Google Doc. The reports must be submitted as **PDF file**. The lab reports should be uploaded via BrightSpace.

**Each lab report account for 20% of the final mark**

#### **Early submission bonus points:**

If you submit your lab report ...	Bonus points ...
2 weeks ahead of due dates	2 points
1 week ahead of the due dates	1 point

#### **Late Penalties:**

The late lab report will be accepted with the following penalties:

Overdue under 24 hours: 5% (1pt)

Overdue between 24 hours and 3 days(72 hours): 10% (2pts)

Overdue between 3 days and 7 days: 15% (3pts)

Overdue more than 7 days will receive zero marks for the assignment.

### **3. (20%) Final online quiz**

During the final exam period, there will be a 2-hour online quiz that covers all the content of the course.

## **COPYING, PLAGIARISM AND OTHER FORMS OF CHEATING**

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 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:

- **using online tutorial services (such as Chegg) or discussion forum/chats to solve quiz or exam problems**
- **Copy other's lab report, lab photo or lab data**
- **collaborating on solving problems during a quiz or the exam**
- **using AI tools, such as ChatGPT, to solve problem or answer questions on the lab report for you.**

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.

## COURSE COPYRIGHT

Classroom teaching and learning activities, including lectures, discussions, presentations, etc., by both instructors and students, are copyright protected and remain the intellectual property of their respective author(s). All course materials, including PowerPoint presentations, outlines, and other materials, are also protected by copyright and remain the intellectual property of their respective author(s).

Students registered in the course may take notes and make copies of course materials for their own educational use only. Students are not permitted to reproduce or distribute lecture notes and course materials publicly for commercial or non-commercial purposes without express written consent from the copyright holder(s).

## ACADEMIC ACCOMMODATIONS

Carleton University is committed to providing access to the educational experience in order to promote academic accessibility for all individuals.

Academic accommodation refers to educational practices, systems and support mechanisms designed to accommodate diversity and difference. The purpose of accommodation is to enable students to perform the essential requirements of their academic programs. At no time does academic accommodation undermine or compromise the learning objectives that are established by the academic authorities of the University.

### **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. For more details, visit the Equity Services website

<https://carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf>

### **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. For more details, visit the Equity Services website <https://carleton.ca/equity/wp-content/uploads/Student-Guide-to-Academic-Accommodation.pdf>

### **Academic Accommodations for Students with Disabilities:**

The Paul Merton 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](mailto:pmc@carleton.ca) for a formal evaluation. If you are already registered with the PMC, contact your PMC coordinator to send me 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). After requesting accommodation from PMC, meet with me to ensure accommodation arrangements are made. Please consult the PMC website for the deadline to request accommodations for the formally- scheduled exam (if applicable).

#### ***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: <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. For more details, see the policy at

<https://carleton.ca/senate/wp-content/uploads/Accommodation-for-Student-Activities-1.pdf>

For more information on academic accommodation, please contact the departmental administrator or visit: [students.carleton.ca/course-outline](http://students.carleton.ca/course-outline)

## **STUDENT RIGHTS & 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.

## **STUDENT CONCERNs**

If a concern arises regarding this course, your first point of contact is me: Email or drop in during student hours and I will do my best to address your concern. If I am unable to address your concern, the next points of contact are (in this order):

**Note: You can also bring your concerns to Ombuds services.**

