

**Carleton University**  
**Department of Physics**  
**Physics 3701 A**  
**Elements of Quantum Mechanics: Fall 2020**

**Instructor:**

Bruce Campbell  
Herzberg 3378  
520-2600x4322  
email: [campbell@physics.carleton.ca](mailto:campbell@physics.carleton.ca)  
Office Hours: Tuesday 13:05 - 14:30, or by appointment

**Teaching Assistant:**

Carel Rethmeier  
email: [carelrethmeier@cmail.carleton.ca](mailto:carelrethmeier@cmail.carleton.ca)

**Lectures:**

Tuesday and Thursday 11:35 - 12:55  
Mainly, synchronous lectures delivered by Big Blue Button in CULearn  
Recordings of the lectures will be posted on CULearn for asynchronous learning  
Complete, detailed, lecture notes will be posted on CULearn  
Some weeks pre-recorded lectures may be posted on CULearn

**Prerequisites:** PHYS 2604, and MATH 2000 or MATH 2004 or MATH 2008, and MATH 3705;  
or permission of the Department.

**Marks Distribution:**

Assignments:	40%
Midterm Examinations	30%
Final Examination	30%

## Course Delivery:

- The course notes posted on CULearn are the primary text for the course. There is also an assigned text, which is required for the course. This text has been chosen because it contains many good worked examples, which you may find helpful, and some of which will be assigned reading.
- The course notes are protected by copyright. They are for your own educational use, but you are *not* permitted to publish to third party sites, such as social media sites, and course materials sites.
- There will be approximately five to seven assignments given out. They will be posted on CU Learn. They are due in class at a time announced on distribution. If there is a particular problem with submission of an assignment by the due date please e-mail the instructor *before* the due date to explain the exceptional circumstances involved.
- You are allowed to discuss the problem assignments with other students in this course. However, the work you turn in must be entirely your own. Figuring out the assignments is the best way to learn the material.
- Working through problems is an essential part of developing a deep understanding of physics. This course is heavily math based and is meant to provide a foundation for the mathematical aspects of physics of future classes. Students are permitted to discuss concepts and strategies related to solving the homework assignments; however, the work handed in must be your own.
- Please note that submitting an examination of any kind, a laboratory report, or other assignment that is copied, in whole or in part, from someone else is considered plagiarism, which is an academic misconduct offence. This includes copying the full solution or any part of the solution from an online resource like Chegg, or from any other type of unauthorized source.
- For University regulations concerning academic offences see:  
<https://calendar.carleton.ca/undergrad/regulations/academicregulationsoftheuniversity/>
- The exact format and timing of the exams will be discussed well in advance. As on-line course delivery for a full semester is new for this year, and guidance from the administration on possibilities for administering examinations is evolving, the exact formalities for examination administration may change. The date(s) of the midterm(s) will be set in consultation with the class. All examinations will be (at least in part) long answer, to be hand-written on paper. The

student is required to have the tools necessary to scan the resulting examination answer sheets, and convert the scans to .pdf format, in order to submit their examination answers electronically. For administration of the examinations, which will be displayed electronically in CULearn, stable internet is required, and for invigilation of the examinations a desktop/laptop with a webcam is required.

- Use of e-Proctoring system: This course has timed written assessments, which may consist of tests, midterms and/or final examinations. The Carleton University e-Proctoring system may be used in your assessments, and requires the use of webcams, microphones, and smart phones.

- Session Recording:

- Web lectures in this course will be recorded for asynchronous learning, and review.

If students do not wish to be recorded they should leave their camera and microphone off, and submit questions to the instructor via *private* chat.

- You will be notified at the start of a lecture when the recording starts.

- The recordings are protected by copyright. The recordings are for your own educational use, but you are *not* permitted to publish to third party sites, such as social media sites, and course materials sites.

- In all communications during the synchronous lectures, or during tutorial sessions, or office hours sessions, all participants should be courteous and respectful.

- Students who miss the final examination may not be eligible for a deferred examination if they have not achieved a passing grade on the term work component of the course (Assignments plus Midterm).

### **Required Text:**

Introduction To Quantum Mechanics (3rd Edition)

David J. Griffiths and Darrell F. Schroeter

Cambridge University Press (2018)

Note that the required text is also the required textbook for PHYS 4708. Students who will be continuing in PHYS 4707 and PHYS 4708 are advised to read this text as a supplement to the class lecture notes posted in CULearn, which are the primary reference text for the material.

## Course Content:

The primary course content is that of the PHYS 3701 CULearn Lecture Notes. The course content is defined by the lectures as well as the notes.

This course is an introduction to the basic ideas and methods of non-relativistic quantum mechanics. It will introduce students to the Schroedinger equation, and its basic properties and interpretation. Elementary solutions of the Schroedinger Equation for 1-dimensional motion will be derived, and their properties analyzed. The Schroedinger Equation in three dimensions will be introduced, and the angular momentum of quantum particles analyzed, including spin angular momentum. Solutions of the 3-dimensional Schroedinger Equation for simple potentials will be derived, and their properties analyzed. Selected applications to atomic, molecular, and nuclear physics will be discussed

For Physics Department policies regarding academic integrity and privacy, please see <http://www.physics.carleton.ca/Policies.html>. **It is your responsibility to read these policies.** Please let me know if you require a hardcopy version.

## 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

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

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.

### 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 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.

### **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**

Text from <https://students.carleton.ca/course-outline/>

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:***

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. For more details, visit the Paul Menton Centre website <https://carleton.ca/pmc>

- The deadlines for contacting the Paul Menton Centre regarding accommodation for final exams for the Fall exam period is **November 13, 2020** and for the Winter exam period is **March 12, 2021**.

***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>

**Assistance for Students:**

Career Services: <https://carleton.ca/career/>

Academic Advising: <https://carleton.ca/academicadvising/>

Co-operative Education: <https://carleton.ca/co-op/>

Centre for Student Academic Support: <https://carleton.ca/csas/>

Writing Services: <https://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/>

**Freedom of Information and Protection of Privacy:**

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 email communication with staff/faculty is 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://calendar.carleton.ca/academicyear/>

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