

CHM 196H1S: THE QUANTUM WORLD AND IT'S CLASSICAL LIMIT

WINTER 2023 Course Syllabus

I TEACHING TEAM

INSTRUCTOR

Name: Paul Brumer

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Online Class: Wednesdays 4pm-6pm (via zoom: information can be found the end of this syllabus)

Office Hours: Fridays 1:30pm-2:30pm (via zoom: information can be found at the end of this syllabus)

Note that this virtual course is listed as “synchronous” which means that students are expected to attend lectures at the designated lecture hours. Lectures will also be recorded and posted on Quercus for review purposes. However, attendance during lecture hours is vital (note grading scheme below).

There are no teaching assistants for this course. Students would benefit greatly from interacting with other students as will be outlined in the first lecture.

II COURSE OVERVIEW

COURSE DESCRIPTION:

Quantum Mechanics provides a reliable description of behavior of atoms, molecules, and photons, but is characterized by a variety of conceptual problems resulting from its non-intuitive predictions. We will discuss aspects of quantum mechanics and its classical limit, focusing first on its manifestations in nature and then on fundamental issues such as uncertainty, interference, entanglement, and decoherence. Students will be advised to interact with the Writing Centres at their college to gain strength in essay writing. A strong interest in Physics and Mathematics are advantageous.

STUDENT LEARNING OUTCOMES:

Students will gain knowledge through hypothesis-driven methods of inquiry aimed at answering scientific questions through the design and implementation of experimental and theoretical methods.

Students will also learn, due to the subtle character of quantum ideas, accuracy and care in reading, writing, analyzing. (E.g., “Reading Like a Writer...” by Francine Prose; “Eats, Shoots and Leaves: The Zero Tolerance Approach to Punctuation” by Lynne Truss; “The Random House Handbook” by Frederick Crews).

NB: clarity in English writing is crucial to the proper expression of ideas. The University has numerous tools to aid the student in learning how to properly write and to express their ideas clearly. You are urged to look carefully for University Resources available to all students.

REQUIRED READINGS:

- *The New Quantum Universe*, by Hey and Walters
- *The Strange World of Quantum Mechanics*, by Daniel Streyer
- *The Character of Physical Law*, by Richard Feynman

You need not buy Streyer's book until we reach the appropriate time during the year.

Suggested advanced readings:

- *Quantum Physics: What Everyone Needs to Know*, by Michael Raymer
- *Through Two Doors at Once: The Elegant Experiment that Captures the Enigma of Our Quantum Reality*, by Anil Ananthaswamy

Lots more reading (not obligatory) will be suggested during the course.

III COURSE ORGANIZATION

This course is organized by weeks, details regarding the course structure and details of the evaluation scheme will be discussed in lecture.

IV EVALUATION/GRADING SCHEME

OVERVIEW:

Random Quizzes/Tests during lecture: 15% (timing to be explained during lecture)

Midterm Test: 20% (March 1, 2023)

Final Assessment: 35% (during final assessment period)

Essay: 15% (due March 31, 2023)

Class participation: 15%

All material is to be submitted via Quercus

Re Grades: This is not a competition! Work together!

IMPORTANT: if an unexpected technical issue occurs with a university system (e.g., Quercus services, network outage) that affects availability or functionality, it may be necessary to revise the timing or weighting of the quizzes/term tests.

V COURSE POLICIES

- Each member of this course is expected to maintain a:
 - (i) professional and respectful attitude during all course activities
 - (ii) personal calendar/schedule/organizer to ensure that all course activities are completed

- (iii) collection of notes recorded independently based on concepts covered in course activities
- (iv) familiarity with the university policy on Academic Integrity
- The University of Toronto is committed to equity, human rights, and respect for diversity. All members of the learning environment in this course should strive to create an atmosphere of mutual respect where all members of our community can express themselves, engage with each other, and respect one another's differences. As a Course Instructor, I will neither condone nor tolerate behaviour that undermines the dignity or self-esteem of any individual in this course and wish to be alerted to any attempt to create an intimidating or hostile environment. It is our collective responsibility to create a space that is inclusive and welcomes discussion. Discrimination, harassment and hate speech will not be tolerated. If you have any questions, comments, or concerns, we encourage you to reach out to the staff in our Equity Offices.
- Communication with instructor can be carried out via direct discussion in lecture, or if necessary, via email

VI TECHNOLOGY REQUIREMENTS

- Specific guidance from the U of T Vice-Provost, Students regarding student technology requirements is available here:
<https://www.viceprovoststudents.utoronto.ca/covid-19/tech-requirements-online-learning/>
- Advice for students more broadly regarding online learning is available here:
<https://onlinelearning.utoronto.ca/getting-ready-for-online/>
- This course requires the use of computers, and technical issues are possible. When working on a piece of academic work, students are responsible for scheduling enough time to allow for reasonable delays due to technical difficulties to be overcome, so such issues will not be acceptable grounds for deadline extension. Particularly, maintaining an up-to-date independent backup copy of your work is strongly recommended to guard against hard-drive failures, corrupted files, lost computers, etc.

VII INSTITUTIONAL POLICIES & SUPPORT

ACADEMIC INTEGRITY

Academic integrity is essential to the pursuit of learning and scholarship in a university, and to ensuring that a degree from the University of Toronto is a strong signal of each student's individual academic achievement. As a result, the University treats cases of cheating and plagiarism very seriously. The University of Toronto's Code of Behaviour on Academic Matters

governingcouncil.utoronto.ca/secretariat/policies/code-behaviour-academic-

[matters-july-1-2019](#)) outlines the behaviours that constitute academic dishonesty and the processes for addressing academic offences.

Potential offences include, but are not limited to:

In homework:

1. Using someone else's ideas or words without appropriate acknowledgement.
2. Submitting your own work in more than one course without the permission of the instructor.
3. Making up sources or facts.
4. Obtaining or providing unauthorized assistance on any report. **Please note that the use of websites (such as Chegg.com, or the course discussion board, or a Chatbot like ChatGPT) to post virtual report material/questions or to post/access answers to questions is an academic offence under the University of Toronto's Code of Behaviour on Academic Matters. Alleged instances of this nature are forwarded to the Faculty of Arts & Science Student Academic Integrity office.**

On quizzes and term tests:

1. Using or possessing unauthorized aids. **Please note that the use of websites (such as Chegg.com, or the course discussion board, or a Chatbot like ChatGPT) to post quiz/term test questions or to post/access answers to questions is an academic offence under the University of Toronto's Code of Behaviour on Academic Matters. Alleged instances of this nature are forwarded to the Faculty of Arts & Science Student Academic Integrity office.**
2. Looking at someone else's answers or collaborating/discussing answers during a quiz or term test.
3. Misrepresenting your identity.

In general academic work:

1. Falsifying institutional documents or grades.
2. Falsifying or altering any documentation required by the University.

All suspected cases of academic dishonesty will be investigated following procedures outlined in the Code of Behaviour on Academic Matters. If you have questions or concerns about what constitutes appropriate academic behaviour or appropriate research and citation methods, you are expected to seek out additional information on academic integrity from your instructor or from other institutional resources (see www.academicintegrity.utoronto.ca/).

PLAGIARISM DETECTION

Normally, students will be required to submit their course essays to the University's plagiarism detection tool for a review of textual similarity and detection of possible plagiarism. In doing so, students will allow their essays to be included as source documents in the tool's reference database, where they will be used solely for the purpose of detecting plagiarism. The terms that apply to the University's use of this tool are described on the Centre for Teaching Support & Innovation web site

(<https://uoft.me/pdt-fag>).

COPYRIGHT

If a student wishes to copy or reproduce class presentations, course notes or other similar materials provided by instructors, he or she must obtain the instructor's written consent beforehand. Otherwise, all such reproduction is an infringement of copyright and is absolutely prohibited.

ACCESSIBILITY NEEDS

Students with diverse learning styles and needs are welcome in this course. The University of Toronto is committed to accessibility: if you require accommodations for a disability, or have any other accessibility concerns about the course, please contact [Accessibility Services](#) as soon as possible.

ACCOMMODATIONS FOR RELIGIOUS OBSERVANCES

Following the University's policies, reasonable accommodations will be made for students who observe religious holy days that coincide with the due date/time of an assignment, tutorial, class or laboratory session. Students must inform the instructor **before** the session/assignment date to arrange accommodations.

ADDITIONAL SERVICES & SUPPORT

The following are some important links to help you with academic and/or technical service and support:

- General student services and resources at [Student Life](#)
- Full library service through [University of Toronto Libraries](#)
- Resources on conducting online research through [University Libraries Research](#)
- Resources on academic support from the [Academic Success Centre](#)
- Learner support at the [Writing Centre](#)
- Information for [Technical Support/Quercus Support](#)

ACKNOWLEDGEMENT OF TRADITIONAL LANDS

We wish to acknowledge this land on which the University of Toronto operates. For thousands of years, it has been the traditional land of the Huron-Wendat, the Seneca and, most recently, the Mississaugas of the Credit River. Today, this meeting place is still the home to many Indigenous people from across Turtle Island and we are grateful to have the opportunity to work on this land.

ZOOM INFORMATION

Lecture hours: Wednesday (4:10pm-6:00pm)

Meeting ID: [REDACTED]

Passcode: [REDACTED]

Office Hours: Friday (1:30pm-2:30pm)

Meeting ID: [REDACTED]

Passcode: [REDACTED]