

Physics 9203 – Quantum Mechanics

Classical Electrodynamics:	Physics 9203a (Fall 2016)
Lecturer:	Prof. Martin Houde mhoude2@uwo.ca http://www.astro.uwo.ca/~houde
Location:	PAB Room 48
Lectures:	Tuesday and Thursday, 9:30 am – 11:20 am
Recommended text:	Quantum Mechanics , (Cambridge University Press), by G. Auletta, M. Fortunato and G. Parisi.
Useful references:	See the bibliography below.

Contact information:

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I can be reached at my office, especially after class where I will do my best to reserve time to answer your questions. I can also be reached during the week through e-mail for simple inquiries, or to make an appointment. I will try to reply to e-mails within two working days of reception.

Students should regularly check the course's WebCT OWL web site.

Evaluation: The course will contain regular assignments, a mid term exam, and a final exam, worth 20%, 40%, and 40% of your final mark, respectively. *The exams will be closed book, and no electronics equipment (e.g., calculators, computers, etc.) will be allowed unless explicitly authorized ahead of time.* Students absent on an examination day may be allowed to take a make-up exam if they present a note from a medical doctor within a reasonable amount of time. Similar consideration may be given under other exceptional circumstances.

Assignments: You will receive three or four lists of suggested problems during the semester. I will indicate, for each list, which ones should be turned in for your assignments. Some of these problems may be chosen as material for the exams. Students will be allowed to discuss the material amongst them, *and only one copy can be turned in for a small group of students (two or three) if the group worked out the assignment together.* Assignments must be turned in at the requested date. However, a student may miss a due date *once* during the semester, and hand in the late assignment on the following lecture day without incurring any penalty. Otherwise, for *every day* for which they are late, assignments will automatically have a third of the maximum number of points subtracted from their total.

Description

This course is intended to provide an advanced and modern treatment of non-relativistic quantum mechanics. It is intended to provide the student with the necessary tools to tackle more complex problems than those usually covered in undergraduate courses, and provide a better understanding of the underlying principles and concepts of quantum mechanics. Although the contents of the course will often require some degree of sophistication in the development of the theoretical formalism, numerous examples and problems will be used throughout to help the students grasp the underlying physics.

Course Outline

1. The postulates and principles of quantum mechanics.
2. The density matrix.
3. Angular momentum and spin.
4. Identical particles.
5. The measurement problem in quantum mechanics.
6. Perturbations and approximation methods.
7. Quantization of the electromagnetic field.
8. Entanglement.

Bibliography

1. **Quantum Mechanics**, by G. Auletta, M. Fortunato and G. Parisi (Cambridge University Press). *This is a fairly recent textbook that provides a complete and modern treatment of non-relativistic quantum mechanics. This is the book I will extensively use for the course. An e-book version is available.*
2. **Quantum Mechanics** (2 volume set), by C. Cohen-Tannoudji, B. Diu, and F. Laloë, 1996 (New York: Wiley). *I guess everybody has a favourite textbook on Quantum Mechanics; this is mine (although I use the original edition in la langue de Molière). I will often refer to it in my lecture notes. Cohen-Tannoudji won the Nobel Prize in Physics in 1997. This is a truly fantastic book.*
3. **Lectures on Quantum Mechanics**, by S. Weinberg, (Cambridge University Press). *A fairly exhaustive and recent (2013) book on quantum mechanics by one of the best physicists over the last 50 years or so. It is very modern in its treatment and covers several topics that are not often found in other textbooks. Weinberg won the Nobel Prize in Physics in 1979. An e-book version is available.*
4. **Exploring the Quantum – Atoms, Cavities and Photons**, by S. Haroche and J.-M. Raimond, 3rd edition (Prentice Hall). *This is a recent and very different kind of book by two of the leading experts in experimental quantum optics over the last several decades. In this textbook quantum mechanics is explored through a series of thought and real experiments that have shaped its development and our understanding of it. Haroche won the Nobel Prize in Physics in 2012 (he also was a PhD student of Cohen-Tannoudji). An e-book version is available.*
5. **Quantum Mechanics**, by A. Messiah (Dover Publications). *Another French classic (older than Cohen-Tannoudji; originally written in the late 1950s). It is written at an advanced level and is very exhaustive. An e-book version is available.*

University Policies:

Several of the links to material and documents specified in the information below can be found at Western's Student Services web site located at

<https://studentservices.uwo.ca/secure/index.cfm>.

Accessibility: Please contact the course instructor if you require material in an alternate format or if you require any other arrangements to make this course more accessible to you. You may also wish to contact Services for Students with Disabilities (SSD) at 661-2111 x82147 for any specific question regarding an accommodation.

Religious holidays: A student who, due to unavoidable conflicts with religious holidays which (a) require an absence from the University or (b) prohibit or require certain activities (*i.e.*, activities that would make it impossible for the student to satisfy the academic requirements scheduled on the day(s) involved), is unable to write examinations and term tests on a Sabbath or Holy Day in a particular term shall give notice of this fact in writing to his or her Dean as early as possible but not later than November 15th for mid-year examinations and March 1st for final examinations, *i.e.*, approximately two weeks after the posting of the mid-year and final examination schedule respectively. In the case of mid-term tests, such notification is to be given in writing to the instructor within 48 hours of the announcement of the date of the mid-term test. The instructor(s) in the case of mid-term tests and the Dean in the case of mid-year and spring final examinations will arrange for special examination(s) to be written at another time. In the case of mid-year and spring final examinations, the accommodation must occur no later than one month after the end of the examination period involved. It is mandatory that students seeking accommodations under this policy give notification before the deadlines, and that the Faculty accommodate these requests. The list of approved dates is updated annually and is available at Departmental, Dean and Faculty advising offices.

Medical accommodation:

- If you are unable to meet a course requirement due to illness or other serious circumstances, you must provide valid medical or other supporting documentation to the Dean's office as soon as possible and contact your instructor immediately. It is the student's responsibility to make alternative arrangements with their instructor once the accommodation has been approved and the instructor has been informed. In the event of a missed final exam, a "Recommendation of Special Examination" form must be obtained from the Dean's Office immediately. For further information please see:

http://www.uwo.ca/univsec/handbook/appeals/accommodation_medical.pdf

- A student requiring academic accommodation due to illness should use the Student Medical Certificate when visiting an off-campus medical facility or request a Records Release Form (located in the Dean's Office) for visits to Student Health Services. The form can be found here:

<http://www.uwo.ca/univsec/handbook/appeals/medicalform.pdf>

Academic misconduct:

- **Cheating:** University policy states that cheating is a scholastic offence that can result in an academic penalty (which may include expulsion from the program). If you are caught cheating, there will be no second warning. Complete information on the University policies on academic offenses can be found at http://www.uwo.ca/univsec/handbook/appeals/scholastic_discipline_undergrad.pdf
- **Plagiarism:** Students must write their essays and assignments in their own words. Whenever students take an idea or a passage from another author, they must acknowledge their debt both by using quotation marks where appropriate and by proper referencing (such as footnotes or citations). Plagiarism is a major academic offence. For more details, see http://www.uwo.ca/univsec/handbook/appeals/scholastic_discipline_undergrad.pdf
- Plagiarism or cheating will not be tolerated. Penalties will vary depending on the seriousness of the offence. They can range from a grade of zero on an assignment or essay, to failure of a course, to expulsion from the University.
- If you have any questions at all on this issue please consult with your instructor.

Health and Wellness

As part of a successful graduate student experience at Western, we encourage students to make their health and wellness a priority. Western provides several on campus health-related services to help you achieve optimum health and engage in healthy living while pursuing your graduate degree. For example, to support physical activity, all students, as part of their registration, receive membership in Western's Campus Recreation Centre. Numerous cultural events are offered throughout the year. Please check out the Faculty of Music web page <http://www.music.uwo.ca/>, and our own McIntosh Gallery <http://www.mcintoshgallery.ca/>. Information regarding health- and wellness-related services available to students may be found at <http://www.health.uwo.ca/>

Students seeking help regarding mental health concerns are advised to speak to someone they feel comfortable confiding in, such as their faculty supervisor, their program director (graduate chair), or other relevant administrators in their unit. Campus mental health resources may be found at http://www.health.uwo.ca/mental_health/resources.html

To help you learn more about mental health, Western has developed an interactive mental health learning module, found at http://www.health.uwo.ca/mental_health/module.html. This module is 30 minutes in length and provides participants with a basic understanding of mental health issues and of available campus and community resources. Topics include stress, anxiety, depression, suicide and eating disorders. After successful completion of the module, participants receive a certificate confirming their participation.