PHYS 5802W Methods of Theoretical Physics II

Instructor:
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Office Hours: TBA

Teaching Assistant:
NA
e-mail: NA

Brightspace Link:
https://brightspace.carleton.ca/d2l/home/59694

Lectures:
Tuesday and Thursday 11:35 - 12:55
Building: Southam Hall; Room: 516

Prerequisites: Graduate Quantum Mechanics.
Or permission of the Department.

Marks Distribution:

Assignments:	80%
Final Presentation	20%

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.

Course Delivery:
- The course notes posted on CULearn are the guide to the course content. Material covered may be more thoroughly done in either the course notes or the textbook. The assigned textbook is required for the course.

The Georgi text is very good, but tends to be overly algebraic in places. An effort will be made in the notes to keep the exposition simpler, but broaden the scope and introduce the other ways that

Lie Algebras are used in physics.

- 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, or course materials sites.

- There will be approximately half a dozen assignments given out. They are due at a time announced on distribution, at least one week after their distribution. Marks will be deducted for lateness. 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 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 quantitative understanding of the subject material. Students are permitted to discuss concepts and strategies related to solving the homework assignments; however the work that you hand in must be your own.

- Please note that submitting an examination of any kind, a laboratory report, or any 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 final oral presentations will be 20 minutes long, plus 10 minutes question. They will be on a topic of the student's choice, in consultation with the instructor. I have suggestions for presentation topics, but the students are invited to generate their own. Let me know what you wish to present and I can help you find suitable references.

Course Outline:

- A copy of the course outline will be posted on the Brightspace PHYS 5802W webpage. It will be updated with corrected information as necessary. *This online Course Outline is the official course outline for the course.*

Text:

Lie Algebras In Particle Physics (2nd Edition)
Howard Georgi
Westview Press (1999)
ISBN-10 : 0-7382-0233-9
ISBN-13 : 978-0-7382-0233-4

Course Content:

After a review of angular momentum in quantum mechanics, there will be an extended introduction to Groups, Lie Groups, and Lie Algebras, with many examples, which illustrate the origin and general structure of Lie Algebras. The core content will be the analysis of the structure, and the (matrix) representations of the complex simple Lie Algebras, which are described in Chapters 2-3, Chapters 6-9, Chapter 13, and Chapters 19-20 of the Georgi text. We will then proceed to physics applications of the classical Lie Algebras, and develop the special methods that are useful for the Unitary and the Orthogonal algebras. Time permitting we will also discuss Lie groups, and their cosets, and how they may be parametrized in physical applications.

The course content is defined by the lectures as well as the text.

Learning Outcomes:

The purpose of the course is for the student to acquire an understanding of the structure of Lie Groups and Lie Algebras, and for the student to be able to apply them in the analysis of physical systems with continuous symmetries in: atomic physics, nuclear physics, particle physics, gravitational theory, quantum field theory, or superstring thsory.

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.

Academic Accommodation

You may need special arrangements to meet your academic obligations during the term. For an accommodation request the processes are as follows:

Pregnancy obligation:
Write to me 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 accommodation regarding a formally-scheduled final exam, you must complete the Pregnancy Accommodation Form (https://carleton.ca/equity/contact/form-pregnancy-accommodation/).

Religious obligation:
Write to me 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 click here: (https://carleton.ca/equity/focus/discrimination-harassment/religious-spiritual-observances/).

Academic Accommodations for Students with Disabilities:
The Paul Menton 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 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 Carletons 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/equity/sexual-assault-support-services.

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 will be provided to students who compete or perform at the national or international level. Write to me 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. https://carleton.ca/senate/wp-content/uploads/Accommodation-for-Student-Activities-1.pdf