Carleton University Physics Department
PHYS 4608 – Nuclear Physics (Fall 2021)

Course Outline

1. Course calendar description and pre-requisites
Ground state properties of nuclei. Nuclear models, binding energy, properties of excited nuclei. Alpha, beta and gamma decay. Passage of radiation through matter, detectors. Nuclear reactions, cross sections, fission, fusion. Elements of neutron physics.

Pre-requisites: PHYS 3606 or PHYS 3608 or permission of the Department.

2. Instructor contact information
Instructor: Dr. Emily Heath
Email: emily.heath@carleton.ca
Office hours: by appointment

Teaching assistant: Islam El-Gamal
Email: IslamElGamal@cmail.carleton.ca

In accordance with University policy, all communication with instructors and TAs must be via your Carleton email account.

3. Course textbook

Other references:

4. Course website
The course outline and other course information will be posted on the Brightspace website (www.brightspace.carleton.ca). We reserve the right to amend the course outline on the Brightspace website and will inform you if that version changes. In the event of any
discrepancy between this document, and the version currently posted on the website, then the website version on Brightspace will be taken as the definitive version.

If you are unable to access Brightspace or need help with your computing account, please contact the ITS Service Desk at 613-520-3700 or email its.service.desk@carleton.ca

5. Course modality
This is a Hyflex course where students can choose to attend each scheduled lecture in person or online via Zoom. If you plan to attend online then you will require reliable high-speed Internet access and a computer with a webcam and a headset with a microphone.

6. Lectures
Wednesdays and Fridays 14:35 – 15:55 (Eastern Time) in Loeb Building room C164 or online via the Zoom link on the course Brightspace page.

The lectures in this course will be recorded and made available only to those within the class. Please note that 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.

7. Course grading scheme
The grade for this course is split between homework (40%), in-class presentations (10%) and exams (50%).

7.1 Homework assignments (40%)
Assignments will be assigned approximately every week and a half, for a total of 5 assignments, and posted on CULearn. They should be submitted through CULearn before the deadline.

Working through problems is an essential part of developing a deep understanding of the course material. Students are permitted to discuss concept and strategies related to solving the homework assignments; however, the work handed in must be their own.

Late assignments will not be accepted without a legitimate reason, such as illness or a family emergency.
7.2 In-class presentations (10%)
Each student will make a class presentation on an application of Nuclear Physics. The presentations will take place during the December 3rd and 8th lecture sessions. Students can select from a list of topics that will be provided by the instructor or propose their own (subject to approval by the course instructor).

7.3 Midterm exam (15%)
An online midterm exam will be held on October 22nd during the scheduled lecture time. You may use your notes and textbook during the exam but no other assistance is allowed (eg. accessing the internet is not permitted). After the Fall break there will be a follow-up oral exam (~15 min) which will be scheduled outside of the lecture hours during the week of November 1st-5th.

7.4 Final exam (35%)
An online final exam will be held during the final exam period in December. The exam will be 3 hours in duration. More information about the final exam will be provided closer to the final exam date. A follow-up oral exam (~15 min) will be scheduled after the exam.

The Carleton University e-Proctoring system may be used in both midterm and final exams, and requires the use of webcams, microphones, and smart phones.

8. Lecture topics and dates

<table>
<thead>
<tr>
<th>Topic Description</th>
<th>Textbook Sections</th>
<th>Approximate Date(s)</th>
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</thead>
<tbody>
<tr>
<td>Course intro, terminology, units &amp; dimensions</td>
<td>Chap 1</td>
<td>Sept 8th</td>
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<tr>
<td>Nuclear properties</td>
<td></td>
<td>Sept 10th - 15th</td>
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<tr>
<td>Nuclear structure</td>
<td>Chap 2</td>
<td>Sept 17th - 24th</td>
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<tr>
<td>Radioactivity and radioactive decay</td>
<td>Chap 1</td>
<td>Sept 29th &amp; Oct 1st</td>
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<tr>
<td>Nuclear instability</td>
<td>Chap 3</td>
<td>Oct 6th - 13th</td>
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<tr>
<td>Nuclear reactions</td>
<td>Chap 4</td>
<td>Oct 15th - Nov 3rd</td>
</tr>
<tr>
<td>Midterm exam – in class</td>
<td></td>
<td>Oct 22nd</td>
</tr>
<tr>
<td>Interaction of radiation with matter</td>
<td>Chap 5</td>
<td>Nov 5th &amp; 10th</td>
</tr>
<tr>
<td>Radiation detectors</td>
<td>Chap 6</td>
<td>Nov 12th &amp; 17th</td>
</tr>
<tr>
<td>Nuclear fission</td>
<td>Chap 10</td>
<td>Nov 19th &amp; 24th</td>
</tr>
<tr>
<td>Nuclear fusion</td>
<td>Chap 11</td>
<td>Nov 26th &amp; Dec 1st</td>
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<tr>
<td>In-class presentations: applications</td>
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<td>Dec 3rd &amp; 8th</td>
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9. 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 (See above)

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
Submitting an examination or an 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.

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.

https://carleton.ca/registrar/academic-integrity/

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 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/

Information for COVID-19 measures:
All members of the Carleton community are required to follow COVID-19 prevention measures and all mandatory public health requirements (e.g. wearing a mask, physical distancing, hand hygiene, respiratory and cough etiquette) and mandatory self-screening prior to coming to campus daily.

If you feel ill or exhibit COVID-19 symptoms while on campus or in class, please leave campus immediately, self-isolate, and complete the mandatory symptom reporting tool. For purposes of contact tracing, attendance will be taken in all classes and labs. Participants can check in using posted QR codes through the cuScreen platform where provided. Students who do not have a smartphone will be required to complete a paper process as indicated on the COVID-19 website.

All members of the Carleton community are required to follow guidelines regarding safe movement and seating on campus (e.g. directional arrows, designated entrances and exits, designated seats that maintain physical distancing). In order to avoid congestion, allow all previous occupants to fully vacate a classroom before entering. No food or drinks are permitted in any classrooms or labs.

For the most recent information about Carleton’s COVID-19 response and required measures, please see the University’s COVID-19 webpage and review the Frequently
Asked Questions (FAQs). Should you have additional questions after reviewing, please contact covidinfo@carleton.ca

Please note that failure to comply with University policies and mandatory public health requirements, and endangering the safety of others are considered misconduct under the Student Rights and Responsibilities Policy. Failure to comply with Carleton’s COVID-19 procedures may lead to supplementary action involving Campus Safety and/or Student Affairs.