

ERTH 2419 – On the Origin of Planets – Winter 2023

Course description: Origin and evolution of all planetary objects in the solar system. Topics include the geology of comets, asteroids, the terrestrial planets and rocky moons, Earth's formation and early evolution, ocean worlds, the search for exoplanets and detection of extraterrestrial life.

Prerequisites: none.

Lectures: Synchronous online courses, three hours a week (Monday from 11:35 to 14:25)

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Course objectives

By the end of this course, you will gain insight into our current understanding on the formation and evolution of planetary environments over geological time. After a gap in space exploration since the Apollo missions in the 70', a second Space Age has launched in 2018. International collaborations (e.g. JAXA, NASA, ESA, CSA) as well as corporations (e.g. SpaceX) are joining forces in order to expand our understanding and human presence deeper in the solar system. This new Space Age is quickly changing our vision of the solar system and scientific data is exponentially increasing.

Course Learning Outcomes

By the end of this course, you will be able to :

- Summarize our current understanding on the formation and evolution of planets,
- Describe how atmospheres form and how they behave through time,
- Identify the major and minor bodies that constitute the solar system,
- Explain what conditions are required for planetary habitability, and whether those conditions may be, or once were, present on any Solar System bodies,
- State the principal methods by which exoplanetary bodies are discovered ,
- Document the major milestones in Solar System exploration, and how these discoveries have impacted our understanding of Earth.

Evaluation

- 20%: Weekly online quizzes covering the material seen in class.
- 30%: Missions presentations:
 - 15%: short (8 min.) presentations to the class on current and future planetary missions
 - 15%: short (2-3 pages) report on missions, due 1 week after your presentations
- 25%: Mid-term exam. Online test examining the course content covered during the first half of the course.
- 25%: Final exam. Online test at the end of the semester in which the material covered in the second half of the course will be examined.

Course topics (tentative order, might change during the semester)

Day	Lecture	Missions presentations
Jan. 9 th	Introduction; course overview; exams and grading scheme	None
Jan.16 th	How it all started – Big Bang theory and star formation	None
Jan. 23 th	Planetary formation and giant impacts	Soho, Solar Orbiter, Parker Solar Probe, Genesis
Jan. 30 th	The Earth-Moon system	Lunar Scout, Artemis program, Apollo 11, dearMoon project
Feb. 6 th	Meteorites	Hayabusa2, OSIRIS-REx, Physche, Dawn
Feb. 13 th	Mid-term exam	None
Feb. 20 th	Winter break	None
Feb. 27 th	The Solar System: inner planets Mercury and Venus	Bepicolombo, Messenger, Pioneer Venus 2, EnVision
March 6 th	The Solar System: inner planets Mars	Perseverance, Pathfinder, Curiosity, Viking, Insight, SpaceX Mars
March 13 th	Planetary atmospheres, icy and ocean worlds	Europa Lander, Caesar, Enceladus Life Finder, Stardust
March 20 th	The Solar System: Moons	Cassini, Dragonfly, Juice, MMX
March 27 th	Exoplanets	Cheops, Kepler, Hubble Space Telescope, James Webb Space Telescope
April 3 th	Planet habitability conditions and the search for extraterrestrial life	None
April 10 th		

Useful resources and others

Brightspace: Course lecture slides and labs will be posted on Brightspace. All information concerning the course, including assignments, will also be posted on the site. Note that

posting of pdf copies of journal articles on Brightspace is a violation of copyright regulations. However, all students have access to journal articles via the library electronic subscriptions and each student is allowed one copy for personal use.

Technology Checklist:

- Internet-enabled computer (laptop/desktop)
- Zoom software installed on computer (can also install on phone as backup!)
- Access to reliable internet
- Webcam

Course requirements

- All lectures and labs are mandatory.
- Lectures will be synchronous online courses. Turning your cameras on during the class is optional but highly encouraged. Seeing each other humanizes the virtual space, allows to connect with each other and cultivates a sense of community.
- You will have 1 week to submit your space mission report. Failing to hand it in by the deadline will result in 10% reduction of your mark per day, for three days. After that, a mark of zero will be given to the report.
- You must inform us immediately (3 days maximum) of any medical issue that causes a delay in completing an assignment or an exam. We will then agree on how to make up for the missed deadline.

Assessment in this Course

Research about learning strongly suggests that the most important factor in learning is doing the work of reading, writing, recalling, practicing, synthesizing, and analyzing. Learning happens best when people actively engage material on a consistent basis, and that is why we have high standards in this course. We are confident that, with appropriate effort, you all can meet those standards.

We also make an effort to reduce unintentional bias in grading by, for example and when possible, grading assignments one question at a time (grading all of question 1 before grading any of question 2), grading anonymously, and using rubrics.

Note About COVID-19 & Mental Health

The global pandemic has led to extra stress and uncertainty for everyone, and while we may all be experiencing the same storm, this does not mean that we are all in the same boat! If you are struggling, please do not hesitate to reach out. I am happy to listen, and/or direct you to resources that might help. In terms of class, if you need extra help or missed a lesson, don't stress! Email me and we will set a time to meet. I'll work with you, I promise. Remember that Carleton also offers an array of mental health and well-being resources, which can be found [here](#).

Children & video sessions

You are welcome to have children with you during video sessions as I fully understand that childcare situations may be complicated for many of us at this time. Do your best to participate and engage, but also please get in touch with me if you have any questions or concerns.

University Policies

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	A=85-89	A-=80-84
B+=77-79	B=73-76	B-=70-72
C+=67-69	C=63-66	C-=60-62
D+=57-59	D=53-56	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

Academic Accommodations, Regulations, Plagiarism, Etc.

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. More information can be found at: <https://students.carleton.ca/course-outline/>

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: <https://calendar.carleton.ca/undergrad/regulations/academicregulationsoftheuniversity/>

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.

Addressing Human Rights Concerns

The University and all members of the University community share responsibility for ensuring that the University's educational, work and living environments are free from discrimination and harassment. Should you have concerns about harassment or discrimination relating to your age, ancestry, citizenship, colour, creed (religion), disability, ethnic origin, family status, gender expression, gender identity, marital status, place of origin, race, sex (including pregnancy), or sexual orientation, please contact the Department of Equity and Inclusive Communities at equity@carleton.ca.

Religious Obligations

Please contact 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, please review the Student Guide to Academic Accommodation (PDF, 2.1 MB).

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/>

Accommodations for Missed Work

Carleton recognizes that these are unprecedented times during the COVID-19 pandemic, and that students may be experiencing greater stress and other life factors that are not in their control. As a result, Carleton has put into place a protocol for students to apply for accommodations using a self-declaration form in the event of missed work. The form can be found at: <https://carleton.ca/registrar/wp-content/uploads/self-declaration.pdf>

For Pregnancy

Please contact 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, please review the Student Guide to Academic Accommodation (PDF, 2.1 MB).

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 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, see the Senate Policy on Accommodation for Student Activities (PDF, 25KB).

Academic Integrity

The University Academic Integrity Policy defines plagiarism as “presenting, whether intentionally or not, the ideas, expression of ideas or work of others as one’s own.” This includes 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. Examples of sources from which the ideas, expressions of ideas or works of others may be drawn from include but are not limited to: books, articles, papers, literary compositions and phrases, performance compositions, chemical compounds, art works, laboratory reports, research results, calculations and the results of calculations, diagrams, constructions, computer reports, computer code/software, material on the internet and/or conversations.

Examples of plagiarism include, but are not limited to:

- any submission prepared in whole or in part, by someone else;

- using ideas or direct, verbatim quotations, paraphrased material, algorithms, formulae, scientific or mathematical concepts, or ideas without appropriate acknowledgment in any academic assignment;
- using another's data or research findings without appropriate acknowledgement;
- submitting a computer program developed in whole or in part by someone else, with or without modifications, as one's own; and
- failing to acknowledge sources through the use of proper citations when using another's work and/or failing to use quotations marks.

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 or even suspension or expulsion from the University.

Sanctions for not abiding by Carleton's Academic Integrity Policy

A student who has not adhered to Carleton's Academic Integrity Policy may be subject to one of several sanctions:

- 1) If you take full responsibility for your actions, and it is the first time you have violated the policy, you will receive zero on the assessment. If you are found to have violated the policy but do not take responsibility, an additional grade deduction will be applied (e.g. an A- will become a B+)
- 2) Subsequent violations of the policy may result in more severe sanctions such as failing the course, suspension from all studies and/or expulsion.

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).

Process of an Academic Misconduct Investigation

Step 1: The instructor believes misconduct has occurred and submits documentation to the Dean of the Faculty of Science.

Step 2: The Dean reviews documentation and can proceed with or dismiss the allegation.

Step 3: If sufficient evidence, the student receives an allegation statement by email. Ombuds services is copied on the email.

Step 4: The student provides a written response to the evidence provided.

Step 5: Either party may request a meeting between student, dean, and the ombudsperson.

Step 6: Dean informs the student of the decision. Appeal: Student has the right to appeal the decision.

Additional details about this process can be found on the Faculty of Science Academic Integrity website. Students are expected to familiarize themselves with and follow the

Carleton University Student Academic Integrity Policy. The Policy is strictly enforced and is binding on all students.

What are the Penalties for Plagiarism?

A student found to have plagiarized an assignment may be subject to one of several penalties including: expulsion; suspension from all studies at Carleton; suspension from full-time studies; and/or a reprimand; a refusal of permission to continue or to register in a specific degree program; academic probation; award of an FNS, Fail, or an ABS.

What are the Procedures?

- 1) All allegations of plagiarism are reported to the Dean of Faculty of Science. Documentation is prepared by instructors and/or departmental chairs.
- 2) The Dean writes to the student and the University Ombudsperson about the alleged plagiarism.
- 3) The Dean reviews the allegation. If it is not resolved at this level then it is referred to a tribunal appointed by the Senate.

Students are expected to familiarize themselves with and follow the Carleton University Student Academic Integrity Policy. The Policy is strictly enforced and is binding on all students.

Assistance for Students

Academic and Career Development Services: <http://carleton.ca/sacds/>

Writing Services: <http://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/>