ERTH 2419 for Fall 2025

ON THE ORIGIN OF PLANETS

We, the people of the Faculty of Science at Carleton University, acknowledge that our campus is located on the traditional, unceded territories of the Algonquin Anishinabeg people. Miigwetch for your hospitality and stewardship of this territory and the teachings that come from it. We are grateful for this land, the air that we breathe, and the water that sustains us all as well as for the animals, plants and other living beings: these enable us to research, teach, mentor, support, study, and learn. We recognize our responsibility to our natural environment and to reconciliation with Indigenous peoples.

Course Instructor: Hanika Rizo (she/her)

Email: Hanika.Rizo@carleton.ca

Office Location: Room 2221, HP Building

Class Location: Zoom; Synchronous Online Courses.

Note: 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.

Class Times: Fridays, 2:35-5:25 pm.

Prerequisites: none.

Department/Unit: Earth Sciences

Course TAs:

Imogen Addis (she/her)
ImogenAddis@cmail.carleton.ca

Patrick Fraser (he/him)
PatrickMFraser@cmail.carleton.ca

*Note: If you have questions or comments related to the class material, feel free to send us an e-mail (**please add ERTH2419 to the subject line**). Note that there is a Q&A and a Class Discussion Forum on Brightspace that might help you find answers. We will be monitoring the forum twice per week.*

Welcome to this course!

This course looks at the 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. After a gap in space exploration since the Apollo missions in the 70's, a second Space Age has launched since 2018. International collaborations (e.g. JAXA, NASA) as well as corporations (e.g., SpaceX) are joining forces 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.

Topics Covered and Learning Outcomes

Detailed list of topics to be covered (tentative order; might change during the semester).

Day	Lecture	Mission presentations
Sept. 5	Introduction; course overview; exams and grading scheme	None
Sept. 12	Planet Earth	None
Sept. 19	How it all started – Big Bang theory and star formation	Parker Solar Probe, Solar Orbiter, SOHO, Aditya-L1, Proba-3
Sept. 26	Planetary formation and giant impacts, Moon formation	Artemis III, Chang'e 5, Apollo 11, dearMoon project, VIPER
Oct. 3	The Solar System: inner planets Mercury and Venus	BepiColombo, Messenger, Akatsuki, EnVision
Oct. 10	From Asteroids to Meteorites	Hayabusa2, OSIRIS-REx, Pysche, Lucy, DESTINY+
Oct. 17	**Mid-term Exam**	**None**
Oct. 20-24	Fall Break	None
Nov. 7	The Solar System: inner planets Mars	Mars 2020, Pathfinder, SpaceX Mars, MMX
Nov. 14	The Gas Giants: Jupiter	Pioneer 10 &11, Cassini, JUICE, Galileo
Nov. 21	Exoplanets, planet habitability conditions and the search for extraterrestrial life	Cheops, Sphere X, Hubble Space telescope, James Webb Telescope
Nov. 28	The Solar System Moons, icy and ocean worlds	Europa Clipper, New Horizons, Enceladus Orbilander, Dragonfly
Dec. 8-20	**Final examinations**	

Important dates and deadlines can be found here: https://carleton.ca/registrar/registration/dates/academic-dates/, including class suspension for fall, winter breaks, and statutory holidays.

Course level learning outcomes:

- Summarize our current understanding on the formation and evolution of planets
- Describe how hydrospheres developed and have evolved 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 the Earth

We are committed to fostering an environment for learning that is welcoming and inclusive for everyone. In our course, we will seek to behave with the following values: Honesty, Responsibility, Respect, Fairness, Trust and Courage.

Assessments

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.

Grade Breakdown

COMPONENT	GRADE VALUE	DETAILS
QUIZZES	20 %	~ 10 min, weekly, online, through Brightspace. You will have one week to answer the quizzes.
MISSION PRESENTATIONS	20%	Space mission presentations (group activity)
PARTICIPATION	30 %	Feedback for mission presentations (5%) In-class assignments (15%) 1 original post (5-min podcast) to graded forum (10%)
MIDTERM	15 %	Online test examining the course content covered during the first half of the course.
FINAL EXAM	15 %	Test at the end of the semester during the formal exam period, in which the material covered in the second half of the course will be examined.

Late and Missed Work Policies

Late Work

You will have 1 week to complete each online quiz (~ 10 min). Failing to complete the quiz by the deadline will result in a mark of zero on the specific assignment. Note that the lowest quiz mark of the semester will be dropped.

Missed Work

You must inform us immediately (3 days maximum) of any extenuating circumstances that causes a delay (less than 5 days) in completing a quiz or the mid-term exam. We will then agree on how to make up for the missed deadline. Academic requests can be submitted here: *academic considerations form*, and these can be only used once / student. Note that you can miss one in-class assignment and one space mission session without penalty.

Requests for accommodations during the formal exam period must follow the official deferral process.

Learning Materials and Other Resources

Brightspace: Course lecture slides and quizzes will be available 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 be also installed on phone as backup!)
- ☐ Access to reliable internet
- ☐ Webcam
- ☐ Wooclap

Students are not required to purchase textbooks or other learning materials for this course.

Academic Accommodations and Regulations

Carleton is committed to providing academic accessibility for all individuals. You may need special arrangements to meet your academic obligations during the term. The accommodation request processes, including information about the *Academic Consideration Policy for Students in Medical and Other Extenuating Circumstances*, are outlined on the Academic Accommodations website (students.carleton.ca/course-outline).

Statement on Chat GPT/Generative AI usage

Students may use AI tools for basic PowerPoint processing and formatting functions, including: i) grammar and spell checking, ii) basic formatting and design suggestions.

It is not necessary to document the use of AI for the permitted purposes listed above. If you have questions about a specific use of AI that is not listed above, please consult with us. As our understanding of the uses of AI and its relationship to student work and academic integrity continue to evolve, students are required to discuss their use of AI in any circumstance not described here with the course instructor to ensure it supports the learning goals for the course.

This policy ensures that student voices and ideas are prioritized and authentically represented, maintaining the integrity of the work produced by students while allowing basic support to enhance clarity correctness, layout, and flow of ideas. The goal of adopting

limited use of AI is to help students develop foundational skills in writing and critical thinking by practicing substantive content creation without the support of AI.

Statement on Academic Integrity

Students are expected to uphold the values of academic integrity, which include fairness, honesty, trust, and responsibility. Examples of actions that that compromise these values include but are not limited to plagiarism, accessing unauthorized sites for assignments or tests, unauthorized collaboration on assignments or exams, and using artificial intelligence tools such as ChatGPT when your assessment instructions say it is not permitted.

Misconduct in scholarly activity will not be tolerated and will result in consequences as outlined in Carleton University's Academic Integrity Policy. A list of standard sanctions in the Faculty of Science can be found here.

Additional details about this process can be found on the Faculty of Science Academic Integrity website.

Students are expected to familiarize themselves with and abide by Carleton University's Academic Integrity Policy.

Student Rights & Responsibilities

Students are expected to act responsibly and engage respectfully with other students and members of the Carleton and the broader community. See the 7 Rights and Responsibilities Policy for details regarding the expectations of non-academic behaviour of students. Those who participate with another student in the commission of an infraction of this Policy will also be held liable for their actions.

Student Concerns

If a concern arises regarding this course, **your first point of contact is me**: Email or pass by my office and I will do my best to address your concern. If I am unable to address your concern, the next points of contact are (in this order):

Note: You can also bring your concerns to Ombuds services.