

ERTH 2419 for Fall 2026

ON THE ORIGIN OF PLANETS

The sky we study in this course is not separate from the land beneath it. Carleton University sits on the traditional, unceded territory of the Algonquin Anishinabeg people, who have observed, navigated by, and lived in relationship with this sky for thousands of years, long before this university existed. As a settler, I offer Meegwetch to the Algonquin communities for their care of this territory. EARTH 2419 approaches the solar system through the methods and history of Western planetary science, and it also includes Indigenous knowledges of the sky as part of its content, acknowledging that ours is one tradition among many.

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: Thursdays, 8:35-11:25 am.

Prerequisites: none.

Department/Unit: Earth Sciences

Course TAs:

Imogen Addis (she/her)

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*Note: If you have questions or comments related to the class material, feel free to send us an e-mail (**please add EARTH2419 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 examines the origin and evolution of 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 the detection of extraterrestrial life. We are living through a remarkable moment to study these questions. In April 2026, Artemis II carried four astronauts, including Canadian Space Agency astronaut Jeremy Hansen, around the Moon; the first crewed voyage beyond Earth orbit since Apollo 17 in 1972. Alongside this renewed era of human exploration, national agencies (NASA, ESA, JAXA, CSA, CNSA) and private companies are returning samples from asteroids, mapping ocean worlds, and cataloguing thousands of exoplanets. The data are arriving faster than the textbooks can absorb them, and much of what you learn in this course was unknown a decade ago.

Topics Covered and Learning Outcomes

Detailed list of topics to be covered (tentative order; might change during the semester). No assigned readings; slides will be posted on Brightspace before the class starts.

Day	Lecture	Mission presentations
Sept. 10	Introduction; course overview; exams and grading scheme	None
Sept. 17	Planet Earth	None
Sept. 24	How it all started – Big Bang theory and star formation	Parker Solar Probe, Solar Orbiter, SOHO, Aditya-L1, Genesis
Oct. 1	Planetary formation and giant impacts, Moon formation	Artemis II & III, Chang'e 6, Apollo 11, VIPER, GRAIL
Oct. 8	From Asteroids to Meteorites	Hayabusa2, OSIRIS-REx, Psyche, Lucy, Rosetta/Philae
Oct. 15	Kitcikisik (k'icikisik) The Great Sky: Indigenous Star Knowledge Bundle	None
Oct. 22	Mid-term Exam	None
Oct. 26-30	Fall Break	None
Nov. 5	The Solar System: inner planets Mercury and Venus	BepiColombo, Messenger, Akatsuki, EnVision, Venera 13
Nov. 12	The Solar System: inner planets Mars	Mars 2020, Pathfinder, ExoMars Rosalind Franklin, MMX, Tianwen-1
Nov. 19	The Gas Giants: Jupiter	Pioneer 10 & 11, JUICE, Galileo, Voyager 1 and 2
Nov. 26	The Solar System Moons, icy and ocean worlds	Europa Clipper, New Horizons, Enceladus Orbilander, Dragonfly, Cassini
Dec. 3	Exoplanets, planet habitability	Cheops, Hubble Space telescope, James Webb Telescope, Kepler, PLATO
Dec. 10	The search for extraterrestrial life	None
Dec. 12-23	Final examinations	

Important dates and deadlines can be found [here](#), including class suspension for fall, winter breaks, and statutory holidays.

Course level learning outcomes:

- Summarize our current understanding of the formation and evolution of planets, and identify the major and minor bodies of the solar system
- Describe how hydrospheres developed and have evolved through time
- Explain the conditions required for planetary habitability, and assess whether they may be, or once were, present on bodies within and beyond the solar system
- Compare Indigenous and Western knowledge systems concerning the sky, and describe how colonization has affected Indigenous astronomical practices and access to observational sites

- Document the major milestones in solar system exploration and evaluate how these discoveries have changed our understanding of Earth

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	20 %	Feedback for mission presentations (5%) In-class assignments (15%)
INDIGENOUS STAR KNOWLEDGE BUNDLE	10%	Kitcikisik (kīcikīsik) The Great Sky module (~150 min). Knowledge checks (2%), forum post (3%), and questions for the Knowledge Keepers (5%).
MIDTERM EXAM	15 %	Online test examining the course content covered during the first half of the course.
FINAL EXAM	15 %	Online 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), or the activities related to the Great Sky module. Failing to complete these 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 7 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](#), and these can be only used once per term. 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](#).

Students should not make travel arrangements before the end of the December exam period, since the date is not set until SES publishes the schedule.

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). Students registered with the Paul Menton Centre must book each exam by the PMC deadlines (roughly two weeks before the midterm, and by the published deadline for the formal exam period).

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. For written work, including the Indigenous Star Knowledge Bundle forum post and questions for the Knowledge Keepers, AI tools may not be used to generate content. These pieces ask for your own response to the material, and an AI-generated answer defeats their purpose.

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 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 AI tools 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](#).

