

ERTH 2419 – On the Origin of Planets

Instructor: Hanika Rizo (she/her)

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Note: if you have a question or would like to talk with me, feel free to hang around after the lecture, or send me an email and we'll schedule a virtual meeting.

Course TAs:

- Alexandre Rouleau

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- Matthew Brenning

MatthewBrenning@mail.carleton.ca

Lectures: Synchronous online courses. 3h/week on Thursdays 8:35-11:25. First class January 13th 2022.

Prerequisites: none.

Student hours: TBD.

Student hours are dedicated times through the week for the TAs to meet with YOU.

Pop in to introduce yourself, ask questions about the course or discuss content from the course.

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 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.

Learning outcomes

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

- 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

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

Day	Lecture	Missions presentations
Jan. 13 th	Introduction; course overview; exams and grading scheme	None
Jan. 20 th	Planet Earth	None
Jan. 27 th	How it all started – Big Bang theory and star formation	Soho, Solar Orbiter, Parker Solar Probe, Genesis
Feb. 3 rd	Planetary formation and giant impacts, Moon formation	Lunar Scout, Artemis program, Apollo 11, dearMoon project
Feb. 7 th	All about meteorites – Invited speaker (?) Dr. Kim Tait (Curator Royal Ontario Museum)	Hayabusa2, OSIRIS-REx, Psyche, Dawn
Feb. 17 th	Mid-term exam	None
Feb. 22-25	Winter break	None
Mar. 3 rd	The Solar System: inner planets Mercury and Venus	Bepicolombo, Messenger, Pioneer Venus 2, EnVision
March 10 th	The Solar System: inner planets Mars	Mars 2020, Pathfinder, Curiosity, Viking, Insight, SpaceX Mars
March 17 th	The Solar System: Moons	Cassini, Dragonfly, Juice, MMX
March 24 th	Planetary atmospheres, icy and ocean worlds	Europa Lander, Caesar, Enceladus Life Finder, Stardust
March 31 th	Exoplanets – Invited speaker Pamela Arriagada (?) (Astronomer)	Cheops, Kepler, Hubble Space Telescope
April 7 th	Planet habitability conditions and the search for extraterrestrial life	None

Useful resources and others

rightspace: 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 complete each assignment. Failing to hand in assignments by the deadline will result in 10% reduction of your mark on the specific assignment per day, for three days. After that, a mark of zero on the specific assignment.
- 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.

Grade breakdown

- **20%:** Weekly online quizzes covering the material seen in class.
- **30%:** Participation:
 - **10%:** short (7 min.) presentations on current and future planetary missions
 - **10%:** for feedback to students on presentations
 - **5%:** short (2-3 pages) report on missions, due 1 week after presentations
 - **5%:** polls/questions during class
- **25%:** Mid-term exam. In-class test examining the course content covered during the first half of the course.
- **25%:** Final exam. Test at the end of the semester in which the material covered in the second half of the course will be examined.

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	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

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

Academic misconduct undermines the values of honesty, trust, respect, fairness, and responsibility that we expect in this class. Carleton University provides supports such as academic integrity workshops to ensure, as far as possible, that all students understand the norms and standards of academic integrity that we expect you to uphold. Your teaching team has a responsibility to ensure that their application of the Academic

Integrity Policy upholds the university's collective commitments to fairness, equity, and integrity.

(adapted from Carleton University's Academic Integrity Policy, 2021).

Examples of actions that do not adhere to Carleton's Academic Integrity Policy include:

- Plagiarism
- Accessing unauthorized sites for assignments or tests
- Unauthorized collaboration on assignment and exams

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.

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.

Plagiarism

Plagiarism is the passing off of someone else's work as your own and is a serious academic offence. For the details of what constitutes plagiarism, refer [the Faculty of Science Academic Integrity website](#). To further understand Academic Integrity, consider attending the [Learning and Support Academic Integrity Workshop](#).

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?

3. All allegations of plagiarism are reported to the Dean of Faculty of Science. Documentation is prepared by instructors and/or departmental chairs.
4. The Dean writes to the student and the University Ombudsperson about the alleged plagiarism.
5. 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/>