

PHYS 1040QE – The Cosmic Origins of Life
Spring 2025

Syllabus information is subject to change. The most up-to-date syllabus is located within the course page on HuskyCT. [Schedule is available here.](#)

Sometimes I think we're alone in the universe, and sometimes I think we're not. In either case the idea is quite staggering.
- Arthur C Clarke

Course and Instructor Information

Instructor: Professor/Dr. Cara Battersby

Pronouns: she/her

Office: Gant South S113F

Virtual Office: <https://uconn-cmr.webex.com/meet/cab16109>

Email: cara.battersby@uconn.edu

Office Hours: online Mondays 9:30-10:00 on webex (see link above), in person Thursdays after class (12:15pm) until 1pm in GS113F. Also available by appointment anytime, just ask me or try: <https://calendly.com/battersby>

Class Meeting: Tu/Th 11:00am-12:15pm

Class Location: YNG 327

No course pre-requisites

Required Course Materials

For this specialized course topic, we have one textbook:

- ♦ ***Life in the Universe*** by Bennett, Shostack, and MacGregor, 5th edition (ISBN: 9780691241784)

Please also bring a paper and a writing implement to class for notes or activities.

A gentle reminder: *Do not share any of the materials for this course (e.g. assignments, projects, notes, etc.) outside of this course. These are all copyrighted materials.*

What to do if you need to miss a class?

Things happen, and I do not expect that you will be able to attend every class. In-class assignments and quizzes **cannot** be made up, but there is plenty of flexibility built into those scores, that it should be no problem for you to miss a couple of classes. If you do need to miss a class, be sure to:

- 1) Check in with a colleague in the class to find what you missed,
- 2) Read over the content in the textbook, including the assigned pre-class reading,
- 3) Go over the lecture notes, posted on HuskyCT, and
- 4) Ask any questions you have about the content after you've completed the three steps.

You ***do not*** need to email the instructor if you will miss a lecture.

Please follow all University guidance and do not come to lecture if you may infect others. Unless you experience a prolonged absence of more than two weeks, you do not need to let me know that you will be missing class. The in-class assignment and quiz drops are intended for just such an absence! Just do your best to get caught up remotely and let me know if you have any questions.

Course Description

Principles of physics and quantitative reasoning applied to astrobiology, the search for extraterrestrial life, and cosmic, stellar, and atmospheric conditions for habitability. A systems perspective on the impacts of human civilization on habitability.

Course Objectives

This is a general education course designed to use the scientific method to explore the possibility of life in the universe. By the end of the course, students should be able to:

1. Understand the scientific method and be able to apply it to novel situations.
2. Explain how the Earth and solar system formed.
3. Discuss the history of life on Earth, its evolution, and the conditions under which life likely arose.
4. Understand the origin of heavy elements that make up life on Earth.
5. Define "habitability" and explain why Earth is considered habitable, but Venus and Mars are not.
6. Discuss the history of the search for extraterrestrial life both within our solar system and around other stars.
7. Quantitatively demonstrate the challenges of interstellar travel and communication
8. Use the Drake equation to estimate how many (advanced) civilizations might exist in our Galaxy.

How to Succeed in this Course



A photograph of our tiny home world, Earth. This photo was taken by the Voyager spacecraft in 1990 from 3.7 billion miles away. The sun's bright rays caused reflections in the camera that you see as the lines across the image. The tiny pixel of light is our entire Earth. This photo was popularized by, and the quote is from, Carl Sagan in his book "Pale Blue Dot: A Vision of the Human Future in Space," and the image is from NASA.

Your success in this class is important to me. We will all need accommodations because we all learn differently. If there are aspects of this course that prevent you from learning or exclude you, please let me know as soon as possible. Together we'll develop strategies to meet both your needs and the requirements of the course. Mathematics is the language of science, and success in the course will require some basic proficiency in algebra and trigonometry. Here are some resources if you have questions, need a refresher, or are just feeling a bit overwhelmed:

- ◆ The **UConn Q Center** is an excellent resource (free of charge!) if you need help with math concepts in lab or homework assignments: <http://qcenter.uconn.edu>.
- ◆ The **Physics Learning Resource Center** (free of charge - located in room Gant South S-216 of the physics building -- <https://physics.uconn.edu/academics/undergraduate-program/learning-resource-center/>) is *staffed by experienced physicists*
- ◆ And of course, your professor's office hours!

Other suggestions for how to succeed in this course:

- ◆ **Come to lecture!**
- ◆ **Read before lecture!** The unannounced quizzes will include questions from assigned pre-class readings.
- ◆ **Come to office hours!**
- ◆ **Plan, ahead,** especially with your mini-projects and quizzes, as well as for any planned absences.

Course Schedule

Tentative Course Schedule -- subject to change, shared [here: public course schedule](#)*

| Date | Unit | Topic | Reading | Discussion Board Topics | Assignments |
|---------|---|--|----------------------|------------------------------|---|
| Jan. 21 | Unit 1: Introducing Life in the Universe | A Universe of Life | Ch. 1 | | |
| Jan. 23 | | The Science of Life in the Universe | Ch. 2.1-2.2 | Intro Survey and Discussion | |
| Jan. 28 | | Ancient Astronomy and Kepler's Laws | Ch. 2.3-2.4 | | |
| Jan. 30 | | The Universal Context of Life | Ch. 3.1-3.3 | the Drake Equation | |
| Feb. 4 | Unit 2: Life on Earth | The Solar System | Ch. 3.4-3.5 | | Quiz #1 (Ch. 1-2) |
| Feb. 6 | | The Geologic History and Habitability of Earth | Ch. 4.1-4.4 | Kepler's Laws | |
| Feb. 11 | | Climate Regulation and Change | Ch. 4.5-4.6 | | Mini-project #1 Due: Asteroid Mining |
| Feb. 13 | | Nature of Life on Earth | Ch. 5.1, 5.4 | Cosmic Calendar | |
| Feb. 18 | | Life at the Extreme | Ch. 5.2, 5.3, 5.5 | | Quiz #2 (Ch. 3-4) |
| Feb. 20 | | The Origin of Life on Earth | Ch. 6.1-6.2 | Global warming | |
| Feb. 25 | | The Evolution of Life on Earth | Ch. 6.3-6.5 | | |
| Feb. 27 | | Searching for Life in our Solar System | Ch. 7.1-7.3 | Extremophiles | Mini-project #2 Due: Climate Change Solutions |
| Mar. 4 | Unit 3: Life in the Solar System | Mars | Ch. 8.2-8.4 | | Quiz #3 (Ch. 5-6) |
| Mar. 6 | | Life on Jovian Moons Part I | Ch. 9.1-9.2 | How hard is it to form life? | |
| Mar. 11 | | Life on Jovian Moons Part II | Ch. 9.3 | Life in the solar system | |
| Mar. 13 | | Big Questions about Extraterrestrial Intelligence and long-term evolution of humans | Ch. 6.6, 7.4 | the big questions | Quiz #4 (Ch. 7,8,9) |
| Mar. 18 | | spring break | | | |
| Mar. 20 | | spring break | | | |
| Mar. 25 | | Habitable Zones and Factors | Ch. 10.1, 10.3 | | Mini-project #3 Due: Exoplanet Habitability |
| Mar. 27 | | Global warming: Venus vs. Earth | Ch. 10.2, 10.4, 10.5 | What is humanity's future? | |
| Apr. 1 | | Exoplanets: Their Stars and Discovery | Ch 11.1-11.2 | | |
| Apr. 3 | | Exoplanets: Their Nature and Habitability | Ch. 11.3-11.4 | Who funds astronomy and why? | Mini-project #4 Due: Interstellar Civilization |
| Apr. 8 | Unit 4: Life Among the Stars | Intelligence | Ch. 12.1-12.2 | | Quiz #5 (Ch. 10-11) |
| Apr. 10 | | The Search for ExtraTerrestrial Intelligence | Ch. 12.3-12.4 | What is Intelligence? | |
| Apr. 15 | | Interstellar Travel | Ch. 13.1-13.2 | | |
| Apr. 17 | | The Fermi Paradox | Ch. 13.3 | Interstellar Civilizations | Mini-project #5 Due: Video project |
| Apr. 22 | | Kardashev Scale and Dyson Spheres | | | Quiz #6 (Ch. 12-13) |
| Apr. 24 | | Where do we go from here? | | the Fermi Paradox | |
| Apr. 29 | | Student Video Presentations | | | |
| May. 1 | | | | Take-away messages | |

Grading and Course Work

This course is designed to reward persistent effort and hard work throughout the course of the semester. Intelligence is fluid and learning to learn is an important component of this class.

This course is graded on an ****overall point system,**** meaning that your final grade in this class will simply be the total of all the points that you earned divided by 500 points total. All points are weighted equally, and they will simply be added to get your final score. There will be 600 points total available, so if you do 80% of the work, or get an 80% or better on all assignments, you can still earn a 100%. ***Therefore, there will be no quiz, assignment, or project make-ups, and none of these items will be accepted late,*** but there will be opportunities to earn points in other ways.

| Grade Component | Total points available |
|---|---|
| In-class activities and discussions boards There will be 15 assignments in this category, worth 10 points each, for 150 points total. | 150 total points available (25% of all available points) |
| Quizzes There will be 6 quizzes and they will be worth 25 points each, for 150 points total. | 150 total points available (25% of all available points) |
| Mini-projects There will be 5 mini-projects, they will be worth 60 points each. | 300 total points available (50% of all available points) |
| Total There will be 600 points available to you | Your final score will be graded out of 500 points. |

| % | Grade | % | Grade | % | Grade | % | Grade |
|--------|-------|-------|-------|-------|-------|-------|-------|
| 93-100 | A | 83-86 | B | 73-76 | C | 63-66 | D |
| 90-92 | A- | 80-82 | B- | 70-72 | C- | 60-62 | D- |

| | | | | | | | |
|-------|----|-------|----|-------|----|------|---|
| 87-89 | B+ | 77-79 | C+ | 67-69 | D+ | 0-59 | F |
|-------|----|-------|----|-------|----|------|---|

In-class activities and discussion boards

This class will be interactive with opportunities for individual and group activities, discussions, debates, and more. We will also use the discussion board feature of HuskyCT to dive deeper into some of these discussions. Each week, you will complete a discussion board post in advance of a discussion on Thursday. We will discuss in class, then you will either complete and turn in an in-class activity or a follow-up post (I will advise!)

More details will follow about the discussion board topics and specifics of the assignments. There will be 150 points available for these assignments altogether. There will be no late or make-up assignments (but plenty of opportunities to earn scores in other ways).

Quizzes

We will have six short in-class quizzes roughly every two weeks this semester. They are designed to allow you to track your progress, and to reward consistent effort throughout the semester. They will be a mixture of multiple choice, short answer, diagram, and fill in the blank questions. They will largely be based on lecture notes and the textbook.

Quizzes are worth 25 points each, for a total score of 150 points. There will be no quiz make-ups (but plenty of opportunities to earn points in other ways).

Please check the [online schedule](#) for updates, but currently, quizzes are scheduled for Feb. 4, Feb. 18, March 4, March 13, April 8, and April 22.

Mini-projects

There will be five mini-projects throughout the course of the semester, and each will be worth 60 points, for a total of 300 points. There will be no mini-project make-ups or late projects accepted, but plenty of opportunities to earn points in other ways.

Your mini-projects will include mathematical calculations as well as thoughtful written responses. They will be handed in HuskyCT as PDFs before the start of class on the day that they are due. They must be **highly legible** or **typewritten**.

I encourage you to work together on the mini-projects, *but you must write up and submit your own work*. **Prof. Battersby has a zero-tolerance cheating policy**. You are absolutely forbidden from seeking solutions online, posting the questions online, using AI for writing or answering any of the questions or for calculations, copying from anyone, or any other form

of cheating. AI can be used sparingly for getting suggested references, but all words, videos, diagrams, or any submitted work ***must be entirely your own work***. *You may be called on at any time to explain your work* (in discussion posts or mini-projects) to the class. Any suspected case of cheating will be reported to academic misconduct, and Prof. Battersby will recommend failure of the course.

Please check the [online schedule](#) for updates, but currently, the five mini-projects are:

- 1) Asteroid mining, due Feb. 11
- 2) Climate change solutions, due Feb. 27
- 3) Exoplanet Habitability, due March 25
- 4) Interstellar Civilization, due April 3
- 5) Video project, due April 17

More details will follow. Each assignment will be posted to HuskyCT along with a firm due date and time, and further instructions about the mini-projects.

Extra Credit

Extra credit opportunities to be announced.

Alignment to Common Curriculum

The Common Curriculum prepares students to tackle 21st-century challenges by combining coursework across disciplines to expand their worldviews, enhance their range of skills, and develop into critical, creative, emotionally intelligent, and interdisciplinary thinkers. The Curriculum is designed to help students learn to be versatile in a rapidly changing world; combine knowledge in innovative ways; apply learning strategies to new contexts, including their major; see local and global patterns and the interconnectedness of intellectual work; and appreciate how we need each other to tackle today's challenges.

The University has defined student learning objective (what a student should know, be able to do, or attitudes/beliefs they should possess by the end of the course) for each Topic of Inquiry in the Common Curriculum. Each Common Curriculum course aligns to one or more of those objectives. The course's student learning objectives align to the Common Curriculum objectives; course assessment (assignments, exams/quizzes, etc) align to both the course learning objectives and the Common Curriculum objectives.

TOI-4 Environmental Literacy

Earth is an integrated system that includes clouds, oceans, rocks, living beings, a magnetic field, and so forth. We humans, as a part of the Earth system, have created and continue to develop modes of thinking leading to political, economic, legal, social, and cultural systems that have altered the environment and our relationship to it, and which have implications for human health and well-being. Courses in this topic will help students gain the

knowledge, motivation, and skills to make informed and responsible decisions about human interactions with Earth systems and to take actions to improve the well-being of other individuals, societies, and the environment. By exploring environmental issues, engaging in problem solving and critical thinking, and taking action, students can help individuals and societies create awareness and sensitivity to the environment and enhance planetary stewardship.

| Topic of Inquiry | Common Curriculum Objective | Course Objective(s) | Course Assignment |
|---------------------------|--|---|---------------------------|
| 4: Environmental Literacy | Learning Objective 1: Students will be able to investigate how human activities impact Earth systems. | 5. Define “habitability” and explain why Earth is considered habitable, but Venus and Mars are not. | Mini-projects and quizzes |
| | Learning Objective 2: Students will be able to examine how Earth systems affect human activities and well-being. | 2. Explain how the Earth and solar system formed 3. Discuss the history of life on Earth, its evolution, and the conditions under which life likely arose. 6. Discuss the history of the search for extraterrestrial life both within our solar system and around other stars | Mini-projects and quizzes |

TOI-6 Scientific and Empirical Inquiry

Knowledge production stems from an interplay of observation, data, hypotheses, and theory concerning the natural universe, social systems, and theoretical models. Through scientific inquiry in the form of problem-solving and questioning, a greater understanding of observable phenomena develops and facilitates well-reasoned conclusions and predictions. Essential to this inquiry is a comprehension of major principles guiding modern scientific thought and awareness of the roles and limitations of interpreting and predicting observable phenomena.

| Topic of Inquiry | Common Curriculum Objective | Course Objective(s) | Course Assignment |
|------------------|-----------------------------|---------------------|-------------------|
|------------------|-----------------------------|---------------------|-------------------|

| | | | |
|-------------------------------------|---|--|---------------------------|
| 6: Scientific and Empirical Inquiry | Learning Objective 1: Students will be able to explain and appropriately utilize basic scientific language and concepts. | 1. Understand the scientific method and be able to apply it to novel situations. 4. Understand the origin of heavy elements that make up life on Earth. | Mini-projects and quizzes |
| | Learning Objective 2: Students will be able to design or conduct an experiment or analysis suitable to test a scientific hypothesis and be able to interpret the results. | 7. Quantitatively demonstrate the challenges of interstellar travel and communication | Mini-projects and quizzes |
| | Learning Objective 3: Students will be able to solve problems described verbally, graphically, symbolically, or numerically. | 8. Use the Drake equation to estimate how many (advanced) civilizations might exist in our Galaxy | Mini-projects and quizzes |

Academic Integrity

Don't cheat. Not even once, not even a little bit. Academic honesty is a fundamental tenet of education. Copying someone else's work, letting someone copy yours, seeking or using homework solutions or old exams (found online, from a friend, *anywhere*) is cheating. If any of you are caught cheating in any way, I will report the incident to Academic Misconduct and recommend failure of the course.

Take responsibility for your learning process and be a part of the community of scholars at UConn. Similarly, plagiarism in any form, meaning the failure to adequately document the source(s) of one's work, is wrong. Both copying and plagiarism violate the UConn Student Code. See Appendix A: Academic Integrity in Undergraduate Education and Research:

<http://community.uconn.edu/the-student-code-appendix-a/>

Instances of copying or plagiarism will be handled under the guidelines specified in the Student Code (<http://community.uconn.edu/the-student-code-preamble/>). You are responsible for acting in accordance with this code. Review and become familiar with these expectations. "I didn't know" is not an excuse. Please note that copying another student's

assignment is not the same as sitting down in a study group and discussing the assignment. As long as you maintain the boundary of *doing your own work* following discussion, there should not be a problem.

All lectures, notes, handouts, mini-project descriptions, quizzes, and displays are copyrighted by state and federal law. You are welcome to take notes and share them with other students in the class. You are not authorized to share course materials outside our class and are expressly forbidden from commercial use of course materials.

UConn policies

Full UConn policies can be found on the web, here is a good place to start:

<http://provost.uconn.edu/faculty-and-staff-resources/syllabi-references/>

Resources for Students Experiencing Distress

The University of Connecticut is committed to supporting students in their mental health, their psychological and social well-being, and their connection to their academic experience and overall wellness. The university believes that academic, personal, and professional development can flourish only when each member of our community is assured equitable access to mental health services. The university aims to make access to mental health attainable while fostering a community reflecting equity and diversity and understands that good mental health may lead to personal and professional growth, greater self-awareness, increased social engagement, enhanced academic success, and campus and community involvement.

Students who feel they may benefit from speaking with a mental health professional can find support and resources through the Student Health and Wellness-Mental Health (SHaW-MH) office. Through SHaW-MH, students can make an appointment with a mental health professional and engage in confidential conversations or seek recommendations or referrals for any mental health or psychological concern.

Mental health services are included as part of the university's student health insurance plan and also partially funded through university fees. If you do not have UConn's student health insurance plan, most major insurance plans are also accepted. Students can visit the Student

Health and Wellness-Mental Health located in Storrs on the main campus in the Arjona Building, 4th Floor, or contact the office at (860) 486-4705, or <https://studenthealth.uconn.edu/> for services or questions.

Accommodations for Illness or Extended Absences

Please stay home if you are feeling ill and please go home if you are in class and start to feel ill. If illness prevents you from attending class, it is your responsibility to notify your instructor as soon as possible. You do not need to disclose the nature of your illness, however, you will need to work with your instructor to determine how you will complete coursework during your absence.

If life circumstances are affecting your ability to focus on courses and your UConn experience, students can email the Dean of Students at dos@uconn.edu to request support. Regional campus students should email the Student Services staff at their home campus to request support and faculty notification.

Policy Against Discrimination, Harassment and Related Interpersonal Violence

The University is committed to maintaining an environment free of discrimination or discriminatory harassment directed toward any person or group within its community – students, employees, or visitors. Academic and professional excellence can flourish only when each member of our community is assured an atmosphere of mutual respect. All members of the University community are responsible for the maintenance of an academic and work environment in which people are free to learn and work without fear of discrimination or discriminatory harassment. In addition, inappropriate amorous relationships can undermine the University's mission when those in positions of authority abuse or appear to abuse their authority. To that end, and in accordance with federal and state law, the University prohibits discrimination and discriminatory harassment, as well as inappropriate amorous relationships, and such behavior will be met with appropriate disciplinary action, up to and including dismissal from the University. Additionally, to protect the campus community, all non-confidential University employees (including faculty) are required to report sexual assaults, intimate partner violence, and/or stalking involving a student that they witness or are told about to the Office of Institutional Equity. The University takes all reports with the utmost seriousness. Please be aware that while the information you provide will remain private, it will not be confidential and will be shared with University officials who can help. More information is available at equity.uconn.edu and titleix.uconn.edu.

Students with Disabilities

The University of Connecticut is committed to protecting the rights of individuals with disabilities and assuring that the learning environment is accessible. If you are a student with approved academic accommodations through the Center for Students with Disabilities (CSD),

please let me know immediately so we can discuss implementation. If you anticipate or experience any physical or academic barriers based on disability or pregnancy, you should contact the CSD to request accommodations at csd@uconn.edu or (860) 486-2020.

Information about requesting accommodations is available on the CSD website at <http://csd.uconn.edu/>

Inclement weather and emergency preparedness

In case of inclement weather, a natural disaster, or a campus emergency, the University communicates through email and text message. Students are encouraged to sign up for alerts through <http://alert.uconn.edu>. Students should be aware of emergency procedures, and further information is available through the Office of Emergency Management at <http://publicsafety.uconn.edu/emergency/>

Sexual Assault Reporting Policy:

To protect the campus community, all non-confidential University employees (including faculty) are required to report assaults they witness or are told about to the Office of Diversity & Equity under the Sexual Assault Response Policy. The University takes all reports with the utmost seriousness. Please be aware that while the information you provide will remain private, it will not be confidential and will be shared with University officials who can help. More information is available at:

<http://sexualviolence.uconn.edu/>