ASTR 380: Life in the Universe
Spring 2023

Lectures: 2:00 p.m. - 3:15 p.m. TuTh, Iribe Center, Room 0318

Instructor: Julia Brodsky (she/her)
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TA: Maureen McKinney Clark (they/them)
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Preferred contact: Please contact me during office hours or immediately after class. Please don't hesitate to send an email if something urgent comes up.
Office Hours: on Thursdays after the class, per appointment; alternatively, we can meet over Zoom on Friday morning, 9-10 am, or in the afternoon, per appointment.
Course content: All course content will be hosted on the ELMS webpage.

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Textbook:"Life in the Universe" by Bennett & Shostak, 4th edition ., Pearson, ISBN-13:978-013-408908-9

Note that the textbook is excellent, but there are new things in this fast-moving field that are not in the text. There will be required reading of articles and papers on special topics to be assigned in class. E-text is available here: https://www.pearson.com/en-us/subject-catalog/p/life-in-the universe/P200000006993/9780135234457

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Additional helpful material on the topics of complexity and emergence:

Website: https://complexityexplained.github.io/,
Complexity: A Guided Tour Links to an external site.by Melanie Mitchell,
"The Emergence of Complexity" .by Jochen Fromm, Kassel University Press GmbH, Kassel, © 2004

Helpful reference on physics (optional): "From alchemy to quarks", Sheldon L. Glashow, Brooks/Cole Publishing Company, Pacific Grove, California

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This course will provide an introduction to the science of astrobiology along with applications to the Solar System, exoplanets, and the search for life in the universe. This class is appropriate for students majoring outside of physics and astronomy. This course has no prerequisites and satisfies the university's General Education Distributive Studies Natural Sciences (DSNS) requirements, including the following learning outcomes:
● Demonstrate a broad understanding of scientific principles and the ways scientists in a particular discipline conduct research.
● Apply quantitative, mathematical analyses to science problems.
● Solve complex problems requiring the application of several scientific concepts.
● Look at complex questions and identify the science and how it impacts and is impacted by political, social, economic, or ethical dimensions.
● Critically evaluate scientific arguments and understand the limits of scientific knowledge.
● Communicate scientific ideas effectively.

Homework (30%): There will be (weighted) homework assigned weekly. Reading Quizzes: Almost every lecture will be accompanied by a required reading from the textbook and/or articles and papers on the topic to be covered.
In-class Activities (10%): There will be occasional student presentations and in-class activities in which students will either collaborate on a scientific problem or discuss the societal implications of scientific discoveries related to life in the universe. There will also be occasional brief in-class “quizzes” to solicit feedback on the lecture and content. If you have an excused absence and miss an activity as a result, you may make up the in-class activity as homework due two weeks after the activity initially took place. These activities will be part of the “participation” category of grades (10%)
Exams (15%, 15%, 25%): There will be two midterm exams and one final project on the dates outlined in the course schedule. Exams will consist of multiple question types, including multiple-choice, short-answer, and free response.
Project (5%): For extra credit or to replace a midterm grade, you are encouraged to participate in a collaborative science communication project.

Attention: The Final Project for the course is due by May 13th

Course Schedule:

Lesson #	Module	Topic
1	Universe and the Solar System	Introduction to Astrobiology. Solar system and planetary motion. Copernican revolution and Kepler's laws.
2		Gravity. Formation of the Solar System.
3		Formation of the elements. Star lifecycles. Nuclear fusion. The abundance of elements in the universe.
4		Mercury and Venus; the concept of the habitable zone.
5		Earth and the Moon; habitability.
6		Mars and the asteroid belt
7		Jovian planets and their moons
8		James Webb telescope and upcoming space missions.
9	Exam or Project (15%)	"Redesign the Solar System" project or Written exam - mixed format
10	Life and Evolution	Systems thinking
11		Complexity and emergence
12		Self-organization and self-replication
13		Extremophiles
14		LUCA - last universal common ancestor
15		Life on early Earth
16		Mass extinctions, part 1
17		Mass extinctions, part 2

18	Project or Exam (15%)	Project or Written exam - mixed format
19	Humanity as a space-faring civilization	Exoplanets
20		Kardashev Scale and Drake equation
21		SETI and METI
22		Terraformation and space mission planning
23		The Fermi Paradox and Great Filter
24		Alternative chemistry
25		AI in space
26		The future of humanity
27		Semester review
28	Exam or Final Project (25%)	Final project (hard deadline May 13th)

Grading
Below is the distribution of grades for the course.
Mid-term 1: 15%
Mid-term 2: 15%.
Final exam/ project: 25%.
Homework: 30%. Includes reading quizzes (1/3 of grade) and homework assignments (2/3 of grade).
Participation: 10%
Project: +5%, if for extra credit. 15%, if you inform me that the project will fully replace one of your two mid-term exam scores.
The cumulative grading distribution is as follows:

A+ 97-100% A 93-97% A- 90-93% B+ 87-90% B 83-87% B- 80-83% C+ 77-80% C 71-77% C- 66-71% D 60-66% D- 57-60% F < 57%

Attendance and Missed Assignments:
Students are expected to take full responsibility for their own academic work and progress. Students, to progress satisfactorily, must meet all of the requirements of each course for which they are registered. Students are expected to attend classes regularly. Consistent attendance offers students the most effective opportunity to gain command of course concepts and materials. Excused absences must be requested promptly and must be supported by appropriate documentation.
Even if you have an excused absence, homework must be handed in electronically by the due date.
In-class exercises may be done as homework if you have an excused absence from class, due two weeks from the original in-class assignment date.