

# AST 309L: The Search for Extraterrestrial Life

## Course Syllabus

Unique# 48035 Spring 2021

### Course and Contact Information

<b>Instructor:</b> Dr. Michael Endl <b>e-mail:</b> <a href="mailto:mike@astro.as.utexas.edu">mike@astro.as.utexas.edu</a> (best way to communicate with me!)	<b>Teaching Assistants:</b> Keshav Siddharth Chodavarapu e-mail: <a href="mailto:siddharthc@utexas.edu">siddharthc@utexas.edu</a> Kapil C Nidadavolu, e-mail: <a href="mailto:kapilc@utexas.edu">kapilc@utexas.edu</a>
<b>Lecture Hours:</b> T,Th 12:00 PM-1:30PM	<b>Lecture Location:</b> online (Zoom)
<b>Office Phone:</b> 512-471 8312	<b>Office Location:</b> PMA 17.328
<b>Office Hours:</b> online via Zoom (per appointment, almost any time works) TAs: online via Zoom per appointment	
<b>Course Website:</b> CANVAS ( <a href="http://canvas.utexas.edu">http://canvas.utexas.edu</a> )	

### Basic Course Information

#### Course Description

This is an astronomy course for non-science majors about one of the most interesting and fascinating questions that humans ever asked themselves: *Are We Alone in the Universe?* The course consists of a study of our Solar System with an emphasis on the habitability of planets and moons and the search for extraterrestrial life. We will discuss theories about the structure and formation of the Solar System, with a focus on the factors that were important for the emergence of life on our planet and the potential for its existence elsewhere. It includes a scientific investigation of other planetary systems around other stars than the Sun (i.e. Extrasolar Planets) and the possibilities to search these exoplanets for extraterrestrial life. Many of the topics that we will discuss are very recent scientific discoveries! Astrobiology is a relatively new science that constitutes a interdisciplinary approach to this topic. Be prepared to deal with topics ranging from geology, biology, chemistry and astrophysics, as well as sociology and even philosophy.

The concepts that we will discuss are primarily qualitative, but there will be some little amount of (high school-level) algebra in the course.

**This course is 100% online, we will use the conferencing tool Zoom (accessible from our Canvas website) to take this journey through the Universe.**

**Prerequisites and Core Requirements:**

This course has the following prerequisites: AST 301 or AST 307. Designed for non-College of Natural Sciences majors. Three lecture hours a week for one semester. May not be counted toward a degree in the College of Natural Sciences.

This course will include work designed to develop skills in critical thinking, communication, quantitative analysis, and teamwork. This will involve such activities as discussions, in-class teamwork to solve mini-quizzes and critical analysis of key concepts, and quantitative problem solving. Communication in the course will consist of student questions and subsequent classroom discussions during lectures and homework assignments. The course material will emphasize the synthesis of observation and theory to gain insight into the operation of the natural world, drawing on other fields such as physics, chemistry, geophysics and biology. The mathematical skills required to solve the problems in this course do not exceed high school algebra level.

**About me:**

I am a former Senior Research Scientist with the University of Texas at Austin's McDonald Observatory and a current Lecturer in the Astronomy Department. I am also a member of the Center for Planetary Systems Habitability at UT. My own field of research is the study of extrasolar planets, in particular those which could be deemed habitable. For instance, I was involved in the discovery of *Proxima b*, a potentially habitable planet around the closest star to the Sun (Proxima Centauri). *It is my favorite course to teach at UT.*

**Class Website:**

This course will be run through the Canvas system at [canvas.utexas.edu](https://canvas.utexas.edu). All class activities and communications (lectures, exams, in-class activities (instapolls), homework assignments, etc.) will be done through Canvas.

**Required Texts/Materials**

- **"Life in the Universe"**, 4<sup>th</sup> Edition – by Bennett & Shostak (e-text or hardcopy)
- Scientific calculator for use on (occasional) problems

**Grading System:**

5 Exams (online)	60%
Homework	20%
In-class activities (Instapolls)	15%
Discussion Board	5%
Extra Credit (not required)	(3%)
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	100%

This class will not be graded on a curve. The percentage in each of these grade components

will be added by the above percentages to derive the final course grade, which will be assigned as follows (where the numbers represent the percentage of total points):

93–100 = A 90–92.9 = A–  
 87–89.9 = B+ 83–86.9 = B 80–82.9 = B–  
 77–79.9 = C+ 73–76.9 = C 70–72.9 = C–  
 67–69.9 = D+ 63–66.9 = D 60–62.9 = D–  
 < 59.9 = F

### **Your grades will be posted on Canvas during the semester.**

Grades are **non-negotiable**. These are the grades that **you** earn (and are not “given” by the instructor). Follow your progress over the semester in the grade center on Canvas and check if you will meet your goals. Talk to the instructor or TA if you have questions regarding your progress. *There is no last-minute extra credit.* There is ample opportunity for extra credit during the semester to improve your grade. Please read this syllabus carefully, it is your responsibility to be aware of all the requirements to achieve a certain grade. *Note that the running percentage on Canvas during the semester is not necessarily an exact proxy of your final grade*, as some grade components will only be entered at the end of the course! When in doubt, please contact me or one of the TAs!

## **Course Policies:**

### **Online Teaching:**

**This class includes required virtual live class meetings on the days and times listed.** Students must be able to attend virtual class meetings in real time. You must have the following things to succeed in an online class:

- Reliable access to a working computer, laptop, or tablet
- A computer (or tablet) with a webcam and a microphone is recommended
- Basic computer skills, such as creating and formatting documents, uploading and downloading documents
- Access to reliable (preferably high speed and broadband) internet service

(Access to a printer is useful but not required)

**We will use the online conferencing tool Zoom to meet virtually.** You can launch Zoom from our Canvas website. We will meet in our regular class hours Tuesday and Thursday at noon to 1:30PM. All lectures will be recorded and the recordings will be available on Canvas. You are free to re-watch these at any time after the class. I will also post all my lecture slides on Canvas. *These lecture slides and your lecture notes are your primary source of information in preparing for the exams.*

During each lecture, I will describe and explain the important concepts of each chapter. Every once in a while, we will take a break from lecturing and do an in-class activity or online poll (Instapoll). These activities will help you digest and review the material and help to deepen your understanding of the concepts. This is an introductory astronomy course for non-science majors, so we will focus on conceptual understanding. Any quantitative problems will not require math that exceeds your high school algebra level. After about 45 minutes we will take a 5-minute bathroom break.

**Exam policies:**

There will be **5 online exams throughout the semester, each exam is worth up to 12% of your final grade. *There is no comprehensive final exam.*** Note the test dates in the course calendar and please enter them in your personal calendar. We conduct all tests during nominal lecture hours using Canvas. *All tests will be multiple-choice tests.* The TAs and myself will support and proctor the exams via Zoom. You will need to have your webcam activated during the exams. This will also give you the ability to ask any questions, if something is unclear.

**The questions on each test will quiz you on the major concepts that we discuss in the section leading up to the test.** Except for general fundamental concepts (like the concept of gravity, light, etc), each test will cover only the material in the section since the last test (i.e. in test 2 you will not be quizzed in detail on section 1, and so on....). *Also, you will not be tested on anything that I did not cover during the lectures, or that was not subject to homework assignments.* However, I encourage you to read the complete chapters of the textbook, also the sections I did not cover, for an improved understanding of the course material.

***Exam re-weighting:*** since everyone can have a bad day or other troubles arising during a full semester, I will re-weigh your exam grades at the end of the semester. Your best test will be upgraded to account for up to 18 points and your lowest test score will only account for up to 6 points. Example: your test grades are 88(/100),77,54,67,91. So your total exam grade will be:  $88\%*12 + 77\%*12 + 54\%*6 + 67\%*12 + 91\%*18 = 47.5$  (out of 60) as compared to 45.2 without reweighting. Obviously, this can only be done at the end of the semester.

**In-class activities:** during lectures we will frequently perform small in-class activities (2-5 mins) to deepen your understanding of the material covered that day. You can use textbook, lecture slides and the internet to complete the activity. We will use *Instapoll* on Canvas or other online tools to do these activities. All submitted and correct answers will count for your *in-class activity* score (15% of your final total). **If you answered 70% of all Instapolls correctly you will get the whole 15 points.** If you have less than 70% correct, the points will be adjusted accordingly. We will do all Instapolls during our regular Zoom classes. This low limit of 70% is chosen to also accommodate connection issues, when your internet cuts out during an Instapoll.

*Never hesitate to ask a question in the classroom* (there are no stupid questions in my course, in fact those questions perceived to sound stupid, often are the most interesting!). **Zoom has an option to virtually raise your hand. I will respond in the order that they were raised.** Just raise your (virtual) hand and I will react. Also, please speak up whenever I ask a question to the classroom. If you have heard some interesting astronomy news, please also share them with our class

The course webpage on the Canvas system will be updated with course announcements, homework assignments, and deadlines. *It is your responsibility to check these on a regular basis.* Please come to class prepared to participate in in-class discussions and activities, this is for your benefit.  
**Cell phones:** please silence and pack away your cell phone **during Zoom classes.** Please be considerate.

**Homework Policies:** We will post homework assignments on Canvas. These assignments are individual assignments, but I encourage discussions and collaborations between students.

Please do not hesitate to ask me if something seems unclear. Doing the homework is essential for a better understanding of the course material and it is a sure recipe to be successful in this class. The questions are closely connected to the course material and the corresponding chapters in the *Life in the Universe* textbook.

**The homework grade is important, as it constitutes up to 20% of your total grade.** I do accept late homework, but you will only receive 50% of the points (unless you have a valid excuse like a documented illness).

### **Discussion Board:**

Canvas offers a *discussion board* that allows students to talk about course-related astronomy topics. **For the discussion board score (so 5 points for the total) each student is required to start one discussion topic and moderate it over the entire semester.** If you need help with Canvas just ask the TAs. It is not sufficient to post a link to a new article as a discussion, without any kind of explanation and/or justification why this is interesting for our course. I want to see why you chose this subject and how you think this relates to our class. Occasionally, I will participate in these discussions. Also, the posts should be about interesting progress in astrobiology and not miscellaneous course-related questions (e.g. about homework or exams). If you are in doubt about the topic you chose, just ask me. Since you are supposed to moderate your discussion post, **all posts need to be entered on Canvas before the semester midpoint (Mar 11).** Any discussion posts entered after this date will receive only half credit (up to 2.5 points for your total).

### **Extra Credit**

There will be many extra credit opportunities over the course of the semester. Each exam and homework assignment will contain bonus questions that will give you an opportunity to earn extra, additional points. **I want my students to learn and succeed.** The extra credit is – of course – not required to achieve 100% in this course.

I will post a special extra credit opportunity using the *Zooniverse* in the second half of the semester. This activity will allow you to gain up to **3 extra points** to your final total. Please keep track of your grade and be pro-active with extra credit if you want to improve. *There will be no extra-extra credit at the end of the course!* If you have any questions about your grade, just ask me or a TA.

**Instructor Absences:** I am a professional research astronomer, *which might require absences during the semester.* I will do my best to minimize the impact of these activities, and will maintain email and Canvas communication at all times. When I cannot teach a lecture, another UT astronomy professor will lead the class in my place (using my slides and instructions) or we perform in-class activities directed by the TAs.

### **Academic Dishonesty:**

*University of Texas Honor Code:* The core values of The University of Texas at Austin are learning, discovery, freedom, leadership, individual opportunity, and responsibility. Each member of the university is expected to uphold these values through integrity, honesty, trust, fairness, and respect toward peers and community. Students who violate University rules on scholastic dishonesty are subject to disciplinary penalties, including the possibility of failure in the course and/or dismissal from the University. Standards for Academic Integrity are posted at <http://deanofstudents.utexas.edu/conduct/index.php>

*Plagiarism:* As a research university, the University of Texas at Austin takes plagiarism very

seriously. Do not risk getting involved in a plagiarism infraction - the consequences simply aren't worth it. Always cite your sources, and when in doubt consult a professor or librarian. You may also read more about plagiarism at the Student Judicial Services website:  
<http://deanofstudents.utexas.edu/conduct/academicintegrity.php>

**Documented Disability Statement:**

Please notify me of any modification/adaptation you may require to accommodate a disability-related need. The University of Texas at Austin provides upon request appropriate academic accommodations for qualified students with disabilities. For more information, contact Services for Students with Disabilities at 471-6259 (voice) or 232-2937 (video phone) or <http://diversity.utexas.edu/disability/>

**Email:**

Email is recognized as an official mode of university correspondence; therefore you are responsible for reading your email for university and course-related information and announcements. Please check your email regularly and frequently.

**Course Outline:**

**Course Module 1:** Science, Astrobiology Fundamentals, Earth's Habitability

**Course Module 2:** Life on Earth, Origin & Evolution, History of Life on Earth

**Course Module 3:** Life in the Solar System? Mars, Jovian Moons

**Course Module 4:** Extrasolar Planets, Biosignatures, The Drake Equation

**Course Module 5:** SETI, Technosignatures, Fermi Paradox & Interstellar Travel

## Course Calendar

*(topics are subject to change, depending on overall progress, test dates are permanent)*

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### - Section 1:

Week 1 – Jan 19:	Introduction/Welcome/Syllabus review
Week 1 – Jan 21:	Scientific Method & Astrobiology
Week 2 – Jan 26:	Solar System Overview and Planet Earth
Week 2 – Jan 28:	Earth Habitability 1
Week 3 – Feb 2:	Earth Habitability 2
Week 3 – <b>Feb 4:</b>	<b>TEST 1 (Homework 1 due)</b>

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### - Section 2:

Week 4 – Feb 9:	Origin of Life 1
Week 4 – Feb 11:	Origin of Life 2
Week 5 – Feb 16:	Evolution of Life 1
Week 5 – Feb 18:	Evolution of Life 2
Week 6 – Feb 23:	Evolution of Life 3
Week 6 – <b>Feb 25:</b>	<b>TEST 2 (Homework 2 due)</b>

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### - Section 3:

Week 7 – Mar 2:	Mars 1
Week 7 – Mar 4:	Mars 2
Week 8 – Mar 9:	Mars 3
Week 8 – Mar 11:	Jovian Moons 1
	<b>All Discussion Board posts due</b>
Week 9 – Mar 16:	<b>Spring Break</b>
Week 9 – Mar 18:	<b>Spring Break</b>
Week 10 – Mar 23:	Jovian Moons 2
Week 10 – <b>Mar 25:</b>	<b>TEST 3 (Homework 3 due)</b>

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### - Section 4:

Week 11 – Mar 30:	Exoplanets 1
Week 11 – Apr 1:	Exoplanets 2
Week 12 – Apr 6:	Habitable Exoplanets and Biosignatures
Week 12 – Apr 8:	The Rare Earth Hypothesis
Week 13 – Apr 13:	The Drake Equation
Week 13 – <b>Apr 15:</b>	<b>TEST 4 (Homework 4 due)</b>

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### - Section 5:

Week 14 – Apr 20:	SETI 1
Week 14 – Apr 22:	SETI 2
Week 15 – Apr 27:	Technosignatures
Week 15 – Apr 29:	Interstellar Travel
Week 16 – May 4:	The Fermi Paradox
Week 16 – <b>May 6:</b>	<b>TEST 5 (Homework 5 due)</b>

### - End of course

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