

AST 184L: Life in the Universe Lab



College of the
Environment, Forestry,
and Natural Sciences

College of the Environment, Forestry, & Natural Sciences

Department of Astronomy and Planetary Science

Semester: Spring 2020

Prerequisites/Co-Requisites: AST 183: Life in the Universe

Location: Physical Sciences Bldg, Rm. 321/232

Meeting Time & Format: Tuesdays, 6:30pm – 9:00pm (1 credit hour)

Instructor: Alissa Roegge, ar3283@nau.edu

Office Location: Peterson 205

Office Hours: By appointment

Undergraduate Teaching Assistant (TA): Clarke Morley, dm2638@nau.edu

Course Purpose & Description (Fall, 2019)

This course is a laboratory complement to the lecture course AST 183: Life in the Universe, a multidisciplinary exploration of modern scientific inquiry into the question of life's origin, evolution, and future place in the universe. Students will participate in a hands-on introductory study of primary evidence that has shaped a modern scientific view of life's place in the universe. This course uses the exceptional environment of Northern Arizona – its dark skies, deep sedimentary rock exposures, meteor impact record, volcanic terrain, and nearby halophilic organisms – as a unique laboratory wherein students will have direct contact with the kinds of data used to draw diverse astrobiological conclusions. The lab course will also include two mandatory, all-day field trips to occur on two weekends. The focus of this lab course is on (1) the astronomical setting for life as we know it; (2) nearby stars and the prospects for life; (3) environmental impacts of comets, meteorites, and asteroids in the solar system; (4) the evidence used to construct our picture of the history of complex life on Earth; and (5) evidence that differentiates between volcanic and impact origin for craters on Earth. Letter grade only.

Course Objectives & Learning Outcomes

This course has several objectives and learning outcomes that will be addressed during the lab sections and assessed through lab reports and quizzes. Students will be assessed on their critical and creative thinking, quantitative analysis, use of technology, and scientific inquiry, with an added focus on environmental consciousness. By the end of the semester:

- Students will be able to identify and spatially visualize (through dark-sky observations) the cosmological setting of life on planet Earth, including the orientation and simple motions of the Earth in the plane of the solar system, our location and orientation in the Milky Way Galaxy, and the location of the nearest galaxies (scientific inquiry, critical and creative thinking).
- Students will be able to explain evidence for the distances to the nearest stellar systems and identify their stellar magnitudes within visible range. They will be able to identify stellar colors and explain their corresponding spectral types and evolutionary pathway. They will use this information to draw inferences about the suitability of various kinds of stars for harboring extraterrestrial life (creative and critical thinking, quantitative analysis, use of technology, and scientific inquiry).
- Students will exhibit mastery of first-hand evidence for past and current influx of solar system materials in the form of crater morphology and surface densities together with meteor shower count rates. From quantitative considerations of related studies, they will draw conclusions about the positive and negative impact of exogenous materials on life (environmental consciousness, scientific inquiry, critical and creative thinking, and quantitative analysis).
- Students will be able to explain how the chronology of landscape and biological evolution is inferred from sedimentary rock types, fossils, and elementary stratigraphic principles (environmental consciousness, scientific inquiry, and critical and creative thinking).

Assessment

Students will be assessed on the above objectives through a series of lab reports and quizzes. The modes of assessment and how they relate to the content of this course are discussed below.

Class Lab Reports: Virtually all lab projects will involve lab reports. The lab reports should be turned in at the end of the lab period. These lab assignments will typically be completed in groups, but the student must ensure it is their own work on the report. Labs may be turned in late by 5pm the next day for 20% off the total assignment score.

Field Trip Lab Reports: Two labs will be conducted outdoors and on the weekends. If both outdoor labs are missed, the student will automatically fail the class. One trip will be to the Grand Canyon to complete an assignment on the sedimentary rock record of Northern Arizona. The second trip will be to Meteor Crater to look at a well preserved crater and study how cratering works on terrestrial planets. These labs must be turned in at the end of each respective field trip.

End of Semester Presentation: Each student will be required to do a 7 minute presentation on a topic of their choice that relates to the overall goals of the class. Each student will submit topic ideas to the professor for approval at least 3 weeks prior to presentations. The presentation should include background on the topic, current knowledge of the topic, and any future discoveries or potential research avenues the student can identify.

Grading System: The breakdown of percentage points is as follows:

<i>Classroom Lab Reports & Assignments</i>	<i>65%</i>
<i>Field Trip Lab Reports & Assignments</i>	<i>25%</i>
<i>Final Presentation</i>	<i>10%</i>
<i>Total</i>	<i>100%</i>

Class, Departmental, & University Policies

- Please disclose any disabilities or special requirements to the NAU Disabilities Resources Office, who will contact me privately regarding any accommodations. I want to make sure that every student has an equal opportunity to learn and succeed.
- Don't cheat. You're paying good money to learn, and if you don't appreciate the knowledge gained right now, you will in the future. *If you feel like you need to cheat in order to succeed in this class, come talk to the professor to establish a more sustainable plan for succeeding.*
- Students are required to attend both field trips and all in-class labs, and will be graded on the basis of participation.
- As a courtesy to the instructor and to your fellow students, please come to class on time.
- Lab write-ups will be accepted late, but with points deducted for each working day that the assignment is late. Make-ups will only be given for institutional or documented and appropriate reasons. Prior written documentation must be supplied for institutional excuses, while other forms of documentation (e.g., medical notes) may be excepted afterwards.
- Please silence all cellular devices during class. Please refrain from any other "electronic distractions" (e.g., text messaging, browsing social media) during class. If you are anticipating cellular disruptions during class for any personal or professional reasons, please notify the professor prior to class.
- Class disruptions are defined as activities that distract the instructor or other students from delivering or learning the course materials. Such activities include talking or whispering during class, habitual tardiness or leaving class early, or "electronic distractions." Disruptive students will be asked to leave the classroom, and repeat offenders may be withdrawn from the class.
- Neither audio nor video recording will be permitted except under special circumstances prescribed by the NAU Disability Resources Office or discussed with the professor prior to class.

- **Additional departmental and university policies can be found at www.physics.nau.edu/SYLLABI/POLICY/policy.html.** This course falls under all departmental and university policies unless otherwise stated in this document.
- NAU-s Safe Working and Learning Environment Policy (SWALE) prohibits discrimination and harassment, including sexual harassment, on the basis of sex, race, color, age, national origin, religion, sexual orientation, gender, gender identity, disability, or veteran status by anyone at this university. Retaliation of any kind as a result of making a complaint under the policy or participating in an investigation is also prohibited by SWALE. The Equity and Access Office (EAO) handles complaints of discrimination and harassment that fall under the SWALE policy and also assists with religious accommodations.
- Title IX and NAU prohibit discrimination based on sex or gender in any education program or activity receiving federal financial assistance. Sex discrimination includes sexual harassment, sexual assault, relationship violence and stalking. The Title IX Coordinator is EAO Director, Pamela Heinonen. The Title IX Coordinator has overall responsibility for Title IX compliance, including training, education, and administration of grievance procedures.
- University education aims to expand student understanding and awareness. Thus, it necessarily involves engagement with a wide range of information, ideas, and creative representations. In the course of college studies, students can expect to encounter-and critically appraise-materials that may differ from and perhaps challenge familiar understandings, ideas, and beliefs. Students are encouraged to discuss these matters with faculty.
- Everyone has the right to be addressed and referred to by their correct name and pronouns. Class rosters have a student's legal first name, unless they have entered a preferred/chosen first name on SPIRE. Pronouns are not included on rosters, so students will be asked to indicate the pronouns that they use for themselves whenever they are asked to share their names. A student's chosen name and pronouns are to be respected at all times in the classroom.

Course Schedule

The following course schedule includes the lab topics, dates of examinations, and the required reading materials. This schedule is subject to change, and any changes will be discussed with the class prior to their implementation.

Lab

Week	Date	Topic
1	Tu, 01/14/2020	Lab Introduction / The Size of Astronomy
2	Tu, 01/21/2020	Classification Schemes as a Scientific Tool
3	Tu, 01/28/2020	Age Relationships on Planetary Surfaces
4	Tu, 02/4/2020	Drake Equation Lab
5	Tu, 02/11/2020	Habitable Zone Lab
6	Tu, 02/18/2020	Classification of Stellar Spectra
7	Tu, 02/25/2020	Exploring Mars
8	Tu, 03/03/2020	Kepler's Laws
9	Tu, 03/10/2020	Celestial Sphere Lab
10	Tu, 03/17/2020	Constellation Lab
11	Tu, 03/24/2020	Telescope Lab
12	Tu, 03/31/2020	Sedimentary Rock Lab
13	Tu, 04/07/2020	Igneous Rock Lab
TRIP	Sat, 04/11/2020	Grand Canyon Trip
TRIP	Sat, 04/18/2020	Meteor Crater Trip
Final	Tu, 04/21/2020	Final Presentations