NORTHERN ARIZONA UNIVERSITY | College of Engineering, Forestry, and Natural Sciences

FYLI First Year Learning Initiative

Introduction to Astronomy

General Information

- Department: Astronomy and Planetary Science
- Course: AST 180 (Introduction to Astronomy) – Class Number 8586 Section 002
- Term: Spring 2020
- Total Units of Course Credit: 3
- Pre- and Co-Requisite(s): None
- Mode of Instruction: Face-to-Face
- Meeting Time: Tuesday/Thursday 4:00 – 5:15 p.m.
- Location: Physical Sciences (Bldg 19) 103
- Instructor: Mark Loeffler
- Phone: 928-523-0369; Email: Mark.Loeffler@nau.edu
- Address for Office Hours (My laboratory): Physical Sciences (Bldg. 19) 313, 313A
- Office Hours: Tuesday 2:45 – 3:45 p.m. and Thursday 1:15 – 2:15 p.m. and you can always just stop by as well
- Teaching Assistant – Kaitlyn Wolf (kdw289@nau.edu)
    - Office hours and location will be announced on Bblearn

Course Purpose:

This course will survey the scientific topics that comprise the key elements of Astronomy and Planetary Science. These include the philosophical foundations of astronomy as a science, the history of astronomical discoveries, an examination of the origins and lifecycles of stars and their associated solar systems, and the origins of the universe, including the place of life in the cosmos. Letter grade only.

Course Description (Fall, 2018)

AST 180 surveys observational evidence and scientific conclusions about the origin, history, and nature of the universe in which we live. Core topics include the scale of the universe, technological tools of astronomy and planetary science, the Copernican revolution, gravitation and the motion of the planets, electromagnetic radiation and spectra, contents of the solar system (Sun, moon, Earth as a planet – its interior, surface, atmosphere and climate), Terrestrial and Jovian planets (their origins, surfaces, interiors, atmospheres, satellites and rings, asteroids, comets, icy bodies of the outer solar system, etc.), the life cycle of stars, origin and structure of galaxies, and big bang cosmology. The order of topics will also be chosen by the instructor as guided by the textbook

The course meets a 3-hour liberal studies science requirement. It also meets the lab-science requirement when taken together with the 1-credit-hour lab, AST 181. Essential liberal studies skills that are addressed include: the logic of scientific inquiry, quantitative and spatial reasoning, critical reading and thinking, technology and its impact, and environmental consciousness.

Course Objectives & Learning Outcomes

This course has several objectives and learning outcomes that will be addressed during the lecture and assessed through in-class assignments, homework, and examinations. By the end of the semester, students will be able to:

- Demonstrate an understanding of the scientific method and how scientific research is conducted;
- Assess the validity of a scientific claim through critical thinking and evidence-based debate;
- Formulate hypotheses on the basis of observations and design appropriate tests that entail the collection, analyzing, and evaluating of data;
- Quantify the spatial and temporal dimensions of key features of the universe and our solar system, including topics related to the human history of technical observations that led to their discovery;
- Discriminate between the epistemology and narrative associated with a modern scientific view of origins and those that were widely accepted in the pre-scientific era;
- Identify the life-supporting properties of Earth from the general perspective of planets in our solar system and beyond;
- Become adept at making simple quantitative calculations, including the setting up of simple formulae to calculate the numerical solution to a question of physical quantity;

Required Materials & Technology

1. **Top Hat (see Top Hat Access on BBLearn menu)**

Click on the link on BBLearn, or go to our course website https://app.tophat.com/e/160826 on your laptop, or download the app on your device. The code to join is **160826**. If you have purchased Top Hat already, either for this semester or one year subscription, no need to buy it again. Just join the course! If this is your first time, please signup and it is $20 for this semester.

Should you require assistance with Top Hat at any time, due to the fact that they require specific user information to troubleshoot these issues, please contact their Support Team directly by way of email (support@tophat.com), the in app support button, or by calling 1-888-663-5491.

2. **OpenStax: Astronomy e-text (see Syllabus & Info on BBLearn menu)**

Good news: your textbook for this class is FREE! Once you register for Top Hat, you should see the assigned textbook readings and questions on Top Hat. Each chapter will be released as we go along.

You can also choose to download to read offline, however note that questions are ONLY accessible in Top Hat. Click on the link in BBLearn above, or download from here: www.openstax.org/details/astronomy.

3. **Lecture-Tutorials for Introductory Astronomy, 3rd Edition**,
   Edward E. Prather, Slater Timothy F, Jeff P. Adams, Gina Brissenden
   ISBN-13: 978-0321820464
   ISBN-10: 0321820460

   This book can be purchased on Amazon or at the campus book store.

Assessment

Students will be assessed on the above objectives through a series of in-class assignments, homework, and examinations.

In-Class Assignments: Two types of in-class activities will be used during this class.

1) **Class Participation and Attendance**: We will use Top Hat for this category, so please bring your device or laptop to every class. Please don't forget to charge your devices, and make sure it has connection to internet. We will also have concept questions throughout the lecture using Top Hat. Generally, questions will be worth 2 pts (1 pt for correctness and 1 pt for participation/attendance). You will not be able to make up ANY points if you miss any questions in the class, under any circumstances. There will be NO extra credit work given to make up your points. Your score in this category is will be updated regularly on BbLearn. You are allowed to have TWO UNEXCUSED ABSENCES in the semester without them counting against your grade.

IMPORTANT: If you have malfunction or need assistance anytime in class, please write your answers on a piece of paper and turn them in at the end of class. However, you will only get **half credit** for the questions to be fair.

2) **Lecture Tutorials**: Students will use portions of the Lecture-Tutorials in Astronomy workbook, determined by the professor, that will be turned in for points. These tutorials are designed to stimulate discussion and reinforce topics covered in the lectures. These in-class assignments will be completed in small groups in class, though students may work individually if preferred. **Students must turn in their own copy of the assignment, which is preferably torn out of the Lecture-Tutorials in Astronomy workbook. These assignments must be turned in by the end of class on the day in which they were assigned; no late assignments will be accepted.**

Outside Class Assignments: Two types of outside class activities will be required during this class.

1) **Homework assignments:** These assignments are designed to strengthen your understanding of lecture materials and to prepare for examinations. There will be approximately one homework assignment per week. Homework will be assigned and turned in using Top Hat. Grades will be imported to BbLearn regularly.

2) **Observations at Barry Lutz Telescope:** These assignments will involve the student going to the on-campus telescope facility (*Bldg 47; on San Francisco, behind Reilly Hall*) and sketching an image of a celestial object. For these assignments, take the worksheet available in the "Observation Log Worksheet" Tab on BBLearn to the telescope on the evenings that are specifically assigned to our class. The observatory is open to the public, free of charge, on clear Friday nights from 7:30 pm – 10:00 pm. Additionally, one evening each week, rotating Monday-thru-Thursday, will be reserved for AST-180. The schedule will be posted to BbLearn once it is ready. The student is expected to go to three different sessions throughout the semester to complete this portion of the grade, so please do not wait until late in the semester to do this, as we cannot control the weather.

Examinations: This course will consist of two non-cumulative mid-semester examinations and one cumulative final examination. Exams will consist primarily of multiple choice and matching questions, with the option, at the discretion of the professor for several short-answer questions. You will be required to bring your NAU student ID to each exam, and present the photo ID to a proctor during the exam. You will not be allowed to take the exam without a photo ID. If the photo does not 'look' like you, then please bring an additional form of photo ID as well, or make other arrangements with the professor in advance of the exam. **No make-up exams will be offered without prior approval from the professor.**

Participation: An important part of the learning process revolves around your attendance, participation, and engagement both during lecture and outside of class. Ask questions, and come to lecture prepared to learn. Engagement is difficult to assess in a course of this size and as such there are no direct points awarded for this portion. However, students that are engaged and actively participate in the course do significantly better overall. Interruptions and inappropriate behavior will not be tolerated, as it is disrespectful to other and to the academic learning environment. Your professionalism, courtesy, and engagement in the class are critical components of your success.

Grading System: The breakdown of how the final grade in the class will be calculated is given below, and any changes to the class scoring rubric will be discussed with the class prior to implementation:

Homework Assignments:	25 %
In-Class Questions/Attendance:	20 %
In-Class Lecture Tutorials	10 %
Observations at Barry Lutz Telescope	5 %
Two In-Class Exams (10% each)	20 %
Final Examination (Cumulative)	20 %

Approximate Grading Scale:

A: ≥ 90%
B: 80% – 89.9%
C: 70% – 79.9%
D: 60% – 69.9%
F: <60%

Grades will be kept up to date in BbLearn. It is the student's responsibility to frequently check their scores in BbLearn for accuracy. Any score in question must be discussed with me within two weeks of the due date. After two weeks, I will not entertain any challenges to the scores in BbLearn.

Makeup Work:

As stated above, a student must obtain permission in advance of a regularly scheduled examination in order to take a make-up examination. Make up examinations will consist of essay and short answer questions, not multiple-choice questions. All make-up examinations will be given near the end of the semester. There will be no makeup in-class questions or homework assignments. An institutional excuse is required to be excused from a clicker assignment or an online homework assignment.

Tutorial Assistance

Help will be available through office hours held by the FYLI TA and the professor.

Academic Honesty

Please read this section carefully as each student is required to understand and comply with all Academic Integrity rules and standards. Both NAU and this Department//Course have standards which are written and referenced below.

Both myself and the science//engineering profession have absolutely no patience with cheating. Anyone cheating on an exam will receive a zero on that exam, and possibly a failing grade in the course. Using someone else's clicker is dishonest. **If anyone is caught using another student's account in Top Hat, both the students may receive a zero for the entire "in class questions" portion of the grade.**

Note that no student will be allowed to exit the classroom during any of the exams, unless there is an emergency. Therefore, make sure you get a drink and visit the facilities in advance. If you feel that you might need to leave the classroom during an exam, you must get advance permission from the professor, in writing (email), before the exam. The use of cell phones at any time during an exam will be considered an act of academic dishonesty. The same holds true for smart-watches and "Google Glasses", or other enhanced vision products. You must not use or look at or touch your phone or watch (even if not a smart watch) at any time. You will be asked to place all such products securely away, out of reach and view, before the exam begins. You are not allowed to use your phone as a calculator. The same holds true for any calculator that can communicate with any other device or user. You may not bring in any paper to any exam, including "cheat sheets", and you may not take any paper out of the classroom after any exam. You are not allowed to look at the exam of another student, nor are you allowed to send or receive any information and/or signals or other forms of communication during an exam. The violation of any of these Academic codes of conduct may result in your failing the course.

In general, it is not my responsibility to attempt to describe and prohibit any and all forms of Academic Dishonesty. **It is your responsibility to uphold the highest ethical standards**. If you have any doubt or question about this policy, it is your responsibility to ask the professor in advance and to be clear about the answers and policies. Again, the text above and the attached NAU policies try to be very clear about what constitutes an act of Academic Dishonesty, but we cannot anticipate every possible form of cheating in advance. So the attachments and examples above are not meant to be comprehensive.

Academic Dishonesty information will be given to the Dean of Students and a written copy of any such incident may be attached to your official NAU file.

University and Course Policies:

Academic Integrity: NAU expects every student to firmly adhere to a strong ethical code of academic integrity in all their scholarly pursuits. The primary attributes of academic integrity are honesty, trustworthiness, fairness, and responsibility. As a student, you are expected to submit original work while giving proper credit to other people's ideas or contributions. Acting with academic integrity means completing your assignments independently while truthfully acknowledging all sources of information, or collaboration with others when appropriate. When you submit your work, you are implicitly declaring that the work is your own. Academic integrity is expected not only during formal coursework, but in all your relationships or interactions that are connected to the educational enterprise. All forms of academic deceit such as plagiarism, cheating, collusion, falsification or fabrication of results or records, permitting your work to be submitted by another, or inappropriately recycling your own work from one class to another, constitute academic misconduct that may result in serious disciplinary consequences. All students and faculty

members are responsible for reporting suspected instances of academic misconduct. All students are encouraged to complete NAU's online academic integrity workshop available in the E-Learning Center and should review the full academic integrity policy available at https://policy.nau.edu/policy/policy.aspx?num=100601.

Disruptive Behavior: Membership in NAU's academic community entails a special obligation to maintain class environments that are conductive to learning, whether instruction is taking place in the classroom, a laboratory or clinical setting, during course-related fieldwork, or online. Students have the obligation to engage in the educational process in a manner that does not breach the peace, interfere with normal class activities, or violate the rights of others. Instructors have the authority and responsibility to address disruptive behavior that interferes with student learning, which can include the involuntary withdrawal of a student from a course with a grade of "W". For additional information, see NAU's disruptive behavior policy at https://nau.edu/university-policy-library/disruptive-behavior.

Nondiscrimination and Anti-Harassment: NAU prohibits discrimination and harassment based on sex, gender, gender identity, race, color, age, national origin, religion, sexual orientation, disability, or veteran status. Due to potentially unethical consequences, certain consensual amorous or sexual relationships between faculty and students are also prohibited. The Equity and Access Office (EAO) responds to complaints regarding discrimination and harassment that fall under NAU's Safe Working and Learning Environment (SWALE) policy. EAO also assists with religious accommodations. For additional information about SWALE or to file a complaint, contact EAO located in Old Main (building 10), Room 113, PO Box 4083, Flagstaff, AZ 86011, or by phone at 928-523-3312 (TTY: 928-523-1006), fax at 928-523-9977, email at equityandaccess@nau.edu, or via the EAO website at https://nau.edu/equity-and-access.

Title IX: Title IX is the primary federal law that prohibits discrimination on the basis of sex or gender in educational programs or activities. Sex discrimination for this purpose includes sexual harassment, sexual assault or relationship violence, and stalking (including cyber-stalking). Title IX requires that universities appoint a "Title IX Coordinator" to monitor the institution's compliance with this important civil rights law. NAU's Title IX Coordinator is Pamela Heinonen, Director of the Equity and Access Office located in Old Main (building 10), Room 113, PO Box 4083, Flagstaff, AZ 86011. The Title IX Coordinator is available to meet with any student to discuss any Title IX issue or concern. You may contact the Title IX Coordinator by phone at 928-523-3312 (TTY: 928-523-1006), by fax at 928-523-9977, or by email at pamela.heinonen@nau.edu. In furtherance of its Title IX obligations, NAU will promptly investigate and equitably resolve all reports of sex or gender-based discrimination, harassment, or sexual misconduct and will eliminate any hostile environment as defined by law. Additional important information about Title IX and related student resources, including how to request immediate help or confidential support following an act of sexual violence, is available at http://nau.edu/equity-and-access/title-ix.

Accessibility: Professional disability specialists are available at Disability Resources to facilitate a range of academic support services and accommodations for students with disabilities. If you have a documented disability, you can request assistance by contacting Disability Resources at 928-523-8773 (voice), 928-523-6906 (TTY), 928-523-8747 (fax), or dr@nau.edu (e-mail). Once

eligibility has been determined, students register with Disability Resources every semester to activate their approved accommodations. Although a student may request an accommodation at any time, it is best to initiate the application process at least four weeks before a student wishes to receive an accommodation. Students may begin the accommodation process by submitting a self-identification form online at https://nau.edu/disability-resources/student-eligibility-process or by contacting Disability Resources. The Director of Disability Resources, Jamie Axelrod, serves as NAU's Americans with Disabilities Act Coordinator and Section 504 Compliance Officer. He can be reached at jamie.axelrod@nau.edu.

Course Time Commitment: Pursuant to Arizona Board of Regents guidance (Academic Credit Policy 2-224), for every unit of credit, a student should expect, on average, to do a minimum of three hours of work per week, including but not limited to class time, preparation, homework, and studying.

Sickness or Hospitalization: Northern Arizona University has an official authorized absence policy that is administered by the Office of Student Life. Institutional excuses can be issued to authorize absences. If a student is hospitalized or has been directed by a physician to remain confined to his or her place of residence because of illness, Fronske Health Center staff or private physicians may issue a statement providing the dates of the student's confinement.

Tentative Course Schedule

The following course schedule includes the daily lecture topics and approximate dates of examinations. This schedule is subject to change, and any changes will be discussed in class. In order to carry out research and present scientific results, Dr. Loeffler may be absent for a class from time to time. In the case where Dr. Loeffler is unavailable due to work related travel, a guest lecturer will cover the class topic slated for that day.

Week	Date	Topic
1	Tu, 1/14	Course Introduction
	Th, 1/18	Ch. 1: A Brief Tour
2	Tu, 1/21	Ch. 2: Observing the Sky: The Birth of Astronomy
	Th, 1/23	Ch. 3: Orbits and Gravity
3	Tu, 1/28	Ch. 3: Orbits and Gravity (cont.)
	Th, 1/30	Ch. 4: Earth, Moon and Sky
4	Tu, 2/4	Ch. 4: Earth, Moon and Sky (cont.)
	Th, 2/6	Ch. 5: Radiation and Spectra
5	Tu, 2/11	Ch. 5: Radiation and Spectra (cont.)
	Th, 2/13	Ch. 6: Astronomical Instruments
6	Tu, 2/18	Ch. 6: Astronomical Instruments (cont)
	Th, 2/20	**EXAM #1 (Ch. 1-6)**
7	Tu, 2/25	Ch. 7-10: Earth, Moon and Terrestrial Planets
	Th, 2/27	Ch. 7-10: Earth, Moon and Terrestrial Planets (cont)
8	Tu, 3/5	Ch. 11-12: The Giant Planets
	Th, 3/7	Ch. 13-14: Asteroids, Comets, and Meteors
9	Tu, 3/12	Ch. 14: Planetary Evolution
	Th, 3/14	Ch. 15-17: The Sun and Analyzing Starlight
	Tu, 3/19	SPRING BREAK – NO CLASS
	Th, 3/21	SPRING BREAK – NO CLASS
10	Tu, 3/19	Ch. 15-17: The Sun and Analyzing Starlight (cont.)
	Th, 3/21	Ch. 18-19: The Stars: A Celestial Census
11	Tu, 3/24	Ch. 18-19: Celestial Distances
	Th, 3/26	**EXAM #2 (Ch. 7-19)**
12	Tu, 3/31	Ch. 20-21: Birthplace of Stars and Exoplanets
	Th, 4/2	Ch. 20-21: Birthplace of Stars and Exoplanets (cont.)
13	Tu, 4/7	Ch. 22-24: Stellar Evolution and the Death of Stars
	Th, 4/9	Ch. 25: Our Galaxy: The Milky Way
14	Tu, 4/14	Ch. 26: Galaxies
	Th, 4/16	Ch. 26: Galaxies (cont.)
15	Tu, 4/21	Ch. 27: Active Galaxies and Quasars
	Th, 4/23	Ch. 28-29: Evolution and Distribution of Galaxies
16	Tu, 4/28	Ch. 30: Astrobiology
	Th, 4/30	Exam Review

	Wed, 5/6	**FINAL EXAM (Cumulative, 3:00 pm – 5:00 pm)**