

Introduction to Astronomy

General Information

- Department: Astronomy and Planetary Science
- Course: AST 180 (Introduction to Astronomy) – Class Number 7881
- Term: Spring 2024
- Total Units of Course Credit: 3
- Pre- and Co-Requisite(s): None
- Mode of Instruction: Face-to-Face (and Zoom if needed!)
- Meeting Time: Monday/Wednesday/Friday 9:10 – 10:00 a.m.
- Location: Biological Sciences (Bldg 21) 256
- Instructor: Dr. Mark Loeffler
- E-mail: mark.loeffler@nau.edu (the best way to get in touch with me)
- Office location: Physical Sciences, Room 311 (office) and Room 313 (laboratory)
- Office hours: Monday: 12:00 – 1:00 pm or by appointment (anytime) – **feel free to just stop by anytime**
- Phone: 928-523-0369 (office), 928-523-7569 (laboratory)

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.

Course Description (Spring, 2024)

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.

This course also satisfies the course requirement for the BS in Astronomy degree.

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;

NACE Competencies

The National Association of Colleges and Employers (NACE) is a leading source of information on employment for the college educated. They identified eight Career Readiness Competencies (CRC) that are “a foundation from which to demonstrate requisite core competencies that broadly prepare the college educated for success in the workplace and lifelong career management”. More information can be found at <https://www.nacweb.org/career-readiness/competencies/career-readiness-defined>. The following are the CRCs that apply to this course.

1. **Communication:** Clearly and effectively exchange information, ideas, facts, and perspectives with persons inside and outside of an organization.
2. **Critical Thinking:** Identify and respond to needs based upon an understanding of situational context and logical analysis of relevant information

3. **Professionalism:** Knowing work environments differ greatly, understand and demonstrate effect work habits, and act in the interest of the larger community and workplace
4. **Teamwork:** Build and maintain collaborative relationships to work effectively toward common goals, while appreciating diverse viewpoints and shared responsibilities.
5. **Technology:** Understand and leverage technologies ethically to enhance efficiencies, complete tasks, and accomplish goals.

Required Materials & Technology

1. Top Hat (see [Top Hat Access on Canvas](#))

In the navigation bar on the left side of the Canvas course, click on the link labeled “Top Hat 1.3” and follow the instructions. You should have received an invitation to join the course, but if not, the join code is 624537. Top Hat is FREE for all NAU students. You should not be asked to pay if you sign up. If you are please contact me immediately.

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

The textbook for this class is FREE. You can access it through both Top Hat and Canvas.

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: <https://openstax.org/details/books/astronomy>.

Assessment

Participation: Success in this course is strongly dependent on student participation. Furthermore, students that do well in my courses typically are the ones who attend and participate in class. So, ask questions and come to lecture prepared to learn. 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. NACE CRC: **Professionalism**

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

Lecture Tutorials: Students will complete pdfs of Astronomy Workbook tutorials that will be turned into Canvas for points. These tutorials are designed to stimulate discussion and reinforce topics covered in the lectures. Ideally, these will be done in-class in small groups, though students may work individually if preferred. There will be 10 lecture tutorials worth 10 pts each throughout the semester. **Students must turn in their own copy of the assignment. These will be due at 11:59 pm on the next class day (i.e. if I assign them in class on Monday, they will be due on Wednesday at 11:59 pm).** NACE CRCs: **Communication, Critical Thinking, (Teamwork), Professionalism, Technology**

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 Canvas regularly. NACE CRCs: **Communication, Critical Thinking, Professionalism, Technology**

Examinations: This course will consist of two non-cumulative mid-semester examinations and one cumulative final examination. Exams will consist of a mixture of multiple choice and short-answer questions. **No make-up exams will be offered without prior approval from the professor.** NACE CRCs: **Communication, Critical Thinking, Professionalism**

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:	200 pts
Lecture Tutorials (10 pts each)	100 pts
Two in-class exams (50 pts each)	100 pts
Final Examination (Cumulative)	100 pts

Approximate Grading Scale:

- A: 450 – 500 pts
- B: 400 – 449 pts
- C: 350 – 399 pts
- D: 300 – 349 pts
- F: <300 pts

Grades will be kept up to date in Canvas. It is the student's responsibility to frequently check their scores in Canvas 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 Canvas.

Makeup and Late Work:

As stated above, a student must obtain permission in advance of a regularly scheduled examination in order to take a make-up examination. An institutional excuse is required to get an extension from an online homework assignment. In addition, if unforeseen sickness occurs, please reach out to me and I will do my best to accommodate you in a reasonable manner. Points will be deducted at a rate of 10% for every day (excluding weekends) that they are late.

Extra Credit

The only opportunity available to students for extra credit is to go to the on-campus telescope facility (*Bldg 47; on San Francisco, behind Reilly Hall*), observe a celestial object and sketch an image of it. For this opportunity, take the worksheet titled “Observation Log Worksheet” in Canvas to the telescope on the evening that you want to observe and have the operator sign it. 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 Canvas once it is ready. The student can visit the observatory once for extra credit, which is worth 10 pts. If you are interested in doing this, please do not wait until late in the semester to do this, as we cannot control the weather.

Tutorial Assistance

Help will be available through office hours held by the professor and by the TA (Max Hood).

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. **If anyone is caught using another student’s account in Canvas, both the students may receive a zero for the entire portion of the grade (i.e. all lecture tutorials, homework, etc.).**

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 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>.

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.

DISRUPTIVE BEHAVIOR

Membership in NAU's academic community entails a special obligation to maintain class environments that are conducive 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 Academic Policy 100227 / Syllabus Requirements and Template Page 2 of 2 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 [7](https://nau.edu/disability-resources/student-</p></div><div data-bbox=)

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

RESPONSIBLE CONDUCT OF RESEARCH

Students who engage in research at NAU must receive appropriate Responsible Conduct of Research (RCR) training. This instruction is designed to help ensure proper awareness and application of well-established professional norms and ethical principles related to the performance of all scientific research activities. More information regarding RCR training is available at <https://nau.edu/research/compliance/research-integrity>.

SENSITIVE COURSE MATERIALS

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 their college studies, students can expect to encounter and to critically appraise materials that may differ from and perhaps challenge familiar understandings, ideas, and beliefs. Students are encouraged to discuss these matters with faculty.

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. If we do not get to all the topics, that is ok.

Week	Date	Topic
1	W, 1/17	Course Introduction
	F, 1/19	Ch. 1: A Brief Tour
2	M, 1/22	Ch. 2: Observing the Sky: The Birth of Astronomy
	W, 1/24	Ch. 3: Orbits and Gravity
	F, 1/26	Ch. 3: Orbits and Gravity (cont.)
3	M, 1/29	Ch. 3: Orbits and Gravity (cont.)
	W, 1/31	Ch. 4: Earth, Moon and Sky
4	F, 2/2	Ch. 4: Earth, Moon and Sky (cont.)
	M, 2/5	Ch. 4: Earth, Moon and Sky (cont.)
	W, 2/7	Ch. 5: Radiation and Spectra
5	F, 2/9	Ch. 5: Radiation and Spectra (cont.)
	M, 2/12	Ch. 6: Astronomical Instruments
	W, 2/14	Ch. 6: Astronomical Instruments (cont.)
6	F, 2/16	Ch. 6: Astronomical Instruments (cont.)
	M, 2/19	EXAM #1 (Ch. 1-6)
	W, 2/21	Ch. 7-10: Earth, Moon and Terrestrial Planets (class may be pre-recorded)
7	F, 2/23	Ch. 7-10: Earth, Moon and Terrestrial Planets (cont.) - (class may be pre-recorded)
	M, 2/26	Ch. 7-10: Earth, Moon and Terrestrial Planets (cont.)
	W, 2/28	Ch. 11-12: The Giant Planets
8	F, 3/1	Ch. 13-14: Asteroids, Comets, and Meteors
	M, 3/4	Ch. 13-14: Asteroids, Comets, and Meteors (cont.)
	W, 3/6	Ch. 14: Planetary Evolution
9	F, 3/8	Ch. 15-17: The Sun and Analyzing Starlight
	M, 3/11	SPRING BREAK – NO CLASS
	W, 3/13	SPRING BREAK – NO CLASS
10	F, 3/15	SPRING BREAK – NO CLASS
	M, 3/18	Ch. 15-17: The Sun and Analyzing Starlight (cont.)
	W, 3/20	Ch. 18-19: The Stars: A Celestial Census
11	F, 3/22	Ch. 18-19: Celestial Distances
	M, 3/25	Ch. 18-19: Celestial Distances (cont.)
	W, 3/27	EXAM #2 (Ch. 7-19)
12	F, 3/29	Ch. 20-21: Birthplace of Stars and Exoplanets
	M, 4/1	Ch. 20-21: Birthplace of Stars and Exoplanets (cont.)
13	W, 4/3	Ch. 20-21: Birthplace of Stars and Exoplanets (cont.)

	F, 4/5	Ch. 22-24: Stellar Evolution and the Death of Stars
12	M, 4/8	Ch. 22-24: Stellar Evolution and the Death of Stars (cont.)
	W, 4/10	Ch. 25: Our Galaxy: The Milky Way
	F, 4/12	Ch. 25: Our Galaxy: The Milky Way
13	M, 4/15	Ch. 26: Galaxies
	W, 4/17	Ch. 26: Galaxies (cont.)
	F, 4/19	Ch. 26: Galaxies (cont.)
14	M, 4/22	Ch. 27: Active Galaxies and Quasars
	W, 4/24	Ch. 27: Active Galaxies and Quasars (cont.)
	F, 4/26	Ch. 28, Evolution
15	M, 4/29	Ch. 29, Distribution of Galaxies
	W, 5/1	Ch. 30, Astrobiology
	F, 5/3	Final Exam Review
16	Wed, 5/8	FINAL EXAM (Cumulative, 7:30 am – 9:30 am)