NAU NORTHERN ARIZONA UNIVERSITY
College of the Environment,
Forestry, and Natural Sciences

FYLI

Department of Astronomy and Planetary Science
AST 180: Introduction to Astronomy
Spring 2021

Meeting Times
- **Asynchronous Learning:** Online Blackboard Learn Course Page
- **Synchronous Classes:** TTh 4:00—5:15 pm through Zoom
  Your NAU Sign-in to Zoom is required:
  1) click on "Sign In with SSO" when you open your Zoom, and then type "nau".zoom.us, or
  2) go to https://nau.zoom.us and click "Sign in" before you click the Zoom link below.

  Zoom Link: https://nau.zoom.us/j/86501650740?pwd=RkFKMnArU01PUkw5a2x3S2p0anlTdz09
  Meeting ID: 865 0165 0740 Password: grogu (926254 if you're using a phone)

Credit/ Pre- or co-requisites
3 credit hours, no pre- or co-requisites

Mode of Instruction
This course is **fully remote the whole semester**, with content for Asynchronous Learning (required) and Synchronous Classes (highly encouraged) of lectures and Q&A. This course is designed to be transparent, inclusive, and accessible to all students.
- **Asynchronous Learning** content includes: 1) Recorded lecture videos (of each Synchronous Classes), mixed with Youtube videos and interactive software, 2) Lecture Questions for each lecture, 3) Homework, 4) Activities including tutorials on BBLearn and some simple outdoor observations, and 5) Online Midterm and Final Exams.
- **Synchronous Classes** on Zoom will be lectures, followed by Q&A. You can earn **1 extra point** for every class you attend! **Note that attendance for Synchronous Classes is NOT REQUIRED!** If you cannot attend for any reasons, it's ok and I totally understand! Please just watch the recorded lecture videos after the class, and send me any questions you have.

Instructor Contact & Availability
Dr. Lisa Chien
Email: **Lisa.Chien@nau.edu**
Office Hours: Please join in to Synchronous Classes to ask me questions (and earn 1 extra point), or email me anytime. I will get back to you as soon as I can, definitely within 24 hrs.

Teaching Assistants:
Neave Flint (nmf87@nau.edu), Gabrielle Jones (ggj8@nau.edu)

Course Purpose & Student Learning Outcome
"Introduction to Astronomy" presents the astronomical phenomena of the universe—i.e., the night sky, planets, stars, galaxies, cosmology—in the context of physical science. Core topics include the scale of the universe, technological tools of astronomy, the Copernican revolution, gravitation and the motion of the planets, electromagnetic radiation and spectra, contents of the solar system, 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.

This liberal studies course meets a 3-hour Science and Applied Science requirement if taken by itself; and meets the Lab-science requirement if the separate lab, AST 181, is also taken. This course will address several of the

liberal studies essential skills, focusing on the logic of scientific inquiry.

The overarching goals of this course are for you to:
1. understand the nature of science through the eyes of astronomy
2. understand the big ideas in astronomy
3. develop a lifelong interest in astronomy and current events surrounding astronomy.

Required Materials & Technology

1. Stable internet connection in order to connect to Synchronous Classes on Zoom, or watch recorded lecture videos, participate online assignments, and finish online exams.

2. OpenStax: Astronomy

Good news: your textbook for this class is **FREE** available for online, in web view, PDF format, or iBook and Kindle:www.openstax.org/details/astronomy. If you prefer to purchase a print version, get the official OpenStax print version. (Simple printouts sold by third parties on Amazon are not verifiable and not as high-quality.)
Astronomy from OpenStax, Print ISBN 1938168283, Digital ISBN 1947172247

3. ClassAction

ClassAction is an interactive astronomy software, developed by University of Nebraska Lincoln, for college learners. It is essential to your understanding and required to answer questions and do activities on BBLearn. Please go to this page to download and install it on your computer (super easy too!). You can also watch the videos to see details of installation (on both Windows and Mac). Please contact Dr. Chien (Lisa.Chien@nau.edu) ASAP if you cannot install the software for any reasons.

Grading System & Late Policy

Assessment	Points
Lecture Questions	255
Homework	325
Activity	300
Midterm Exam	60
Final Exam	60

Grade	Score
A	895 — 1000
B	795 — 894
C	695 — 794
D	595 — 694
F	0 — 594

Connection Issues and Late Submission Policy for all Assignments:
If you encounter any difficulties accessing any assignments on BBLearn, first keep trying with different internet connections, browsers, or devices. If problems still exist and it is getting close to 6 hours before the due date, *i.e.*, 6:00pm on Fridays and Mondays, please email me as soon as you can and I can give you an extension for **another 24 hours**. **Please, you have to let me know that you're having difficulties, otherwise late submissions for**

- **Lecture Questions: 2 points off**
- **Homework: 2 points off**
- **Activity: 5 points off**
- **Exams: count as 0 points**

Assignments & Assessments

1. Lecture Questions

After each lecture, whether you join the Zoom Synchronous Classes or watch the recorded video after the class, answer these Lecture Questions on BBLearn. These Questions are what I usually asked in the in-person classes. They are administered as a "Test/Quiz" format on BBLearn, however you can have unlimited attempts, and only the highest grade is counted BEFORE the due date. **Each lecture has different amount of Questions associated to it (and thus different points). There are 15 assignments, and the total is 255 points**. No Lecture Question points are dropped, and they are due every Friday.

You can choose to do any **Extra Credit Opportunities** (posted on the top of menu bar in BBLearn) to make up the points you missed. There are no limits to how many extra credit points you can earn!

2. Homework

Each Chapter Homework is posted on BBLearn. They are due every Friday. Please see the latest Schedule on BBLearn for their dues. Each homework is 25 points. There are 15 assignments, and the total is 325 points, with two lowest dropped. They are due every Sunday.

3. Activity

Throughout the semester there are **fourteen** activities (almost every week) that are in various formats. Most are tutorial style activities that you can finish on BBLearn. Some are related to observing the sky or current astronomy events. They are simple but can be TIME SENSITIVE, so please make sure you know the dates and time, and that you are available during those times. Each Activity is 25 points. There are 14 assignments, and the total is 300 points, with two lowest dropped. They are due every Monday.

To help you get used to sky viewing, here are some free (lite version), helpful and highly recommended apps/ software (NOT required for the class). All these apps/software allow you to point your device to the sky, and displays and identifies objects right on your device!

SkyView— I recommend this one among the two below, since it overlays on what you see through your camera, and you can take a quick picture with labels on the sky!

Night Sky— This app has incredible visualization, and when you pinch or tap on the constellations or any objects, it takes you to a 3D view of the stars in space and shows you more than enough of information you want to know about the object.

Star Chart— It's simple and easy to use (without information overload), and when you tap on objects, it give you nice simple astronomical data about them.

stellarium.org— Stellarium is a free open source planetarium for your computer (which also has a web form: stellarium-web.org/ and a non-free app called Stellarium Mobile PLUS Sky Map). It shows a realistic sky in 3D, just like what you see with the naked eye, binoculars or a telescope.

4. BBLearn Exams

Midterm Exam: due Monday, March 8, 11:59pm | Ch1 to 12, total 60 points
Final Exam: due Monday, April 27, 11:59pm | Unit 13 to 29, total 60 points

The exams are all on BBLearn with multiple choice questions, fill-in-the-blanks, matching, and some short-answer questions. **Both exam will be open for four days, and will be closed at the due date listed above.** Again if you encounter any technical difficulties during your exams, please contact Dr. Chien at Lisa.Chien@nau.edu immediately.

You can choose to do any **Extra Credit Opportunities** (posted on the top of menu bar in BBLearn) to make up the points you missed. There are no limits to how many extra credit points you can earn!

Below is a summary of the Assignments and Assessments:

Category	Due (see latest schedule on BBLearn)	# of Assignments	Points	Includes:
Lecture Question	Every Friday	15, various points	255	NONE Dropped
Homework	Every Sunday	15, 25 points each	325	2 Lowest Dropped
Activity	Every Monday	14, 25 points each	300	2 Lowest Dropped
Midterm Exam	Due Monday 3/8	1	60	Ch 1 to 12 Materials
Final Exam	Due Wednesday 4/28	1	60	Ch 13 to 29 Materials

Respect for Diversity

It is my intent that students from all diverse backgrounds and perspectives be well served by this course, that students' learning needs be addressed both in and out of class, and that the diversity that students bring to this class be viewed as a resource, strength and benefit. It is my intent to present materials and activities that are respectful of diversity: gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture. Your suggestions are encouraged and appreciated. Please let me know ways to improve the effectiveness of the course for you personally or for other students or student groups. In addition, if any of our class meetings conflict with your religious events, please let me know so that we can make arrangements for you. I am NAU Safe Zone certified.

Class Tentative Schedule (Please see BBLearn page for most updated version)

Week	Date	Day	Topic			Lecture Questions Due	Homework Due	Activity Due
			Chapter	Lecture	Reading			
1	1/12	T	Ch1	1.1 What do we see?	Ch1.1-1.3			
	1/14	Th		1.2 Where are we?	Ch1.4, Ch1.6-1.9			
	1/15	F				Ch1		
	1/17	Sun					Ch1	
2	1/18	M						-
	1/19	T	Ch2	2.1 The Celestial Sphere 2.2 Day to Day Changes	Ch2.1, Ch4.1			
	1/21	Th		2.2 Day to Day Changes 2.3 Birth of Modern Astronomy	Ch2.2, Ch2.4			
	1/22	F				Ch2		
	1/24	Sun					Ch2	
3	1/25	M						**#1: Globe At Night** #2: Position & Motion of Stars
	1/26	T	Ch4	4.1 Keeping Time, Seasons 4.2 Moon Phases	Ch4.2-4.3			
	1/28	Th		4.2 Moon Phases 4.3 Tides 4.4 Eclipses	Ch4.3, Ch4.5-4.7			
	1/29	F				Ch4		
	1/31	Sun					Ch4	
4	2/1	M						#3: Retrograde Motion & Seasons
	2/2	T	Ch3	3.1 Kepler's Laws	Ch3.1			
	2/4	Th		3.2 Satellite Orbits 3.3 Gravity	Ch3.4-3.5			
	2/5	F				Ch3		
	2/7	Sun					Ch3	
5	2/8	M						#4: Moon Phases
	2/9	T	Ch5	5.1 Light & EM Spectrum 5.2 Thermal Radiation Laws	Ch5.1, Ch5.2			
	2/11	Th		5.3 Spectrum & Atomic Structure 5.4 Doppler Effect	Ch5.3-5.6			
	2/12	F				Ch5		
	2/14	Sun					Ch5	

Week	Date	Day	Topic			Lecture Questions Due	Homework Due	Activity Due
			Chapter	Lecture	Reading			
6	2/15	M						#5: Kepler 2nd & 3rd Laws
	2/16	T	Ch6	6.1 Telescopes 6.2 Detectors & Resolution	Ch6.1-6.2			
	2/18	Th		6.3 Radio, Space & Large Telescopes	Ch6.3-6.6			
	2/19	F				Ch6		
	2/21	Sun					Ch6	
7	2/22	M						#6: EM Spectrum & Blackbody Radiation
	2/23	T	Ch7	7.1 Intro to Solar System	Ch7.1-7.2			
	2/25	Th	Ch8-10	8-10.1 Terrestrial Planets 8-10.2	Ch8.2-8.3, 8.5 Ch9.2-9.4, Ch10.2-10.5			
	2/26	F				Ch7 & 8-10		
	2/28	Sun					Ch7 & 8-10	
8	3/1	M						#7: Temperature & Formation of Our Solar System
	3/2	T	Ch11-12	11-12.1 The Giant Planets 11-12.2	Ch11.2-11.3, Ch12.1-12.2, 12.5			
	3/4	Th	Ch13-14	13-14.1 Outer Solar System	Ch13.2-13.4, Ch14.1-14.2			
	3/5	F				Ch11-12		
	3/7	Sun					Ch11-12	
9	3/8	M	**FIRST MIDERM DUE: Ch1-12**					
	3/9	T	Ch13-14	13-14.2 Formation of Solar System	Ch14.3-14.4			
	3/11	Th	Ch17	17.1 Stellar Luminosity & Brightness	Ch17.1			
	3/12	F				Ch13-14		
	3/14	Sun					Ch13-14	
10	3/15	M						#8: Design a Space Mission Patch
	3/16	T		17.2 Stellar Temperature & Size	Ch17.2-17.3 Ch18.3			
	3/18	Th	Ch18-19	18-19.1 Stellar Mass	Ch18.2			
	3/19	F				Ch17		
	3/22	Sun					Ch17	
11	3/22	M						#9: Equinox Youtube Live with Lowell Observatory
	3/23	T		18-19.2 Stellar Distances & Motion	Ch17.4 Ch19.2-19.2			
	3/25	Th		18-19.3 H-R Diagram	Ch18.1, 18.4 Ch19.4			
	3/26	F				Ch18-19		
	3/28	Sun					Ch18-19	
12	3/29	M						#10: Luminosity, Temperature, and Size
	3/30	T	Ch21	21.1 Birth of Stars 21.2 Exoplanets	Ch21.1-21.2, 21.4-21.6			
	4/1	Th	Ch22-23	22-23.1 From Main Sequence to Red Giants 22-23.2 Evolution of More Massive Stars	Ch22.1, 22.4 Ch23.1, 23.5			
	4/2	F				Ch21		
	4/4	Sun					Ch21	
13	4/5	M						#11: Parallax and Distance & H-R Diagram
	4/6	T	Ch23-24	22-23.3 Death of High-Mass Stars 24.1 Black Holes	Ch22.5 Ch23.3-23.4 Ch24.5-24.7			
	4/8	Th	Ch25	25.1 Milky Way Structure & Stellar Populations 25.2 Milky Way Spiral Structure & Formation	Ch25.1-25.2, 25.5 Ch19.3			
	4/9	F				Ch22-23 & 24		
	4/11	Sun					Ch22-23 & 24	
14	4/12	M						#12: Stellar Evolution
	4/13	T		25.2 Milky Way Spiral Structure & Formation 25.3 Milky Way Mass & Dark Matter	Ch25.3, 25.6			
	4/15	Th	Ch26	26.1 Galaxies	Ch26.2-26.3			
	4/16	F				Ch25		
	4/18	Sun					Ch25	
15	4/19	M						#13: Galaxy Classification
	4/20	T	Ch28	28.1 Distribution of Galaxies 28.2 Formation & Evolution of Galaxies	Ch28.2-28.3, 28.5			

	4/22	Th	Ch29	29.1 Age of the Universe 29.2 Model of the Universe	Ch29.1-29.4			
	4/23	F				Ch26 & 28-29		*#14: Lyrids Meteor Shower (DUE Friday)
	4/25	Sun					Ch26 & 28-29	
16	4/28	W	**FINAL EXAM DUE: Ch13-29**					

Academic Deadlines

- ADD/DROP deadline (without "W"): Jan 20
- Last day to file for A-Pass/Fail: Feb 12
- Last day to withdraw: Mar 14

Academic Integrity Policy

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 have standards which are written and referenced below.

- Passing other's work off as your own (plagiarism) and cheating are not accepted at NAU and are absolutely not tolerated in this class. It is not the professor's 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.
- If you are caught cheating or if any of your **assignments/exams are found suspiciously similar** (such as exact same wording on written responses— note, changing a few words or the order of certain words is still plagiarism!), **ALL** students involved will receive zero points on that assignment or exam. The bottom line: ***Do your own work and do not let others copy off of you.***
- 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. If cheating/plagiarism continue, you will receive F in the class and the Dean's office will be notified. University Academic Integrity Policy can be found here.

University Policies can be found at nau.edu/university-policies/.

COVID-19 REQUIREMENTS AND INFORMATION

The following statements in red set forth in this document's first section are specific to NAU's response to the COVID-19 situation. The requirements outlined below are mandatory until further notice. They are based upon current public health conditions and guidance and may change as circumstances warrant or new information becomes available. Additional information about the University's response to COVID-19 is available from the **Jacks are Back!** web page located at https://nau.edu/jacks-are-back/lumberjack-responsibilities.

FACE COVERING AND PHYSICAL DISTANCING REQUIREMENTS

Appropriate face masks or other suitable face coverings must be worn by all individuals when present in classrooms, laboratories, studios, and other dedicated educational spaces. To maximize the benefits of physical distancing as an important strategy to help reduce community transmission of the SARS-CoV-2 virus, instructors may implement mandatory student seating arrangements or specific seat assignments. Instructors may remove students who do not cooperate with these requirements from the instructional space in the absence of an approved accommodation arranged through Disability Resources. Failing to comply with these requirements may constitute a violation of the university's *Disruptive Behavior in an Instructional Setting* policy available at https://nau.edu/university-policy-library/disruptive-behavior.

USE NAUFLEX TO HELP MAINTAIN PHYSICAL DISTANCING

NAUFlex (available at https://nau.edu/nauflex/student) is designed to help all students actively participate in their coursework during the required day and time of a course when they are not physically present in the classroom. This course design model allows students to be fully engaged with faculty and peers and receive the high-quality educational experience for which NAU is known.

CLASS SESSION RECORDINGS FOR STUDENTS AND FACULTY USE ONLY

Certain class sessions may be audio or video recorded to help reinforce live instruction during the COVID-19 pandemic. These recordings are for the sole use of the instructor and students enrolled in the course. Recordings will be stored in approved, accessible repositories. By enrolling, students agree to have their image and classroom statements recorded for this purpose, to respect the privacy of their fellow students, and university-owned intellectual property (including, but not limited to, all course materials) by not sharing recordings from their courses. Questions regarding restrictions on the use of classroom audio or video recordings may be addressed to the appropriate academic unit administrator.

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 (ABOR Policy 2-224, *Academic Credit*), each unit of credit requires a minimum of 45 hours of work by students, including but not limited to, class time, preparation, homework, and studying. For example, for a 3-credit course a student should expect to work at least 8.5 hours each week in a 16-week session and a minimum of 33 hours per week for a 3-credit course in a 4-week session.

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 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 in an Instructional Setting* 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 as set forth in the *Consensual Romantic and Sexual Relationships* policy. The Equity and Access Office (EAO) responds to complaints regarding discrimination and harassment that fall under NAU's *Nondiscrimination and Anti-Harassment* policy. EAO also assists with religious accommodations. For additional information about nondiscrimination or anti-harassment 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 visit 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 Elyce C. Morris. 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 928-523-3515, by fax at 928-523-0640, or by email at elyce.morris@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 https://in.nau.edu/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.

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.

MISCONDUCT IN RESEARCH
As noted, NAU expects every student to firmly adhere to a strong code of academic integrity in all their scholarly pursuits. This includes avoiding fabrication, falsification, or plagiarism when conducting research or reporting research results. Engaging in research misconduct may result in serious disciplinary consequences. Students must also report any suspected or actual instances of research misconduct of which they become aware. Allegations of research misconduct should be reported to your instructor or the University's Research Integrity Officer, Dr. David Faguy, who can be reached at david.faguy@nau.edu or 928-523-6117. More information about misconduct in research is available at https://nau.edu/university-policy-library/misconduct-in-research.

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.

*"**Education** is the most powerful weapon which we can use to change the world."*
— Nelson Mandela