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 2020

Meeting Times & Location
Section 1 — MWF 12:40 to 1:30 pm, Physical Sciences Building Rm 103

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

Mode of Instruction
Face-to-face. Some of class time will be spent on lecture and demonstrations; Most of the time will be spent on interactive group activities and tutorials. There will also be observational projects throughout the course. You should constantly check your grades on BBLearn.

Instructor Contact & Availability (Contacts & Hours on BBLearn)
Dr. Lisa Chien
Email: **Lisa.Chien@nau.edu**
Phone: 928-523-0422
Office: Bldg. 19, Rm. 311
Office Hours: **Mon 2-3 pm, Tue and Thur 11 am-12 pm**
Please email me your name and class (AST180). I much prefer email communications when it is outside of office hours, whether you like to schedule a different time to meet or for course questions. I will get back to you within 24 hrs.

Teaching Assistant (Contacts & Hours on BBLearn)
Tabatha Trigler (tet48@nau.edu)
Office hour & location: **Mon 11 am-12 pm, rm 202**

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. Top Hat (Top Hat Access on BBLearn)

Click on the link on BBLearn, or go to our course website https://app.tophat.com/e/906710 on your laptop, or download the app on your device. The code to join is **906710**. 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 $30 for this semester (or pay $48 for one year).

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.

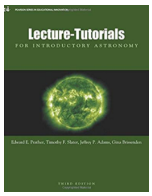
OpenStax: Astronomy e-text (Syllabus & Info on BBLearn)

Good news: your textbook for this class is **FREE** available for online, in web view and PDF format! 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, or download from here: 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

2. Lecture-Tutorials for Introductory Astronomy, 3rd ed. (Syllabus & Info on BBLearn)



This book provides a collection of 44 collaborative learning, inquiry-based activities to be used with introductory astronomy courses. Based on education research, these activities are "classroom ready" and lead to deeper, more complete understanding through a series of structured questions that prompt you to use reasoning and identify and correct their misconceptions. You can buy it on Amazon for $42.50 or NAU bookstore for $52.25.

Grading System

Assessment	Percentage
Attendance & Participation	15%
Tutorial Worksheets	20%
Midterm Exam	20%
Final Exam	20%
Project	20%
Online Homework	5%

Grade	Score
A	89.5 – 100
B	79.5 – 89.5
C	69.5 – 79.5
D	59.5 – 69.5
F	0 – 59.5

Assignments & Assessments

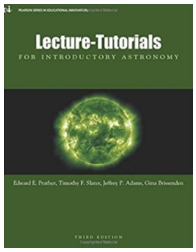
1. Attendance & Participation (through Top Hat)

We will use Top Hat as **attendance**, 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. Each attendance is 1 point. We will also have **discussion questions** using Top Hat throughout the class with various points assigned. Your Attendance & Participate score is calculated using the **TOTAL of all Top Hat points**, and is updated regularly on BBLearn.

MALFUNCTION/MAKE-UP POLICY:

• If you have malfunction or need assistance anytime in class, please write your name and answers on a piece of paper and hand it in at the end of class. However, I do take **1 POINT OFF** to be fair.
• If you have any documented reasons, I will exempt your points from that class.
• You can also attend any extra credit opportunities (see more detail below) to make up the points you missed in this category.

2. Tutorial Worksheets



We will do lots of collaborative classroom activities, called Lecture Tutorials, which target specific ideas presented in lecture. These are designed to be completed in pairs during class by talking through the questions and writing a detailed consensus response. You will submit the activities done in class for grading when you finish. These worksheets will be graded based on proficiency and the rubric is posted on BBLearn. I will use the **HIGHEST 10** worksheets as your score.

LATE POLICY:

• Every student is allowed with **TWO late submissions WITHIN A WEEK** in the semester. Once the solutions are posted on BBLearn in a week, you CANNOT submit your worksheets for grades.
• If you have any documented reasons, you can be exempted for that worksheet.

3. Exams

Midterm Exam: Mar 13
Final Exam: May 4, Monday, 12:30 - 2:30pm

ABSENCE POLICY:

If you have any documented reasons, please contact me as soon as you can to arrange alternative exams.

4. Projects

Throughout the semester there are **FIVE** projects (almost every month) mostly related to observing the sky or the celestial objects. They are simple but TIME SENSITIVE, so please make sure you know the dates and time, and that you are available during those times. No projects will be dropped.

LATE/MAKE-UP POLICY:

• All the submissions are on BBLearn, and each project is worth 30 points. If you are marked late, you will get **5 POINTS OFF. If it is due to technical difficulties, please provide proof and you will not get penalized.**
• If you missed any projects, please contact me as soon as you can, and you can make up ONE project with the last research project (Project #6, only by request) due the end of the semester.
• If you have any documented reasons, please contact me to discuss extension of due.

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.

5. Online Homework Review Questions (through Top Hat)

Questions for each chapter will be open throughout the semester, and usually are due ONE WEEK AFTER we finish the lecture. So please pay careful attention to the dues on Top Hat. No homework will be dropped.

LATE/MAKE-UP POLICY:

If you have any documented reasons, please contact me to discuss extension of due.

Extra Credit Opportunities towards your Class Participation!

There are many opportunities outside of the classroom to participate in local night viewing events and learn more about our sky and relate to our course materials. There are no limits of how many times you go to these events or places. Besides what are listed below, new timely opportunities may be announced in class and posted on BBLearn.

☆ **NAU Campus Observatory Public Nights (free)**

As described earlier, you MUST visit the Campus Observatory ONCE for this class. Then any **ADDITIONAL** visits will count **5 points** every visit.

If you attend any of the events or sites below, you can earn 10 points for each event towards your Class Participation! Please write a brief summary address the following: What did you attend and where did you go? What is the event about? Can you relate the event back to anything we've covered in class? If not, tell me something new that you learned and would be interesting to cover in the future classes. If you observed, what objects did you see and what did you learn about them? Was it an object that we talked about in class? Is there anything you can tell about it from your naked eye observations? Color? Brightness?

☆ **Flagstaff STEM Night 2020 (March 9, 5-7pm, free)**

STEM CITY
FLAGSTAFF, ARIZONA

Flagstaff STEM City organization recognizes, celebrates and expands the tremendous human and capital assets in Science, Technology, Engineering and Math (STEM) that exist in Flagstaff. This event will be held at **NAU Sky Dome**.

Astronomy on Tap Flagstaff Events (Every 1st Thur each month, 6:30-8pm, free, age 21+ only)

Astronomy on Tap Flagstaff is free night of engaging science presentations from local astronomers, interactive trivia, and prizes! Topics range from telescopes to black holes and galaxies. These events take place at the **Southside Tavern** in downtown Flagstaff. There are also **Science on Tap** events, not necessarily astronomical, held at the Green Room on every 3rd Thur each month from 6:30-8pm that you can attend.

I ❤ Pluto Festival (Feb 15& 18, $20+)

This year is the 90th anniversary of the discovery of Pluto, right here at the Lowell Observatory in Flagstaff, by Clyde Tombaugh on Feb 18, 1930. To celebrate the anniversary, Lowell Observatory and the city will hold events on these two days. Check out the website for more information: iheartpluto.org.

Lowell Observatory Evening Programs ($14 or $20; see me or Dept. Office for coupons!)

Lowell Observatory at Mars Hill, Flagstaff offers a variety of events and night sky viewing programs **from 10am-10pm, Monday to Saturday, and 10am-5pm on Sunday.** There is a regular Meet An Astronomer event every Sat. night. You can find coupons from me, the Dept. Office, or in local newspapers, advertisements, websites). Visit: lowell.edu.

Meteor Crater ($22)

The world's best preserved meteorite impact site on Earth, located near Winslow about one hour drive from Flagstaff. Meteor Crater is the spectacular result of a collision that rocked the American Southwest approximately 50,000 years ago with the energy of more than 20 million tons of TNT. Visit: meteorcrater.com.

Coconino Astronomical Society Events (free)

Every month there is a Saturday evening free talk, from 6:45-8pm by the Coconino Astronomical Society held at Lowell Observatory. Check out their calendar for events: www.coconinoastro.org/calendar.htm.

International Dark Sky Locations

Since the day you arrived in Flagstaff, you've probably heard that Flagstaff is the world's first International Dark Sky City, recognized by the International Dark Sky Association in 2001. There are more cities, locations, national parks etc that have been recognized, and many are located near us. Visit these locations and learn about them: www.flagstaffdarkskies.org and darksky.org.

Any other Observatories, Science Museums, or Astronomy-related Facilities/Locations

There are a few public/private observatories in AZ as well as research facilities that are not mentioned above, such as USGS (US Geological Survey) near Buffalo Park, NOAO (National Optical Astronomy Observatory) down at Tucson, Kitt Peak Observatories near Tucson etc. If you get a chance during holidays or breaks, visit observatories or science museums! (Note: visiting Dark Sky Brewing Company, or Roswell UFO museum in NM, do not count, sorry…)

Class Tentative Schedule

Week	Dates	Text	Topics	Project	Important Dates
1	1/13-1/17	Ch 1-2, 4	Observing the Sky	**Project 1**: all semester	**1/20— No Class**
2	1/20-1/24			**Project 2: 1/16-1/25**	
3	1/27-1/31				**1/31— Project 2 DUE**
4	2/3-2/7	Ch 3, 5-6	Fundamental Science and Instruments	**Project 3: 2/1-2/29**	
5	2/10-2/14				
6	2/17-2/21				
7	2/24-2/28	Ch 7-14	Solar System & Planetary Evolution		**3/2— Project 3 DUE**
8	3/2-3/6				
9	3/9-3/13	Ch 17-19	Measuring the Stars		**3/13— Midterm Exam: Ch1-14**
10	3/16-3/20		**SPRING BREAK**	**Project 4: 3/19, 3/20**	
11	3/23-3/27				
12	3/30-4/3	Ch21-24	Stellar Evolution	**Project 5: 4/1-4/30**	**3/30— Project 4 DUE**
13	4/6-4/10				
14	4/13-4/17	Ch25-27	Galaxies and Beyond	-	**5/1— Project 1 AND Project 5 DUE**
15	4/20-4/24				
16	4/27-5/1				
17	5/4-5/8	-	-	-	**5/4— FINAL EXAM 12:30 - 2:30 pm**

Academic Deadlines

- ADD/DROP deadline: Jan 23
- WITHDRAWAL deadline (without petition and fee): Mar 23

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.

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

University Policies can be found at nau.edu/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 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.

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.