OBSERVATIONAL METHODS IN ASTRONOMY

Tuesday & Thursday | PMA (RLM) 15.202B | 12:30p-2:00p

What will I get out of this class?

By participating in this class, ***you will develop*** a passion and appreciation for the process of observational astronomy, ***you will learn*** how to plan and conduct observing runs, and ***you will experience*** what it is like to be a professional astronomer. This will rely on some pre-existing astronomy contextual knowledge and programming knowledge from the *prerequisite AST376R*, including basic computing knowledge, and moderate knowledge of Python. It is highly recommended that students have at least one other astronomy course (AST307, AST352K, AST353, AST358, or AST364), as we will assume that students have a passing knowledge of several astrophysical phenomena.

Course Learning Objectives:

This course has five primary goals, each with one or more learning objectives. You can find these in full in the document "Course Goals and Learning Objectives" on Canvas, but we summarize them here:

Instructors

Prof. Adam Kraus
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Office hour: Fri 1-2

Prof. Steven Finkelstein
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Office Hours:
T 11a-12p (or by appt)

Teaching Assistant

Jackie Champagne
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PMA (RLM) 16.310
Office Hours: W 1-3 (in lab)

Course Goal 1: Intuition for the night sky in an observing context.

You will learn how to estimate the locations and assess the observability of objects in the night sky.

Course Goal 2: Ability to creatively identify a science question, and develop and execute observations to test the hypothesis.

You will learn how to go from science question, to observing plan, through execution of an observing run.

Course Goal 3: Ability to translate raw telescope data into measurements, and interpret those measurements.

You will learn how to use Python to reduce and analyze telescope imaging and spectroscopic data, and make publication-level plots for your project reports.

Course Goal 4: Ability to communicate science results and interpretation, and ability to persuasively write telescope proposals.

You will learn how to summarize your results through both written reports and oral presentations, as well as write persuasive telescope proposals.

Course Goal 5: Ability to critically examine the writing of others.

You will learn to comparatively evaluate persuasive arguments, in the context of judging the merits of peers' observing proposals and research summaries.

Image credit: https://www.flickr.com/photos/35188692@N00/2282306375

Required Materials:

There is no textbook for this course. You will need access to the astronomy computer lab (PMA 15.202B) and a machine login You may optionally complete programming and writing work on a personal machine, provided you are able to install the required software (its all free!).

Course Website:

Canvas page for this course:

https://utexas.instructure.com/courses/1268373

GitHub course page:

https://github.com/UTAustin_AST376_Spring2020/

Where can I find... ?

Canvas will have the following:

1. Lecture slides
2. Weekly assignments
3. Project Descriptions
4. List of Learning Objectives
5. Data or other files needed for class
6. Gradebook
7. Important Announcements

What is expected of me in this class?

- Attend class and participate! Work collaboratively and be prepared to share your ideas.
- Complete all assigned homework on time, including small assignments and reading. Make sure to take the time to think deeply about the reading!
- Don't procrastinate on the projects! Each one will take place over multiple weeks, and will require lots of planning and time for analysis.
- Take advantage of us! We are here to help you!

What happens in lecture?

- Not much lecturing! We have designed this class from the ground up to be very interactive, focusing on your attainment of the course learning outcomes.
- There will broadly be three different types of class periods:
  - Content: During these classes, we will discuss new concepts, using questions designed to learn what you know, and have you explore what other knowledge is needed for a particular concept. This will frequently include using small breakouts with the computer to expand your knowledge on the concept.
  - Science discussion: During these classes, we will discuss papers you have read before class on a science topic related to the current observing project. Make sure you come prepared and ready to engage!
  - Work time: During these classes you will work on your projects, taking advantage of your classmates and instructors to work on any problem areas you are having.

What is the grading scale?*

93.0 - 100 A
90.0 - 92.99 A-

87.0 - 89.99 B+
83.0 - 86.99 B
80.0 - 82.99 B-
77.0 - 79.99 C+
73.0 - 76.99 C
70.0 - 72.99 C-

67.0 - 69.99 D+
63.0 - 66.99 D
60.0 - 62.99 D-

< 59.9 F
*no rounding

How is my performance in this class assessed?

Your final course grade will be determined as follows:

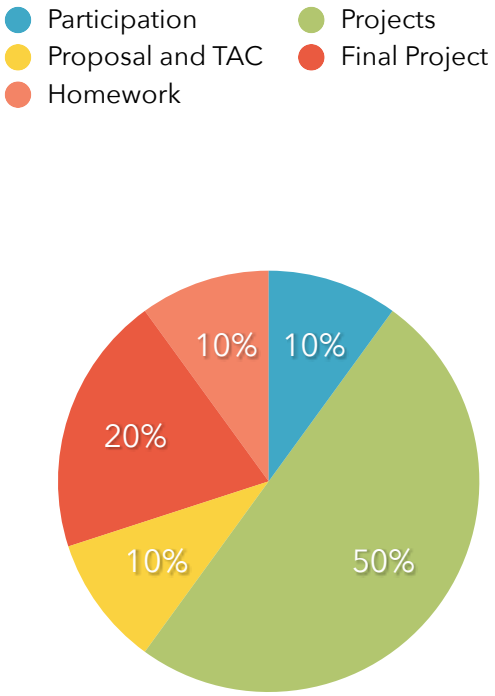
50% - Combined score of four projects

10%- Homework

10%- In-class participation

10% - McDonald 2.7m Proposal and Time Allocation Committee

20% - 2.7m Final Project



Projects: The bulk of your grade will be set by four major observing projects that you'll complete this semester. Each project will last 2-3 weeks and will involve advance planning of the observations, operating one or more telescopes to observe the chosen target and obtain the necessary data, analysis of the data, and description of the observations, results, and conclusions in a written report.

The written reports will be progressive, with early reports consisting of just the description of observations and analysis, advancing to full reports (including all sections found in a typical journal paper) by the end of the course. We will provide grading rubrics for each project in advance. The projects are:

0) CCD Characterization and Calibration
1) Multi-Color Photometry, Galaxies, and Star Cluster Color-Magnitude Diagrams
2) Time-Series Photometry and Transiting Planetary Systems
3) Narrowband Imaging and H2 Regions in Nearby Galaxies

Participation: It is expected that students will attend class regularly and be engaged. This will be assessed by the instructors. Student participation in remote observing will also be a component of this grade. The instructors will communicate to you if you are not meeting expectations.

2.7m Proposals and Time Allocation Committee: The midterm exam will be composed of an observing proposal. Students will conceive of an idea for observations with the 2.7m Harlan J. Smith Telescope, including coming up with a detailed observing plan. They will then write (in LaTeX) a full McDonald Observatory proposal on this project.

Final Project : After the midterms have been turned in, we will split the class into two or more TAC panels, and have students evaluate each others proposals. This will emulate real-world TACs, including having a graduate student as a chair for each panel, to best give students real-world experience. After the TACs meet, the instructors will work with the panel chairs to select 2-4 of the top-ranked programs. The successful proposers will execute the highest-ranked programs during 2.7m observing time we have been allocated in May; the rest of the class will also participate via the remote observing room in the Astronomy department. The final exam will then be for the students in the class to pick one of these datasets, reduce the data, complete the analysis, and perform a final writeup. All students will also give a short oral presentation on their analysis.

What are other policies on exams, assignments, and other course structure?

Course Webpage: The course webpage on the Canvas system will be updated with course announcements, homework and reading assignments, and deadlines. It is your responsibility to check these on a regular basis. Please come to class prepared, having read the required reading assignments. Also please be prepared to participate in in-class discussions and activities, this is for your benefit.

Late work: Assignments turned in late will be subject to a 10% penalty per day late. However, we understand that life events happen, so if you are unable to turn an item in on time, please contact an instructor **in advance of the due date**. Note that being busy with other classes will not be considered as a valid excuse.

Course Conduct: Be respectful of others, especially during in-class peer discussion times, and even if you disagree with them. Please silence cell phones before you enter the classroom, no texting or using your cell phone during class except for use in specified classroom activities. Also, please do not pack up or leave class early unless you have talked to us in advance, as a consideration to us and your fellow students. Only be active on the computer or your laptop when instructed to be. If we see inappropriate computer behavior, you will lose participation credit.

Instructor Travel: As part of their duties as faculty members, your instructors may require to travel as part of their professional research astronomer. They will do their best to minimize the impact of this travel, and will endeavor to maintain Canvas communication at all times while out of Austin. When both instructors are out of town, another UT faculty member will hold the class in their place.

Plagiarism: As a research university, the University of Texas at Austin takes plagiarism very seriously. Do not risk getting involved in a plagiarism infraction - the consequences simply aren't worth it. Always cite your sources, and when in doubt consult a professor or librarian. You may also read more about plagiarism at the Student Judicial Services website: http://deanofstudents.utexas.edu/conduct/academicintegrity.php

Students with Dependents: We recognize the difficulty of being a full time student with children or other dependents. If you have children, or other family commitments, please come see an instructor to discuss any modifications of the course policies which will maximize your success in this course.

Email: Email is recognized as an official mode of university correspondence; therefore you are responsible for reading your email for university and course-related information and announcements. Please check your email regularly and frequently.

Schedule of Topics / Due Dates (subject to some changes):

Date		Topic	Homework	Projects
T Jan 21		**Concepts: Coordinate Systems**		
Th Jan 23		**Concepts: Coordinate Systems,** Rooftop telescope training	Complete in-class programming work	
T Jan 28		**Concepts: Coordinate Systems** **Concepts: How CCDs Work**	Complete in-class programming work, Review Background Material,	Project 0 Assigned, Observe for Project 0
Th Jan 30		**Concepts: How CCD's work**	Coordinate system homework due. Review Background Material,	Observe for Project 0
T Feb 4		**Concepts: Data Reduction**	CCD homework due	
Th Feb 6		**Concepts: The Night Sky**	Complete in-class programming work, Write observing plan for Project 1	Project 1 and associated science reading assigned
T Feb 11		**Concepts: The Night Sky** (in class work) Background Material	Science Reading	Observe Project 1
Th Feb 13		**Concepts: Photometry**		**Project 0 Due**, Observe Project 1
T Feb 18		**Concepts: How Telescopes Work**		Observe Project 1
Th Feb 20	P1 Obs	**Concepts: Making an Image**		
T Feb 25	P1 Obs	Project #1 Science Discussion		

Date		Topic	Homework	Projects
Th Feb 27	P1 Obs	In-class work on Project 1		
T Mar 3	P1 Obs	In-class work on Project 1 & Project 2 Observing Plan Work	Write observing plan for Project 2	**Project 1 Due**, Project 2 Assigned
Th Mar 5		Topics related to Project 2		Observe Project 2
T Mar 10	P2 Obs	Topics related to Project 2 & Project 2 Science Discussion		Observe Project 2
Th Mar 12	P2 Obs	Work on project 2		Observe Project 2
Mar 16-20		Spring Break		
T Mar 24	P2 Obs	Work on project 2		
Th Mar 26		Project 3 Science Discussion	Write observing plan for Project 3	**Project 2 Due**, Project 3 Assigned
T Mar 31	P2 Obs	Discussion on Writing Proposals, Proposal Brainstorming		Assign Midterm Proposal, Observe Project 3
Th Apr 2		Topics Related to Project 3, and Project 3 in-class work		Observe Project 3
T Apr 7		Work day: Project 3 and Proposal		
Th Apr 9		In-class spectra exercise		
T Apr 14		Work day: Project 3 and Proposal		
Th Apr 16		Work day: Project 3 and Proposal		**Midterm Proposals Due**, Assign Final Project
T Apr 21		Grad Student Project Presentations		**Project 3 Due**

Date		Topic	Homework	Projects
Th Apr 23		TAC Meeting		
T Apr 28		TAC results announced! 2.7m observing planning	Science and technical discussion related to final project	Demo final project w/ 30"?
Th Apr 30		2.7m observing planning		Demo final project w/ 30"?
T May 5		Observing	Take part in one observing eavesdropping session	
Th May 7		In-class work on 2.7m project		

The instructors reserve the right to change the course content or the assigned work as needed to match the pace of the class or to incorporate late-breaking astronomical news or discoveries.

University and Course Policies:

Academic integrity: The core values of The University of Texas at Austin are learning, discovery, freedom, leadership, individual opportunity, and responsibility. Each member of the university is expected to uphold these values through integrity, honesty, trust, fairness, and respect toward peers and community. Students who violate University rules on scholastic dishonesty are subject to disciplinary penalties. Ethical conduct is expected at all times. For example, answering Voting Questions to receive credit when you are not in class is unethical. Incidences of academic dishonesty will be reported to Student Judicial Services. For more specific information go to: http://deanofstudents.utexas.edu/conduct/academicintegrity.php.

Academic accommodations (SSD): The University of Texas at Austin provides upon request appropriate adjustments for qualified students with disabilities. We are committed to making an inclusive, accessible and welcoming classroom environment for all students. For more information, contact Services for Students with Disabilities at: 512-471-6259 (voice), 512-410-6644 (video phone), ssd@austin.utexas.edu (email) or online at: **http://diversity.utexas.edu/disability/**

Personal or Family Emergencies: If you experience a personal or family emergency (death in the family, protracted sickness, serious mental health issues) that prevents you from attending an exam or forces you to miss multiple days of class, you should contact Student Emergency Services in the Office of the Dean of Students http://deanofstudents.utexas.edu/emergency/. They will work with you to communicate with your professors and let them know of your situation.

Religious Days: A student who is absent from a class or examination for the observance of a religious holy day will be permitted to make up the missed work, if notice is given at least fourteen days prior to such an absence.