



Observational Astronomy

ASTR 341

Instructor Info



Prof. Karen Masters



Office Hrs: Mon 10-11am; Thu 2-3pm



Observatory A



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Course Info



Prereq: ASTR205/206



Mon, 7.30-10pm



Observatory

Overview

Astro 341 consists primarily of several observing projects that involve using the CCD camera on the 16" Schmidt-Cassegrain telescope (located in the large dome of the Strawbridge Observatory), techniques of data mining from astronomical catalogues, as well as projects(s) using small radio telescope(s) at the Green Bank Observatory. Data from these observations will be analyzed with either an image processing software package (AstroImageJ) or Python. The results of the projects will be written up as formal reports and one will be presented at the end of the semester.

The course will be very informal. After the initial instructional observing sessions, each observing team (consisting of two or three students) will have the responsibility for scheduling observing with the 16" telescope. The Green Bank Observatory Field Trip has already been scheduled: March 22-24th (the weekend after Spring break). The regularly scheduled "class time" (Mondays, 7:30-10:00 p.m.) will serve three purposes. First, some of this time will be used for workshops on a variety of topics; e.g., an introduction to CCD cameras, an introduction to image processing, operating the 16" Schmidt-Cassegrain telescope, introduction to radio astronomy to prepare for our GB trip etc. One session will be used to hold a radio astronomy "TAC" meeting to prepare for our GB trip. In addition, we will meet during this time to discuss the details of individual projects and reports. Finally, this time slot will give assurance that there is at least one night a week when members of all observing teams do not have scheduling conflicts. Because observing sessions often last for 5 or 6 hours, do not make any other commitments on Monday evenings that you cannot reschedule. Of course, because of the weather, there are other days of the week when you might have to observe.

Material

Copies of all books mentioned are held in Reserve in the Observatory Library.

Recommended Text:

An Introduction to Observational Astrophysics, by Mark Galloway

Supplementary Text:

Handbook of CCD Astronomy, by Steve Howell

Other helpful/required journal articles and book chapters will be provided or linked to on Moodle.

List of Projects

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|---------------|--|
| Feb 4th* | Extended Object Imaging lab: Generate a high quality color image of an extended object (or objects) from data taken with the 12" or 16" Strawbridge telescope (using either the SBIG CCD, a DSLR camera, or the SmartPhone Camera Mount) |
| Feb 25th* | An Introduction to CCD Observations: Characterizing the CCD camera and becoming fluent in basic computational techniques |
| Mar 4th | A Proposal for Radio Observing: In teams of two, you will propose something we can observe on the 40' at GBO. As a class we will form a TAC to decide the most suitable project(s). |
| April 15th | Radio Astronomy Project Writeup: A write up of the project done at GBO |
| During Finals | Color-magnitude diagram of an open star cluster: Should include some data taken with the SBIG CCD on the Strawbridge 16" telescope as well as making use of archival Gaia data. |

* Flexible deadlines based on weather

FAQs

? Will I learn how to use a telescope in this class?

! Yes. That's the point - but we'll do more than just use the telescope - we'll use them to learn about astrophysics!

? What is astrophysics?

! The use of physics to understand and learn about objects in the night sky. All areas of physics, as well as a lot of chemistry (and some biology) are important to the full understanding of astrophysical objects.

? What's the difference between astronomy and astrophysics?

! It's really just semantics in the modern usage. The most useful distinction is that there are lots of Amateur Astronomers (someone who as a hobby uses a telescope to view the skies), while it's much more unusual to be an Amateur Astrophysicist (someone who uses physics to interpret objects in the Universe). At Haverford the Astrophysics Major is basically the same as the Physics Major with an Astro emphasis, while the Astronomy Major has more astronomy and less core physics.

? What is your favourite astronomical object?

! Galaxies. Which are pretty hard to observe with our telescopes.

Honour Code

Collaboration is an important part of science. You are strongly encouraged to work together and/or consult one another for work in this class. You are encouraged to consult any books necessary as well as resources on the internet. You must, however, turn in your own individual homework, and this must be written on your own. Copying and pasting (even parts of sentences) is not permitted and is a violation of the Honour Code. Good collaboration involves everyone understanding what is going on in the assignments. Therefore even if the basic solution is shared you must explain it in your own words (including mathematical words). Please list any students that you collaborated with. Please pay attention to your classmates to make sure no one is being left out of collaborative work.

You may not obtain materials from students who have taken this course in previous years, nor may you distribute your current materials to students not currently enrolled in this class. Please consult me if you have any questions.

Diversity and Inclusivity Statement

Our classroom should be a place where all members will be treated with respect. I welcome individuals of all ages, backgrounds, beliefs, ethnicities, genders, gender identities, gender expressions, national origins, religious affiliations, sexual orientations, ability - and other visible and non-visible differences. All members of this class are expected to contribute to a respectful, welcoming and inclusive environment for every other member of the class. If something was said in class (by anyone including myself) that made you feel uncomfortable, please talk to me about it (anonymous feedback is always an option). I appreciate any opportunity to continue my learning about diverse perspectives.

In an ideal world, science would be objective. However, science is done by people, and is historically built on a small subset of privileged voices. In this class, we will make an effort to read work from a diverse group of scientists, but limits still exist on this diversity. I believe that integrating a diverse set of experiences is important for a more comprehensive understanding of science. We may discuss issues of diversity in astrophysics as part of the course from time to time. Please contact me (in person or electronically) or submit anonymous feedback if you have any suggestions to improve the quality of the course materials.

Accommodation Statement

Haverford College is committed to providing equal access to students with a disability. If you have (or think you have) a learning difference or disability - including mental health, medical, or physical impairment, please contact the Office of Access and Disability Services (ADS) at hc-ads@haverford.edu. The Coordinator will confidentially discuss the process to establish reasonable accommodations.

Students who have already been approved to receive academic accommodations and want to use their accommodations in this course should share their verification letter with me and also make arrangements to meet with me as soon as possible to discuss their the specific accommodations. Please note that accommodations are not retroactive and require advance notice to implement.

It is a state law in Pennsylvania that individuals must be given advance notice if they are to be recorded. Therefore, any student who has a disability-related need to audio record this class must first be approved for this accommodation from the Coordinator of Access and Disability Services and then must speak with me. Other class members will need to be aware that this class may be recorded.

Draft Class Schedule

Date	Topic/Plan	Deadlines (Weather dependent)
Optical Astronomy		
Week 1 - Mon 29th Jan	Introductory Material (telescopes, co-ordinates etc)	
Week 2 - Mon 4th Feb	CCDs and Image Processing	Extending Object Imaging Lab
Week 3 - Mon 11th Feb	CCDs and Image Processing	
Week 4 - Mon 18th Feb	Proposal Writing process	
Radio Astronomy		
Week 5 - Mon 25th Feb	Introduction to Radio Astronomy	
Week 6 - Mon 4th Mar	No class - observing if clear	Radio Proposal
Spring Break (11-15th Mar)		
Week 7 - Mon 18th Mar	Radio Astronomy TAC Meeting	Read all Radio Proposals
Fri 22nd-Sun 24th Mar	Field Trip to Green Bank Observatory	
Week 8 - Mon 25th Mar	Class cancelled	
Week 9 - Mon 1st April	Intensive project working time	CCD Characterisation due April 2nd
Optical Astronomy		
Week 10 - Mon 8th April	Intensive project working time	Radio project write-up due April 9th.
Week 11 - Mon 15th April	Data Mining Techniques (using Gaia)	
Week 12 - Mon 22nd April	Working time	
Week 13 - Mon 29th April	Wrap Up Class	Presentations on a Project/Part of a Project
Exam Period (6-17th May) -		
Date set by College	(differs for Seniors and other)	Colour-Magnitude Diagram of Cluster Project Writeup