INTRODUCTION TO ASTRONOMY: COURSE SYLLABUS

COURSE DESCRIPTION

Astronomy is the study of astrophysical objects beyond our atmosphere, from the Sun and planets in our solar system, to the billions of stars in our Milky Way galaxy, to the black holes beyond its borders and the origin of the universe itself. In this introduction to astronomy, students will learn the basics of stars, planets, galaxies, and the universe, as well as the technology behind telescopes we use to study them. Through interactive lectures, students will be introduced to the electromagnetic spectrum of light and how different objects in the night sky produce light at different wavelengths. Finally, we will discuss ways for students to continue exploring astronomy on their own using hobbyist binoculars and telescopes, publicly accessible data from NASA and NRAO telescopes, and a basic knowledge of constellations and major stars to orient oneself on a starry night. A major goal will be for students to feel empowered to continue expanding their interest in science and astronomy by introducing opportunities for hobbyist astronomy around Pasadena. One night during the term will be used to set up a real telescope and observe from the PCC observatory. This is a short 5-session course during the PCC Winter Intersession.

INSTRUCTOR: MYLES SHERMAN

COURSE WEBSITE:

https://mylesbsherman.com/pcc-extension-course-materials-astronomy-an-introduction/

LEARNING OUTCOMES

By the end of this course, students will be able to:

...identify major stars and constellations in the night sky, recount the life-cycle of a star form the Main Sequence to supernova, and distinguish between White Dwarfs, Neutron Stars, and Black Holes.

...describe the basic components of an optical telescope,explain the major differences between optical, infrared, and UV astronomy, describe why X-ray and gamma ray telescopes operate differently from OIR and UV telescopes.

...describe the basic components of a radio antenna, explain how radio interferometers work, and list the astrophysical sources of radio waves.

...describe the components of a galaxy (disk, bulge, ISM, halo, CGM), define cosmology, how it is studied (redshift, CMB, 21 cm cosmology, simulations, FRBs), explain how distance, redshift, and time are related within general relativity, and understand how the presence of dark matter and dark energy affect our picture of the Universe.

...list some of the major questions in astronomy today and refer to resources to continue exploring astronomy within and around Pasadena.

COURSE MATERIALS

Students DO NOT need to purchase any textbooks or materials for the course. I will provide any passages or material from the textbooks if needed, and will have hard copies of most of them for reference or supplemental reading. Students should bring a writing utensil and optionally a notebook (guided notes will be provided). Lecture notes will cover topics from the following resources, but will not follow any one textbook directly:

- Binney, James, and Michael Merrifield. "Galactic astronomy." (2021): 1-816.
- Carroll, Bradley W., and Dale A. Ostlie. An introduction to modern astrophysics. Cambridge University Press, 2017.
- Condon, James J., and Scott M. Ransom. Essential radio astronomy. Princeton University Press, 2016.
- Griffiths, David J. Introduction to electrodynamics. Cambridge University Press, 2023.
- Haykin, Simon, and Barry Van Veen. Signals and systems. John Wiley & Sons, 2007.
- Lorimer, Duncan Ross, and Michael Kramer. Handbook of pulsar astronomy. Vol. 4. Cambridge university press, 2005.
- Rybicki, George B., and Alan P. Lightman. Radiative processes in astrophysics. John Wiley & Sons, 2024.
- Thornton, Stephen T., and Jerry Marion. Classical dynamics of particles and systems. MTM, 2019.
- Young, Hugh D., et al. University physics. Vol. 9. Reading, MA: Addison-Wesley, 1996.

Students may find it useful to bring a laptop to follow along with data access demos and when using online astronomy tools, but it is not required.

COURSE SCHEDULE

Class Date	Lecture Outline (80 min + 10 min for questions)	Guided Notes	Problem Set	Problem Set Due Date

Wed. Feb 18	**Introduction & Overview [7 min]** **Brief History of Astronomy [8 min]** **Constellations [15 min]** • **At-Home Astronomy: Online Star Maps [5 min]** **Star Formation & Evolution [40 min]** • **Think-Pair Share [5 min]**	https://mylesbsherman.com/wp-content/uploads/2026/02/guidednotes_lecture1.pdf	https://mylesbsherman.com/wp-content/uploads/2026/02/pset1.pdf	**Wed. Feb 25**
Wed. Feb 25	**The Electromagnetic Spectrum [15 min]** **Geometrical Optics [15 min]** • Think-Pair-Share [5 min] • Demo: Telescope Walkthrough [10 min] **Optical, IR, UV [10 min]** • Think-Pair-Share [5 min] **X-rays, gamma rays [10 min]** • Think-Pair-Share [5 min] • At-Home Astronomy: Stellar Spectra and X-ray Images [5 min]	https://mylesbsherman.com/wp-content/uploads/2026/02/guidednotes_lecture2.pdf	https://mylesbsherman.com/wp-content/uploads/2026/02/pset2.pdf	**Wed. March 4**
Wed. March 4	**Radio Waves [10 min]** **Radio Telescopes [15 min]** **Radio Interferometers [15 min]** • Demo: Mini Interferometer [10 min] • Think-Pair-Share [5 min] **Stellar Remnant Radio Emission [10 min]** • Think-Pair-Share [5 min] • Demo: The Radio-Loud Sky [10 min]	https://mylesbsherman.com/wp-content/uploads/2026/02/guidednotes_lecture3.pdf	https://mylesbsherman.com/wp-content/uploads/2026/02/pset3.pdf	**Wed. March 11**

| Wed. March 11 | **Galaxy Formation and Structure [20 min]**
• Think-Pair-Share [5 min]
A *very* basic introduction to relativity [20 min]
• Think-Pair-Share [5 min]
• At-Home Astronomy: Gravitational Lensing and Gravitational Waves [10 min]
Cosmology [15 min]
• Think-Pair-Share [5 min] | https://mylesbsherman.com/wp-content/uploads/2026/02/guidednotes_lecture4.pdf | https://mylesbsherman.com/wp-content/uploads/2026/02/pset4.pdf | **Wed. March 18** |

ASSIGNMENTS AND ACTIVITIES

1. **Guided Notes:** During each class, students will have a Guided Notes worksheet to complete. This consists of fill-in-the blank lecture notes and figures that students can fill in as we go. Worksheets will be graded only on completion, which I will check at the end of each class.
2. **In-Class Discussions:** During each class we'll have brief 5-minute discussions in groups of 3-4 people; these will not be graded.
3. **Problem Set:** At the end of each class, I will provide a 2-question problem set (each question will have multiple parts) relevant to that day's class material. These will be word problems with minimal math worth 6-7 points each (3 point for completion, 1 point for each part of the question, 3-4 parts per question) graded based on the rubric below. A few bonus questions worth 1 point each will be in each problem set. Finally, each problem set will have an optional section to ask questions they have from the day's class, which I will anonymously answer at the start of the next class.

Problem Set Component	Great=1	Acceptable=0.5	Incomplete=0	Score
Question 1	Student's answer addresses the question, either in words or mathematical calculation. The students shows any relevant math, and cites any relevant resources not listed under Course Materials (articles, other textbooks). The answer provided by the student is correct.	Student's answer addresses the question, either in words or mathematical calculation. The students either (1) shows any relevant math, and cites any relevant resources not listed under Course Materials (articles, other textbooks), but does not obtain the right answer, or (2) obtains the right answer, but does not show work or cite sources.	Not turned in	/4
Question 2	Student's answer addresses the question, either in words or mathematical calculation. The students shows any relevant math, and cites any relevant resources not listed under Course Materials (articles, other	Student's answer addresses the question, either in words or mathematical calculation. The students either (1) shows any relevant math, and cites any relevant resources not listed under Course	Not turned in	/3

	textbooks). The answer provided by the student is correct.	Materials (articles, other textbooks), but does not obtain the right answer, or (2) obtains the right answer, but does not show work or cite sources.		
Completed Q1	N/A	Complete	Incomplete	/3
Completed Q2	N/A	Complete	Incomplete	/3
				Total= /13