

# Astronomy 217 Syllabus

Honors Introductory Astronomy  
Fall 2023  
University of Tennessee Knoxville

## Instructor Information

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## Class Meeting Times

Lecture: Nielsen Physics Building 304, MWF 11:30am - 12:20pm

Lab: Nielsen Physics Building 108, [T 7:45pm - 9:35pm] or [W 7:40pm - 9:30pm]

Office Hours: South College 106, time TBD

Discord (TA and students only): <https://discord.com/invite/vWUSRuKV>

## Textbook

The textbook for the course is *Foundations of Astrophysics* by Barbara Ryden and Bradley M. Peterson. We will be using chapters 1-12 of the book for this course, covering the history of astronomy, basics of astronomical observation, radiation, the solar system, and exoplanets.

## Grading

Grades will be a weighted sum of grades in each of the following categories. The final letter grade will be assigned as follows, and grades within 1% of the boundary will be given a "+" or "-" (so a grade of 89.999% is a B+).

90-100%	A
80-90%	B
70-80%	C
60-70%	D
0-60%	F

### ***Homework (30%)***

There will be weekly homework due on Friday at the beginning of class. Please bring paper copies stapled together. *Collaboration* is encouraged (you must still give credit to your collaborators for each problem), but *copying* is forbidden. See the honor code section below for definitions. There is a late penalty of 20 points per day, but late penalties can be lifted for one assignment during the semester in case you are ill, traveling, etc. 5 points on each homework will be based on participation in a daily “reading question”.

Homeworks will be graded mostly on process, and solutions will be distributed when the homework is due. For questions requiring problem solving, you will be expected to be able to:

- Draw a diagram of the system and label every quantity used in the solution.
- Describe the relevant physics before starting any algebra.
- Provide meaning and units for every symbol used.
- Show correct calculation steps.
- Provide a check that your solution is reasonable.

### ***Review Quizzes (35%)***

In place of midterm exams, there will be a weekly 15-minute review quiz based on all returned homework assignments and in the style of questions on the final exam. Collaboration is not allowed, but you may bring a single 8.5"x11" equation sheet. Solutions will not be provided, but you will be allowed to resubmit the quiz with your homework the following week, and your grade will be averaged between the two attempts. Your lowest quiz score will be dropped at the end of the semester.

### ***Final Exam (10%)***

The final exam will cover the entire course at the level of the reading quizzes, homeworks, review quizzes, and labs. It is tentatively scheduled for Tuesday May 16 10:30am - 12:45pm, but check <https://registrar.utk.edu/calendar> for an updated schedule.

### ***Laboratory (25%)***

As part of this course, you will learn how to interact with the skies to actually verify the stories that your instructor (who is a theorist) tells you. The labs will include a combination of using astronomical imaging hardware, data analysis, computation, and laboratory activities that allow us to make sense of astronomical observations. The grading criteria for the labs are listed in the lab manual.

## Honor Code

You may not obtain an unfair advantage over other students and all proper credit must be given. If you have any questions about the policy, please ask me.

Collaboration: Science is highly collaborative, and you are encouraged to collaborate verbally on homework. **You must cite** the people and resources you use for each question. However, you should never see or hear solutions directly, including those from other students, Chegg, Course Hero, or the textbook solutions manual.

AI: You are required to submit all transcripts of AI (e.g., ChatGPT) used in this course. You may only use the free version of any AI to make the course equitable to all students.

## Logistics

- Students Disability Service: The University of Tennessee, Knoxville, is committed to providing an inclusive learning environment for all students. If you anticipate or experience a barrier in this course due to a chronic health condition, a learning, hearing, neurological, mental health, vision, physical, or other kind of disability, or a temporary injury, you are encouraged to contact Student Disability Services (SDS) at 865-974-6087 or [sds@utk.edu](mailto:sds@utk.edu).
- Sick policy: If you are sick or unwell, please let me know asap so we can make arrangements. If you have or were exposed to COVID-19, please follow the university guidelines at <https://studenthealth.utk.edu/covid-19>.
- Planned absences: If you know you will be absent from class (e.g. traveling to a conference) and will not be absent from class, let me know asap so we can arrange for you to submit assignments early.

## Course Objectives

There are a lot of exciting things you can do in a single semester! I hope to get to all of it, but time will tell. By the end of the course, students should be able to:

- Plan observations and make quantitative measurements to determine the properties and motion of celestial objects.
- Search through the scientific literature to find state of the art research methods and results.
- Communicate findings in the style of a scientific article.
- Use simple programming methods to solve problems.
- Recall:
  - The history of discoveries that led to modern astronomy.
  - Time measurement conventions (calendars and time corrections)
  - Structure of the solar atmosphere
  - Evidence for the age of the Earth and solar system
  - Uncertainties in the canonical formation history of the solar system
  - Evidence for metallic Hydrogen and diamond Carbon in gas planets

- Evidence for the existence of the Oort cloud.
- Evidence for the motion, size, rotation, and mass of the Earth and other planets
- Evidence for water on Mars
- Explain
  - The cause of phases of the moon, direction of motion of celestial objects, seasons on Earth, solar and lunar eclipses, and lunar wobble
  - How to observe light at radio, millimeter, x-ray, and gamma-ray wavelengths
  - How magnetic activity changes the sun's appearance
  - How to measure properties of the Earth's interior
  - The origin of global air circulation patterns
  - How to relate geographic features to the history of a moon or planet
  - What causes the annual cycle of meteor showers
  - How to discover new planets
  - How to measure the distance to the sun
  - Factors driving precession of the Earth's rotation axis
  - Mechanisms and imperfections inherent in various telescope and imaging equipment designs.
  - Origin of noise in images and how to suppress it.
- Use astronomical instruments to collect and process data for:
  - General imaging
  - Parallax distance measurements
  - Apparent brightness under different filters
  - Spectral identification of elements
- Use astronomical data to calculate:
  - Exoplanet orbital period, size, and mass.
  - The current month
  - Knoxville's latitude and longitude.
- Calculate to an order of magnitude:
  - Planetary conditions amenable to life as we know it.
  - The distance to far away objects using parallax
  - The height of ocean tides
  - The orbital periods of planets and moons
  - A rocket's escape velocity
  - The rate at which Earth's rotation slows
  - The equilibrium temperature of a planet
  - The size of impact craters
- Calculate quantitatively:
  - The structure of a simplified atmosphere, and where the assumptions of the model break down
  - The behavior of radiation when propagating through a vacuum or through a medium that absorbs and scatters light.
  - The locations of planets and comets in future years
  - The distribution and intensity of light emitted by a hot object