

ASTRON 1263: Techniques of Astronomy (2024 Fall Term)

Course Web Site: <https://canvas.pitt.edu/> should be checked frequently to view announcements and download needed course material. Login using your Pitt email username and password.

Lecture Instructor: Prof. David Turnshek, 306 Allen Hall, turnshek@pitt.edu.

Lecture Times: 6:00 - 6:50 pm, 105 Allen Hall (except M Sept 2; M Oct 14; M Nov 25; Th Nov 28).

Allegheny Observatory (AO) Instructors: Mr. Lou Coban, coban@pitt.edu; Mr. Ed Potosky, emp105@pitt.edu; Prof. John Stein, jstein@pitt.edu.

AO Manager and Technician: Mr. Lou Coban, Allegheny Observatory, coban@pitt.edu.

AO Lab: 7:00 - 11:00 pm on Monday or Thursday nights after lecture. The lab meets during both clear and cloudy weather. On the inevitable cloudy nights, AO Instructors will occasionally give other instruction; other times should be used to work with data you collect in the AO computer lab. You should be signed up to go to AO on either Monday or Thursday nights. On your designated night, **board the bus near the Allen Hall entrance at 7:00 pm, with return to campus by 11:00 pm.** Since clouds and limited telescope time hinder observations, we must generally make accommodations on a given night to give “unlucky” students first priority to collect data as we progress during the term.

Office Hours: All consultations with instructors (office hours) will take place at AO, as needed.

Required Course Materials: Notes posted on canvas and a bound and organized AO Lab Notebook of your choice, to be turned in at the end of the term for grading. **Reference Materials:** (1) MIRA software help pages, (2) various posts and links, and (3) Optional: *To Measure the Sky: An Introduction to Observational Astronomy* (by Frederick R. Chromery), available on Amazon.

Grading: 45% of the grade will be based on lectures and 55% will be based on AO work. AO observations will be done in teams, but grading will be for individuals. Grading is as follows:

- 15% Lecture Class Homework (3 assignments, each worth 5% of your grade)
- 15% Lecture Class 1st Exam (M Oct 7, tentative)
- 15% Lecture Class 2nd Exam (M Dec 2, tentative)
- 5% AO Lab Attendance (-0.5% for each unexcused missed AO Lab)
- 10% AO Observing Project 1 (astrometric calibration of 24” telescope CCD) writeup
- 10% AO Observing Project 2 (two-color photometry of stellar types with 24”) writeup
- 15% Main Observing Project (see list) writeup
- 5% Observing competence and small telescope use evaluation (by AO Instructors)
- 5% Co-presentation of your Main Observing Project at AO (Th Dec 5 and M Dec 9)
- 5% **AO Lab Notebook** (due at end of term) – you can also earn half-credit points for AO Observing Projects 1 & 2 by making corrections to earn half-credit on previously lost points.

AO Lab Notebook: Each student must keep a well-organized AO Lab Notebook to turn in for end-of-term grading. It must document details of Observing Projects 1 and 2 and your Main Observing Project. These details should include: (1) your observing log table with the following 11 entries (name of object observed, J2000 RA, J2000 Dec, UT date/time of observation, LST of observation, telescope used, instrument used, filter used, exposure time, elevations of object, names and location of raw data files collected), (2) how the raw files were processed and the names and location of the processed files, (3) a description of the measurements made on the processed data with results, (4) relevant images/graphs, and (5) a brief summary of the findings. All three graded projects should be in your AO Lab Notebook, including needed corrections to earn half-credit on previously lost points. To earn points back you must include your original Project 1 and 2 submissions and the corrected versions.

Broad List of Lecture Topics posted on Canvas (in approximate order):

1. AO and Basics of Observational Astronomy (parts 1a and 1b)
2. Astronomical Coordinates and Time
3. General Statistics and Errors
4. Statistics and Errors in Astronomical Measurements
5. CCD Imaging Photometry in the UV, Optical, and IR Context
6. Optical/UV Spectroscopy
7. Standard Stars and Performing Magnitude and Flux Calibrations
8. Other Telescopes/Wavebands: radio, microwave, IR, x-ray, gamma ray, gravitational waves

Possible Main Observing Projects (must understand and present info on observed objects):

1. The mass of Saturn and/or Jupiter (requires knowing their distance) with error propagation.
2. Light curves of variable stars (eclipsing, pulsating, nova) plus analysis.
3. Confirm transits of exoplanets (requires transit ephemeris and precision photometry) plus analysis to estimate the exoplanet sizes.
4. Astrophotography of celestial sources, along with providing a physical description of what the images reveal. This includes imaging of various types of nebulae, globular clusters, open clusters, and galaxies, as well as fast (ultra-short exposure-time) imaging of a planet, the Moon, and/or close double stars. Note that fast imaging involves taking 100s to 1000s of images, rejecting the poorest images, and then stacking the best to achieve an improved image with an angular/spatial resolution approaching the telescope's theoretical limit.
5. Transmission grating spectroscopy of various astronomical sources.

Take the ungraded survey quiz posted on Canvas to indicate your ranked preference for your Main Observing Project by Wednesday, Sept 4, so we can define "Observing Teams."

W-Option for ASTRON 1263: In past fall terms, up to 5 departmental physics and astronomy majors or astronomy majors could meet the writing requirement (W-Option) for their degree by writing up their AO Main Project results (project description, observations, data processing, analysis, and conclusions). This has changed beginning with the 2024/2025 academic year. The change was needed because many students were unable to collect the full data set needed for their main project until November, making it difficult for them to assess how to proceed with their paper. Moving forward, if you want to meet your W-Option requirement using the data you collect for the ASTRON 1263 course, you should sign up for the appropriate W-Option course in the following spring term after you have taken ASTRON 1263.

Academic Integrity and Harassment: Students in this course will be expected to comply with the University of Pittsburgh's Policies on Academic Integrity and Harassment. Students suspected of violating their obligations during the term will be required to participate in the procedural process, initiated at the instructor level, as outlined in University Guidelines. This may include, but is not limited to, the confiscation of an exam of any individual suspected of violating University Policy. Furthermore, no student may bring unauthorized materials to an exam.

Disabilities: If you have a disability that requires special testing accommodations or other classroom modifications, you need to notify both the instructor and Disability Resources and Services. You will likely be asked to provide documentation of your disability to determine the appropriateness of accommodations.