

## ASTRON 1263: Techniques of Astronomy (2022 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](mailto:turnshek@pitt.edu).

**Lecture Times:** 6:00 - 6:50 pm in 105 Allen Hall.

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

**AO Manager and Technician:** Mr. Lou Coban, Allegheny Observatory, [coban@pitt.edu](mailto:coban@pitt.edu).

**AO Lab:** 7:00 - 11:00 pm on Monday or Thursday nights. The lab meets during clear and cloudy weather. On the inevitable cloudy nights, AO Instructors will occasionally give relevant presentations (see intro lecture slides); other times should be used to work with data you collect. 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 campus return 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)
- 15% Lecture Class 1<sup>st</sup> Exam (Oct 3, tentative)
- 15% Lecture Class 2<sup>nd</sup> Exam (Nov 28, 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  
(Answer survey question by noon, Sept 5, indicating ranked preference among six projects)
- 5% Observing competence evaluation (by AO Instructors)
- 5% Co-presentation of your your Main Observing Project (Dec 5 and Dec 8, or prior week)
- 5% AO Lab Notebook Records (due at end of term)

**AO Lab Notebook:** Each student must keep a well-organized AO Lab Notebook and turn it in for grading at the end of the term. 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. You should incorporate the three graded projects into your AO Lab Notebook with needed corrections.

**Broad List of Lecture Topics (in approximate order):**

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

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

1. The mass of Saturn and Jupiter (requires looking up their distance) with error propagation.
2. Light curves of a short-period eclipsing binary and a pulsating variable star plus analysis.
3. Confirm transits of 2 exoplanets (requires transit ephemeris and precision photometry) plus perform an analysis to estimate the exoplanet sizes.
4. Construction of color-magnitude diagrams (HR diagrams) for two clusters to estimate the cluster ages with errors.
5. Make a color pictorial of different types of nebulae, globular and open clusters, and galaxies with a physical description of the properties seen in the images.
6. Fast imaging (of planets, the Moon, and/or close double stars) with rejection of poor images and stacking, to achieve improved images, and estimate the spatial resolution achieved.

**Take the ungraded survey quiz by Monday, Sept 5, so we can define 6 Observing “Teams” of 4 students each (2 students from Monday night and 2 students from Thursday night)!**

**W-Option for ASTRON 1263:** Usually up to 5 department majors can take the W-Option to meet their writing requirement (1 credit – sign up for PHYS 1661). During lecture and/or lab portions of ASTRON 1263, some time will be spent discussing the components of a proper astronomy research paper (or research proposal) with W-Option students. Group and individual meetings will take place during the nighttime lab (e.g., when it’s cloudy). W-Option students must write a paper about their Main Observing Project in a formal way. The paper should include the following: (1) abstract, (2) introduction of the topic stating some background material and the aim of the paper, (3) a description of the observations, (4) data processing, (5) data analysis, (6) a discussion and summary of the results, and (7) references. Tables, images, and graphs should be included as needed. Your 1-credit W-Option grade will be based on the paper alone, not on your performance in ASTRON 1263. I will review drafts of your paper throughout the term. The draft introduction (item 2 above) should be written and submitted before the end of September. Drafts and the final paper will be graded. More details, including grading, will be posted in the ASTRON 1263 W-Option Module.

**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.